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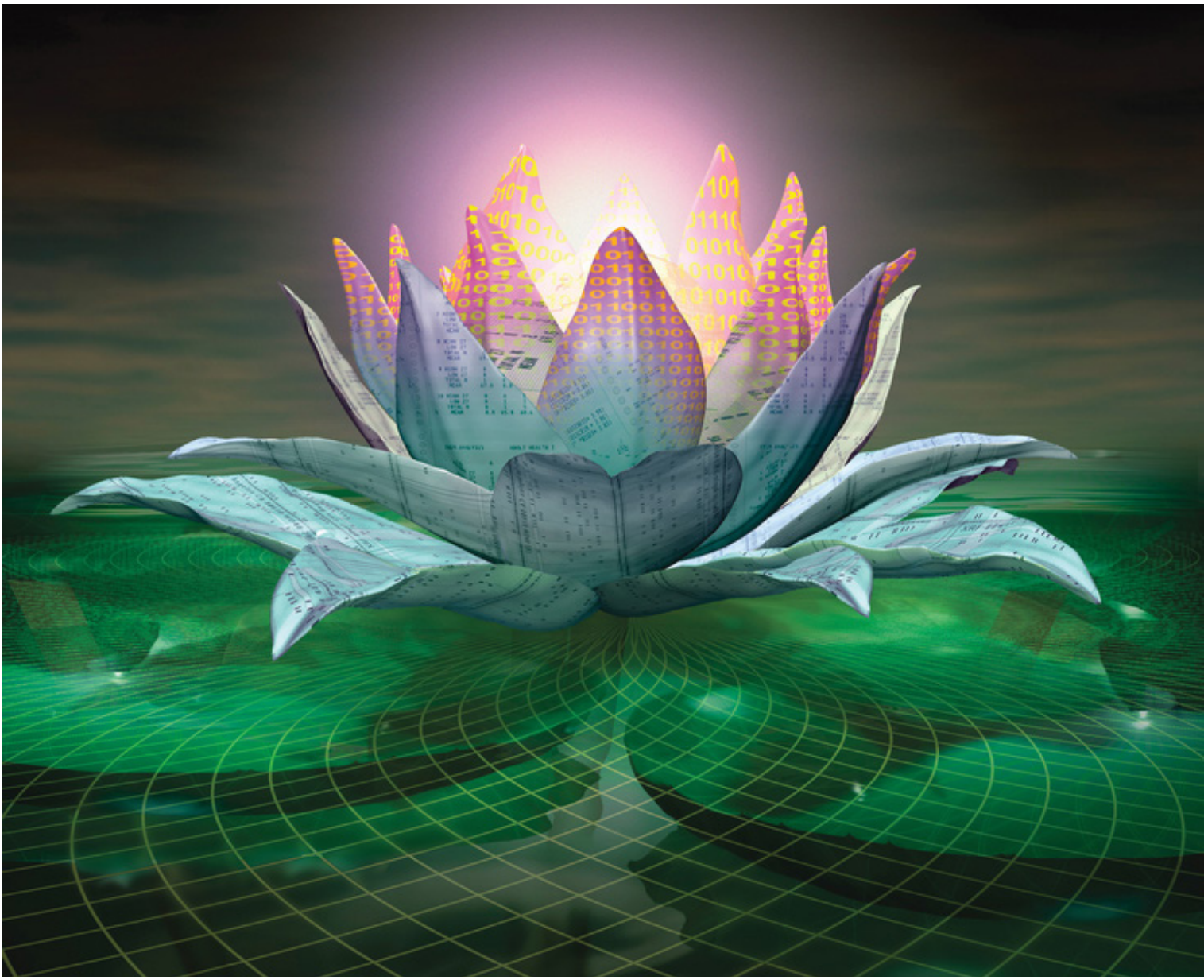

The Future of Platforms

Platforms power some of the world's most valuable companies, but it will get harder and harder to capture and monetize their disruptive potential.

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The world's most valuable public companies and its first trillion-dollar businesses are built on digital platforms that bring together two or more market actors and grow through network effects. The top-ranked companies by market capitalization are Microsoft, Apple, Amazon, and Alphabet (Google's parent company). Facebook, Alibaba, and Tencent are not far behind. As of November 2019, these seven companies represented more than $5.4 trillion in market value, and all of them are platform businesses.[1]

Platforms are also remarkably popular among entrepreneurs and investors in private ventures. When we examined a 2017 list of more than 200 unicorns (startups with valuations of $1 billion or more), we estimated that 60% to 70% were platform businesses. At the time, these included companies such as Ant Financial (an affiliate of Alibaba), Uber, Didi Chuxing, Xiaomi, and Airbnb.[2]

But the path to success for a platform venture is by no means easy or guaranteed, nor is it completely different from that of companies with more-conventional business models. Why? Because, like all companies, platforms must ultimately perform better than their competitors. In addition, to survive long-term, platforms must also be politically and socially viable, or they risk being crushed by government regulation or social opposition, as well as potentially massive debt obligations. These observations are common sense, but amid all the hype over digital platforms — a phenomenon we sometimes call *platformania* — common sense hasn't always been so common.

We have been studying and working with platform businesses for more than 30 years. In 2015, we undertook a new round of research aimed at analyzing the evolution of platforms and their long-term performance versus that of conventional businesses. Our research confirmed that successful platforms yield a powerful competitive advantage with financial results to match. It also revealed that the nature of platforms is changing, as are the ecosystems and technologies that drive them, and the challenges and rules associated with managing a platform business.

Platforms are here to stay, but to build a successful, sustainable company around them, executives, entrepreneurs, and investors need to know the different types of platforms and their business models. They need to understand why some platforms generate sales growth and profits relatively easily, while others lose extraordinary sums of money. They need to anticipate the trends that will determine platform success versus failure in the coming years and the technologies that will spawn tomorrow's disruptive platform battlegrounds. We seek to address these needs in this article.

Platform Company Evolution

The companies that shaped the evolution of modern platform strategies and business models are familiar names. In the 1980s and early 1990s, Microsoft, Intel, and Apple, along with IBM, disrupted the vertically integrated mainframe computer industry. They made the personal computer into one of the first mass-market digital platforms, which resulted in separate industry layers for semiconductors, PC hardware, software operating systems, application software, sales, and services. A second wave of platform firms emerged in the mid-1990s, led by Amazon, Google, Netscape, and Yahoo in the U.S., Alibaba and Tencent in China, and Rakuten in Japan. They leveraged the internet to disrupt a variety of industries, including retail, travel, and publishing. In the next decade, social media businesses, pioneered by Friendster and Myspace, and then Facebook, LinkedIn, and Twitter, used platforms to enable new ways for people to interact, and for companies to target customers. More recently, Airbnb, Didi Chuxing, Grab, Uber, and smaller ventures such as Deliveroo and TaskRabbit have used platform strategies to launch the gig (or sharing) economy.

Today, platform companies are in nearly every market, and they all share common features. They use digital technology to create self-sustaining positive-feedback loops that potentially increase the value of their platforms with each new participant.

THE RESEARCH

This article and the book on which it is based, *The Business of Platforms*, build on some 30 years of research on the strategies and business models of platform companies.

Using 20 years of data from the *Forbes* Global 2000, the authors identified the largest 43 publicly listed platforms built around the personal computer, internet services, or mobile devices from 1995 to 2015 and compared performance with a control sample of 100 nonplatform companies in the same set of businesses.

Drawing on annual reports, the authors also identified 209 direct competitors to the 43 platform companies and analyzed reasons for the competitors' failures.

Through interviews, case studies, and other sources, they identified common challenges faced by all types of platforms, as well as future trends for platform technologies and business models.

They build ecosystems of third-party firms and individual contractors that allow them to bypass the traditional supply chains and labor pools required by traditional companies.

Moreover, all platform companies face the same four business challenges. They must choose the key "sides" of the platform (that is, identify which market participants they want to bring together, such as buyers and sellers, or users and innovators). They must solve a chicken-or-egg problem to jump-start the network effects on which they depend. They must design a business model capable of generating revenues that exceed their costs. And finally, they must establish rules for using (and not abusing) the platform, as well as cultivating and governing the all-important ecosystem.

For all their similarities, it is possible to distinguish platforms on the basis of their principal activity. This yields two basic types: transaction and innovation platforms, with some hybrid companies that combine the two. (See "Basic Platform Types.")

- **Innovation platforms** facilitate the development of new, complementary products and services, such as PC or smartphone apps, that are built mostly by third-party companies without traditional supplier contracts. By *complementary*, we mean that these innovations add functionality or assets to the platform. This is the source of their network effects: The more complements there are or the higher quality they are, the more attractive the platform becomes to users and other potential market actors. Innovation platforms typically deliver and capture value by directly selling or renting a product, as in traditional businesses. If the platform is free, companies can monetize it by selling advertising or other ancillary services. Microsoft Windows, Google Android, Apple iOS, and Amazon Web Services are commonly used innovation platforms.

- **Transaction platforms** are intermediaries or online marketplaces that make it possible for participants to exchange goods and services or information. The more participants and functions available on a transaction platform, the more useful it becomes. These platforms create value by enabling exchanges that would not otherwise occur without the platform as an intermediary. They capture value by collecting transaction fees or charging for advertising. Google Search, Amazon Marketplace, Facebook, Tencent's WeChat, Alibaba's Taobao marketplace, Uber, and Airbnb are commonly used transaction platforms.

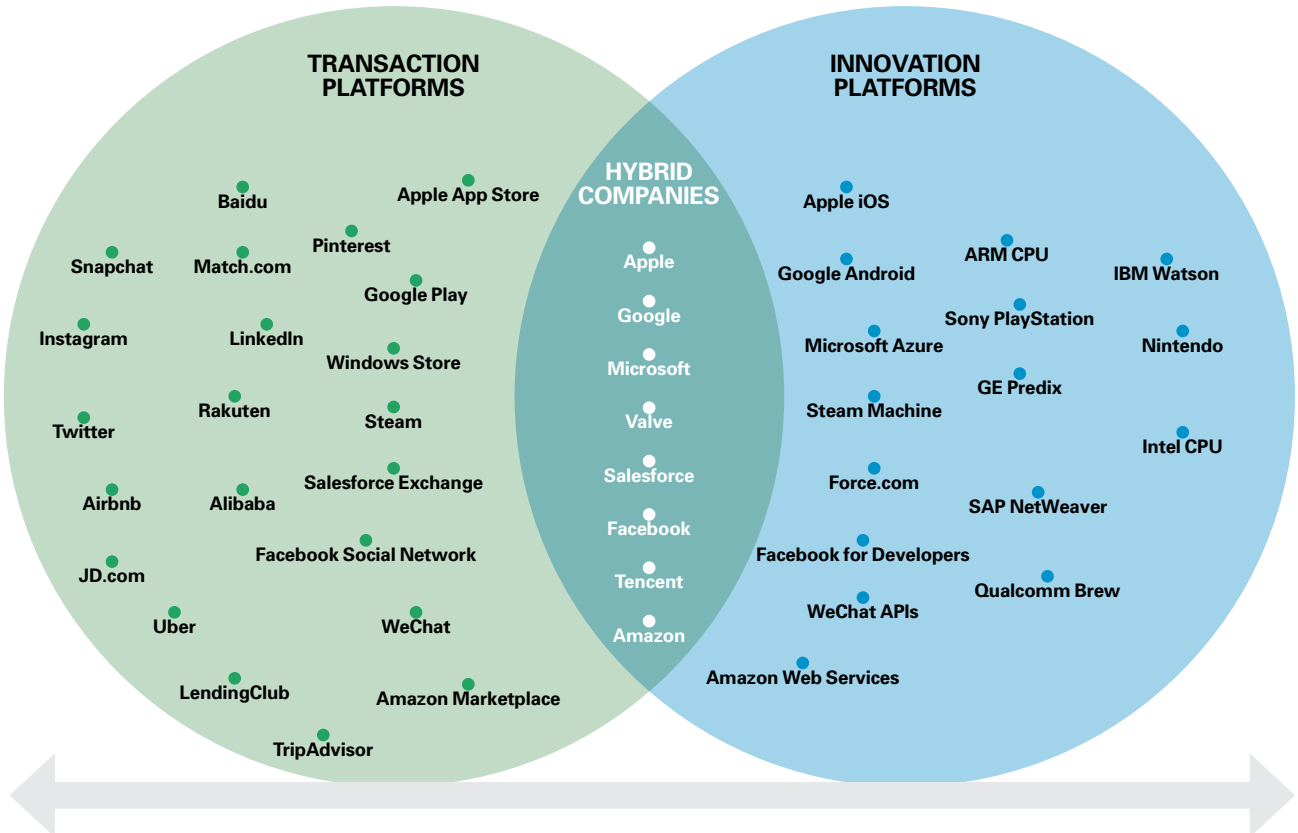
Hybrid companies contain both innovation and transaction platforms. Their strategies are novel because, in the early years of the PC and the internet, innovation and transaction platforms were distinct businesses. Connecting buyers and sellers, advertisers and consumers, or users of social networks appeared to be a fundamentally different activity from stimulating outside companies to create complementary innovations. In the past decade, however, a growing number of successful innovation platforms have integrated transaction platforms into their business models. Rather than lose control over distribution, the owners of these platforms have sought to manage the customer experience, like Apple has done with its App Store. Likewise, some successful transaction platforms have opened their application programming interfaces (APIs) and encouraged third parties to create complementary apps and services. The owners of these platforms, such as Facebook and WeChat, recognize that not all innovation can or should be internal. Other prominent examples of hybrid strategies include Google's decision to buy Android, Amazon's decision to create multiple innovation platforms around Amazon Web Services and Alexa-Echo home AI devices, and Uber's and Airbnb's decisions to allow third-party companies to offer services that complement their ride-sharing and room-sharing platforms. Today, the most valuable global companies (which we mentioned above) all follow hybrid strategies.

Platform Company Value

Most platforms lose money (sometimes billions of dollars), but platforms that dominate their markets have been extraordinarily successful. When we compared the largest 43 publicly listed digital platform companies from 1995 to 2015 with a control sample of 100 nonplatform companies in the same set of businesses, we found that the two samples had roughly the same level of annual revenues (about $4.5 billion). But platform companies achieved their sales with half the number of employees. Moreover,

BASIC PLATFORM TYPES

In the quest for competitive advantage, companies are combining transaction and innovation platforms into a hybrid model.



Transactions
The platform serves as an intermediary for direct exchange or transactions, subject to network effects.

Innovations
The platform serves as a technological foundation upon which other firms develop complementary innovations.

SOURCE: *THE BUSINESS OF PLATFORMS: STRATEGY IN THE AGE OF DIGITAL COMPETITION, INNOVATION, AND POWER* (HARPER BUSINESS, 2019)

platform companies were twice as profitable, were growing twice as fast, and were more than twice as valuable as their conventional counterparts.

In the process of examining the proxy statements and annual reports of the 43 success stories, we identified 209 platform companies that were their direct competitors but failed or disappeared as independent companies. The causes of these failures were primarily mispricing (under- or overcharging) on one side of the market, oversubsidizing platform participants, or entering markets too late. The high number of platform failures supports the observation that even platform businesses can fail or struggle as the competitive environment or other factors change. For example, computing and communications platforms have faced continuous threats from new technologies over the past 40 years. Early success stories such as Myspace, Nokia, and BlackBerry saw their fortunes rapidly decline. Looking at the bigger picture, PCs cannibalized mainframes, smartphones cannibalized traditional cellphones, smartphones and the cloud are cannibalizing PCs, and so on.

In sum, platforms can become extraordinarily successful businesses, and some successful platform companies maintain their powerful positions for decades. However, the creation of a platform, even when it results in an IPO, is no guarantee of long-term success. The business must still be able to generate a profit and respond to change and competition.

Future Platform Trends

While the past 20 years have seen a dramatic expansion of platform-based technologies, applications,

and business models, the next 20 years may see even more disruptive change. Digitization and emerging technologies such as artificial intelligence, machine learning, big data analytics, and infrastructure services have not yet attained their full disruptive potential. More and more individual user and transactional data will become connected with different platform services and functions, with the potential to generate positive and negative outcomes.

No one can predict the future, but we have identified four major trends that are likely to affect platform dynamics across industries: the emergence of the hybrid model as the dominant strategy for platform businesses, the use of AI and machine learning to produce major improvements in platform operations and capabilities, increasing market concentration by a small number of powerful platform companies, and the demand for more platform curation and regulation to address problems unleashed by some of today's platform companies.

TREND 1: More hybrid business models. Competition and the potential of digital technology and data will turn more and more platform firms into hybrids. The underlying driver of this trend is digital competition. Unlike in the traditional economy, where companies require expensive physical investments to build out their business models, in the digital world, companies can grow rapidly with a clever combination of data, software, and ecosystem strategies.

TREND 2: More turbocharged innovation. Next-generation platforms will drive innovation to a new level. Advances in artificial intelligence, machine learning, and big data analytics are already enabling organizations to do more things with less investment, including building businesses that were impossible in years past. Although AI is still in its nascent phase, Google, Amazon, Apple, Microsoft, IBM, and other companies are no longer treating the technology as fully proprietary. Instead, they have turned some of their AI capabilities into platform services that third parties can access and build upon for their own applications. The combination of platforms enabling the capture of more data, with the ongoing improvements in cloud computing, should allow future platforms to enable a wide range of new applications, such as products with voice interfaces and driverless cars.

TREND 3: More industry concentration. The total number of platforms has been exploding, and dominant market shares, as well as strong network effects, have been increasingly difficult to attain because of *multihoming* (the ability of platform users and complementors to access more than one platform for the same purpose, such as using both Lyft and Uber for ride-sharing). Nevertheless, in coming years, we expect to see even more market power concentrated in a smaller number of large platform companies.

This paradoxical situation will result because some markets will tip toward one platform and further concentrate market power. Witness IBM's ascension to the pinnacle of platform power in the computer industry in the 1960s and 1970s, and Intel's and Microsoft's in the 1980s and 1990s. In the past decade, the number of markets that appear to have tipped to a few dominant players has expanded, with Amazon, Alibaba, Apple, Google, Facebook, Microsoft, Tencent, and Uber, among others, achieving market shares well over 50%.

TREND 4: More curation and regulation. Mark Zuckerberg based his early dictum to "move fast and break things" on the premise that good things

PLATFORM BUSINESS PERFORMANCE, 1995-2015

An analysis of the performance of successful platform companies versus an industry control sample reveals the outsized advantage delivered by platforms.

VARIABLE*	INDUSTRY CONTROL SAMPLE	PLATFORM COMPANIES
Number of Companies	100	43
Sales (millions)	$4,845	$4,335
Employees	19,000	9,872
Operating Profit %	12%	21%
Market Value (millions)	$8,243	$21,726
Market Value/Sales Multiple**	1.94	5.35
R&D/Sales	9%	13%
S&M + G&A/Sales***	17%	24%
Sales Growth Versus Prior Year	9%	18%
Market Value Growth	8%	14%
Total number of years of data for the sample firms	1,018	374

* Differences significant at $p < 0.001$ for industry sample versus platforms comparison using two-sample Wilcoxon rank sum (Mann-Whitney) test

**Market Value/Sales Multiple = ratio of market value compared with prior-year sales

***S&M + G&A/Sales = sales and marketing expenses plus general and administrative expenses divided by sales

SOURCE: *THE BUSINESS OF PLATFORMS: STRATEGY IN THE AGE OF DIGITAL COMPETITION, INNOVATION, AND POWER* (HARPER BUSINESS, 2019)

In the years ahead, virtually all large platform companies will evolve from free marketplaces to curated businesses with increasing government oversight and potentially new types of regulation.

will happen if we connect the people of the world. Most platform entrepreneurs and investors agreed with him: They believed that platforms would connect people with products and services at ever-decreasing prices and free the world from the frictions and imperfections of traditional and local marketplaces. As it turns out, not all actors in the digital world are do-gooders. Those engaged in partisan politics, spies, terrorists, counterfeiters, money launderers, and drug dealers all found ways to use digital platforms to their advantage.

Once the platforms reach a scale at which they can affect social, political, and economic systems, their owners increasingly need to evolve from hands-off to hands-on curation. (See "A Crisis of Ethics in Technology Innovation," by Max Wessel and Nicole Helmer, in this issue.) In the years ahead, virtually all large platform companies will evolve from free marketplaces to curated businesses with increasing government oversight and potentially new types of regulation. Although it is a cliché, for the world's biggest platforms, growing power means increased responsibility — and oversight.

Three Emerging Platform Battlegrounds

Several competitions are currently underway that illustrate the trends above and offer insight into what might come next in platform technology and strategy. Several fast-emerging fields — AI, cloud computing, and, ultimately, quantum computing — will enable disruptive innovations as well as changes in business models.

Voice wars: Rapid growth, but chaotic competition. Recent advances in machine learning and the subfield of deep learning have led to dramatic improvements in pattern recognition, especially for images and voice. Apple got the world excited about a voice interface with the introduction of Siri in 2011. For the first time, consumers had access to a natural conversation technology that worked (at least some of the time). Despite its first-mover advantage, however, Apple's strategy for Siri was classic Apple: It designed Siri as a product to complement the iPhone, not as a *platform* that could generate powerful network effects in its own right.

Enter Amazon. When it introduced the Echo speaker and Alexa software in late 2014, it set in motion a war for platform domination among Alibaba, Apple, Google, Microsoft, Tencent, and a host of voice startups. Amazon's strategy was to link multiple platforms powered by Amazon Web Services and offer a combination of speech recognition and high-quality speech synthesis with various applications. Immediately identifying the potential for network effects, Amazon launched its Alexa Skills Kit — a collection of self-service APIs and tools that made it easy for third-party developers to create new Alexa apps. This open-platform strategy accelerated the number of Alexa skills from roughly 5,000 in late 2016 to more than 90,000 in 2019.

Amazon's success spurred Apple, Google, Samsung, and various Chinese companies into action. By late 2017, voice had morphed into a classic platform battle: Amazon and Google began heavily discounting products to build their installed base, with each side racing to add applications and functions. All the major players have also been licensing their technologies (often for free) to consumer electronics, automotive, and enterprise software firms, hoping that these companies will use their voice platforms and solutions.

How the platform war in voice computing will evolve depends heavily on the ease of multihoming. Currently, consumers can easily switch voice platforms or use more than one. It will also depend on how the players choose to position themselves. There are many opportunities for competitor differentiation and niche competition in voice: Apple has focused on the quality of music, Amazon on

media and e-commerce, and Google on search-related queries, to name only a few.

Meanwhile, competitive advantage has not yet hardened into market concentration. Google has already embedded its voice capabilities into hundreds of millions of Android devices. But Amazon has the largest smart-speaker installed base, with tens of millions of devices sitting in users' homes, especially in the United States.

Ultimately, we expect the winner or winners in voice to be those platforms that build the largest installed base of users *and* create the more vibrant ecosystems for producing innovative applications. These ecosystems are likely to generate compelling voice solutions that reduce platform multihoming and competition from niche players and differentiated competitors.

Ride-sharing and self-driving cars: From platform to service. While AI will spawn a range of new products, platforms, and services, it will also enable new capabilities that create, enhance, and destroy existing businesses. Nowhere is this dynamic clearer than in the emergence of self-driving cars, where Japan's SoftBank has invested $60 billion in 40 companies, including Didi, Grab, and Uber. Although Uber has already fallen far below its peak valuations, and other investments may follow, SoftBank is betting that transportation services platforms, such as ride-sharing accessed through smartphones, will eventually become highly concentrated businesses, generating huge returns similar to Alibaba, Apple, Google, and other digital platforms.[3]

Ironically, this new AI-powered technology not only threatens the century-long hegemony of automakers but may also disrupt today's ride-sharing platforms. Despite relatively strong network effects between users and drivers, innovation in technology and business models could replace the platforms belonging to companies such as Didi, Grab, Lyft, and Uber.

The business challenge for ride-sharing platforms is simple: They tend to lose money, and lots of it. Unlike asset-light transaction platforms such as eBay, Expedia, or Priceline, ride-sharing platforms are not fully digital businesses: The ordering and payment transaction is digital, but the service delivery is physical, with mostly local and limited economies of scale and scope. Furthermore, the cost of attracting and paying drivers while keeping fares below the market price of taxis has squeezed the profit potential and resulted in huge losses for these companies. In addition, many drivers and riders multihome: They drive for or use both Uber and Lyft, as well as conventional taxis.

The bottom line is that *platformizing* a low-margin business like taxi services or food delivery does not necessarily make it a profitable business, like selling software products or other digital goods. As a result, Didi, Grab, Lyft, and Uber have announced that their long-term strategies are to move beyond purely transactional platforms that match riders with drivers to transportation as a service. As Lyft CEO Logan Green said, "We are going to move the entire [car] industry from one based on ownership to one based on subscription."[4] In this new model, ride-sharing platforms will probably own or lease fleets of automobiles, as well as bicycles and scooters.

Tech companies like Google and most of the major automobile manufacturers, including General Motors and Toyota, are also investing aggressively in similar strategies. Despite a long history of selling products, even the most conservative car companies see AI as a way to transform themselves into service companies.

Autonomous vehicle technology promises to remove human drivers, which would dramatically drive down the marginal cost of transportation services for ride-sharing platform owners. But, in addition to bringing new competitors into the industry, it would also require massive capital investments in R&D and fleet costs. Some observers see

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this combination of conditions forcing Uber and other ride-sharing platforms to "either figure out a way to buy or at least manage an enormous fleet … or face annihilation by others who will."[5] In response to this threat, Uber began investing in autonomous vehicle technology in 2014. Lyft has taken a different approach by trying to form partnerships through its Open Platform Initiative.

Owning or leasing a fleet of autonomous vehicles is counter to the two-sided platform business model of matching riders with drivers and their cars. If they make the transition to autonomous fleets, Uber and Lyft will become one-sided, company-controlled platforms that own and resell their own assets. The risk is that self-driving car services are unlikely to materialize as quickly or be as profitable as purely digital platforms with high transaction volumes. Nonetheless, future consumers are likely to benefit from more and cheaper ride-sharing services, as long as these businesses have enough capital and cash flow to survive.

Quantum computers: A next-generation computing platform. In 1981 Nobel laureate Richard Feynman challenged his fellow scientists to build a computer mimicking nature — a quantum computer. The challenge was accepted. In 2015 McKinsey consultants estimated that 7,000 researchers were working on quantum computing, with a combined budget of $1.5 billion.[6] By 2018, dozens of universities, approximately 30 major companies, and more than a dozen startups had notable quantum computing R&D efforts underway.[7] More recently still, Google announced that it had built a quantum computer that far exceeded the capabilities of the world's fastest supercomputers, at least for specific types of calculations.[8]

The state of quantum technology today resembles that of conventional computing in the late 1940s and early 1950s: Quantum computers are difficult and expensive to build and program, and reside primarily in universities and corporate research labs. Nonetheless, they represent a revolutionary innovation platform, with the additional potential to stimulate new transaction platforms for specialized applications in simulation, optimization, cryptography, and secure communication.

Will quantum computing produce successful new platform businesses? Currently, the network effects appear weak because the application ecosystems are still nascent and divided among several platform contenders. A spin-off from the University of British Columbia named D-Wave Systems, founded in 1999, has the lead in applications and the largest patent portfolio, followed by IBM and Microsoft. However, D-Wave has not built a general-purpose quantum computer, unlike most other entrants into the field, and recently IBM has taken the lead in annual patent filings. To build better programming tools and test real-world applications, more researchers must gain access to these patents and to more-powerful quantum computers.

Quantum computers will not replace digital computers. Nor do we see this field as a winner-takes-all-or-most market in which one company's unique architecture will dominate, as occurred in mainframes, PCs, smartphones, microprocessors, consumer electronics, and other markets. Quantum computers will most likely always be special-purpose devices for certain types of massively parallel computations, with different technologies more useful for particular applications.

At the same time, quantum computing platforms are likely to face intense scrutiny and regulation because of the potential cryptography applications. On the one hand, quantum computers may be able to break secure keys generated by the most powerful conventional computers, which now protect much of the world's information and financial assets. On the other hand, quantum computers themselves could generate unbreakable keys and facilitate truly secure communication. The leading companies will have to regulate themselves as well as work closely with governments, which are likely to play a major role in overseeing some of these new applications and services.

Platforms as Disrupters

We are heading into a future where we will buy and own fewer products (cars, bikes, vacation homes, household tools, and so on), and we will contract for more services directly with one another. We will likely manage this sharing through peer-to-peer transaction platforms along with general-purpose digital technologies, such as blockchain, to enable more secure and transparent exchanges.

Some platforms that enable this future will follow

> Massive infusions of capital are a third form of disruption that could be just as powerful as new technologies and business models.

the model of disruption that Clayton Christensen has described, with cheaper, inferior technologies gradually overtaking incumbents. This occurred with the gradual domination of personal computers over mainframe computers and the rise of e-commerce and internet marketplaces over traditional stores, though the older technologies and ways of doing business continue to exist. We expect to see similar Christensen-style disruptions in the future, with voice platforms and self-driving cars.

But this is not the only type of disruption we expect to see in the platform economy. Our research illustrates how platform disruption can come from above, as well as from below. For example, Apple and the iPhone disrupted the smartphone industry by building a high-end platform with superior performance and features from the very beginning. Similarly, quantum computing systems and applications such as cryptography or complex simulations will likely arrive as expensive solutions coming from the high end of the market.

Massive infusions of capital are a third form of disruption that could be just as powerful as new technologies and business models, such as turning transportation into a subscription service. The use of smartphones to match drivers and riders was innovative as a business model and required only modest investments in new technology. But what is less remarked on is the fact that Uber and other ride-sharing platforms disrupted the taxi business by spending billions of dollars in venture capital to subsidize a low-margin commodity transportation business. Whether or not Uber and similar ventures survive, and whether or not financial backers such as SoftBank ever recoup their investments, they have disrupted the taxi business forever.

In short, industrywide platforms and their global ecosystems have already disrupted many aspects of our personal and working lives. New innovation and transaction platforms have enabled nearly every type of exchange and activity imaginable in today's world, and platform entrepreneurs have made Anything-as-a-Service possible. No matter how they evolve, we expect that future platforms will continue to inspire both innovation and disruption.

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