

THE MOST INNOVATIVE COMPANIES 2019

THE RISE OF AI, PLATFORMS, AND ECOSYSTEMS



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INNOVATION IN 2019

USERS OF GOOGLE'S EMAIL software recently found that Gmail was offering to finish their sentences for them. This new Smart Compose feature relies on Google's expertise in artificial intelligence (AI) and machine learning (ML), along with billions of training examples and the company's cloud-based Tensor Processing technology, to intuit what Gmail users want to say—often faster than they can complete their own thoughts.

In a world where computers can compose notes to your friends, it's hardly surprising that the theme of BCG's 13th annual global innovation survey and report is the rising importance of AI and of platforms that support innovation. This is not an out-of-the-blue development. Our last few reports have highlighted the crucial role of science and technology in innovation, the impact of digital technologies on both digital natives and more traditional industries, and strong innovators' increasing use of various internal and external vehicles to uncover new ideas. This year's survey shows that AI use is rapidly expanding and that many companies are relying more on platforms and their cousin, ecosystems, to support their innovations efforts.

Digital Natives Lead, but Others Are in Fast Pursuit

The companies on BCG's most innovative list for 2019—especially those in the top ten—

extensively use AI and platforms. (See Exhibit 1.) Alphabet/Google, which unseats Apple at number one after a 13-year reign, is an “AI first” company, according to its CEO. It has long embraced both platforms (think Android) and ecosystems (consider how Alphabet has worked with others to develop Waymo, its autonomous driving venture). Next in line is Amazon, which, besides using AI in its retail business, has pioneered voice recognition technology (Alexa) and platform-based services (Amazon Web Services). Apple, at number three, helped pioneer voice recognition software (Siri) and provided a premier virtual workplace for app developers with its iOS platform. Fourth-place Microsoft has also evolved from a software company into a provider of AI and platform-based services.

All of the ten highest-ranking companies—and many in the top 50—use AI, platforms, and ecosystems to enable themselves and others to pursue new products, services, and ways of working. For example, McDonald's (number 21) uses an AI algorithm to serve digital menus that continuously change in response to such factors as time of day, day of the week, restaurant traffic, and weather. Philips (number 29) launched an AI platform in 2018 that helps “scientists, software developers, clinicians, and health care providers access advanced analytic capabilities to curate and analyze health care data and offers them tools and technologies to build, main-

EXHIBIT 1 | 2019 Most Innovative Companies

1	Alphabet/Google	11	Boeing	21	McDonald's	31	AXA	41	Dell
2	Amazon	12	BASF	22	Marriott	32	Unilever	42	Walmart
3	Apple	13	T-Mobile ²	23	Alibaba	33	Salesforce	43	eBay
4	Microsoft	14	Johnson & Johnson	24	Bayer	34	Pfizer	44	HP Inc.
5	Samsung ¹	15	DowDuPont	25	AT&T	35	Stryker	45	ING
6	Netflix	16	Siemens	26	Allianz	36	NTT Docomo	46	BP
7	IBM	17	Cisco Systems	27	BMW	37	Toyota	47	Daimler ⁴
8	Facebook	18	LG Electronics	28	SAP	38	Volkswagen ³	48	Huawei
9	Tesla	19	Vale	29	Philips	39	3M	49	Rio Tinto
10	Adidas	20	JPMorgan Chase	30	Royal Dutch Shell	40	General Motors	50	Hilton

Source: 2018 BCG Global Innovation Survey.

¹Includes only Samsung Electronics.

²Includes only US T-Mobile, not Deutsche Telekom.

³Includes Audi and Porsche.

⁴Includes Mercedes-Benz.

tain, deploy, and scale AI-based solutions.” BASF (number 12) is collaborating with AI software developer Citrine to build models that identify new materials for capturing carbon dioxide and other greenhouse gases.

Two New Forces

Most companies are at least exploring the use of AI, and strong innovators are seeing positive results. Nine out of ten respondents in our current survey say that their companies are investing in AI, and more than 30% expect AI to have the greatest impact of any innovation area on their industry over the next three to five years. (See Exhibit 2.) Four in ten self-described strong innovators report receiving more than 15% of their sales from AI-enabled products, compared with less than one in ten weak innovators.

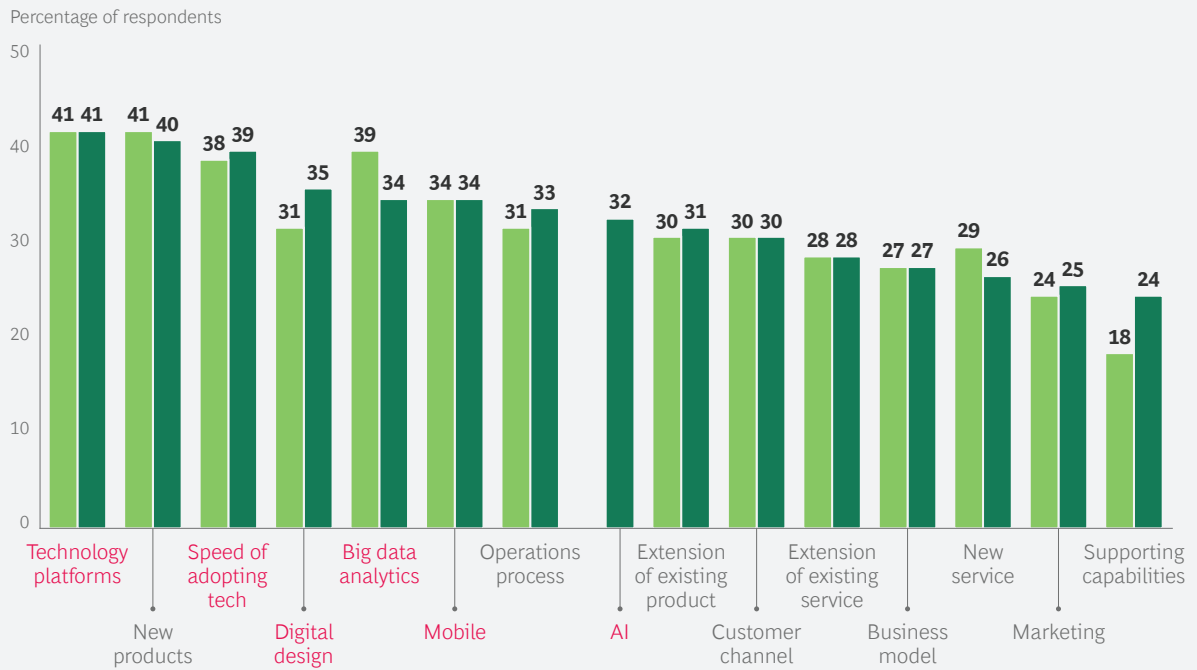
In the next chapter, “AI Powers a New Innovation Machine,” we take an in-depth look at the widening gap in where and how AI is affecting innovation.

Platforms and ecosystems serve multiple functions, including facilitating (and sometimes profiting from) the innovation of others, expanding reach and collaboration, and enabling new multiparty solutions and offerings. Again, strong innovators are more likely than weak ones to expect a significant impact within three to five years and to be actively targeting these areas. (See Exhibit 3.) Strong innovators also show other signs of being focused on external innovation. For example, 75% report using incubators, 81% leverage academic partnerships, and 83% partner with other companies. Weak innovators lag consistently in all of these areas.

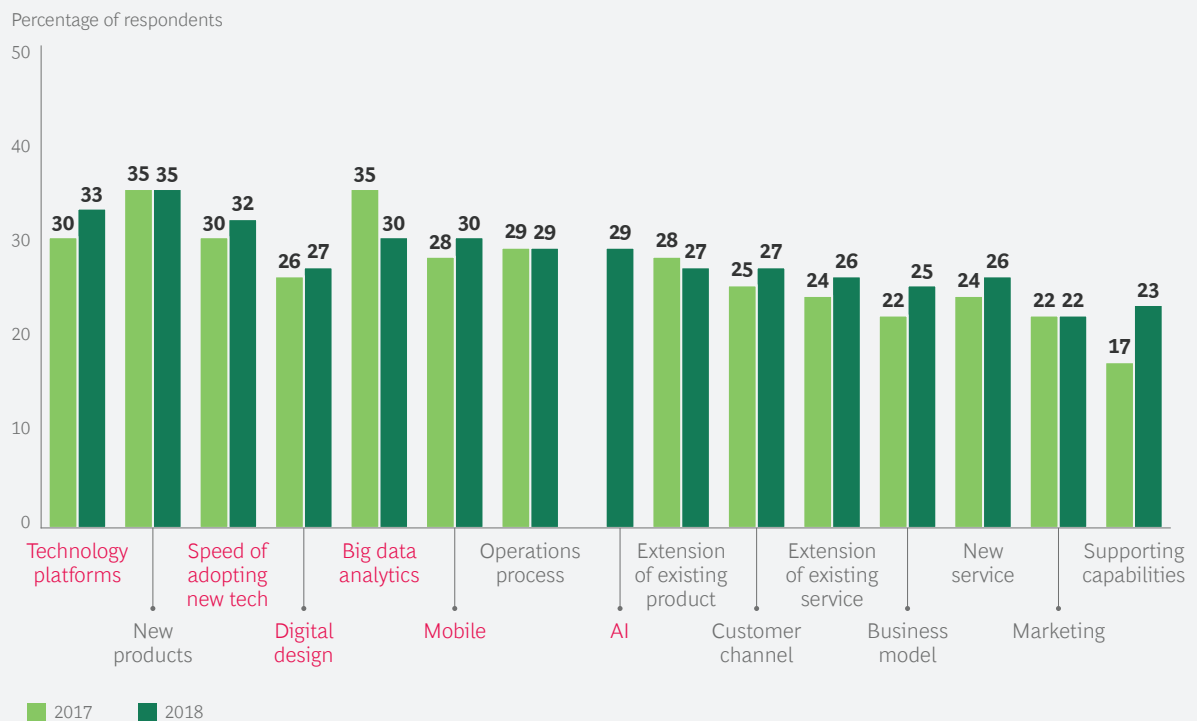
Platforms are technologies that provide a foundation for developing other business offerings. Numerous industrial goods companies, including Siemens (number 16) and Boeing (number 11), have built substantial platform businesses in predictive maintenance to complement their traditional engineering and manufacturing endeavors. Amazon, Microsoft, and IBM, among others, offer

EXHIBIT 2 | Digital Innovations Are Among the Most Promising and Most Targeted Areas

Which of the following areas of innovation/product development will be most impactful to your industry over the next 3–5 years?



Which of the following areas of innovation/product development are you actively targeting?

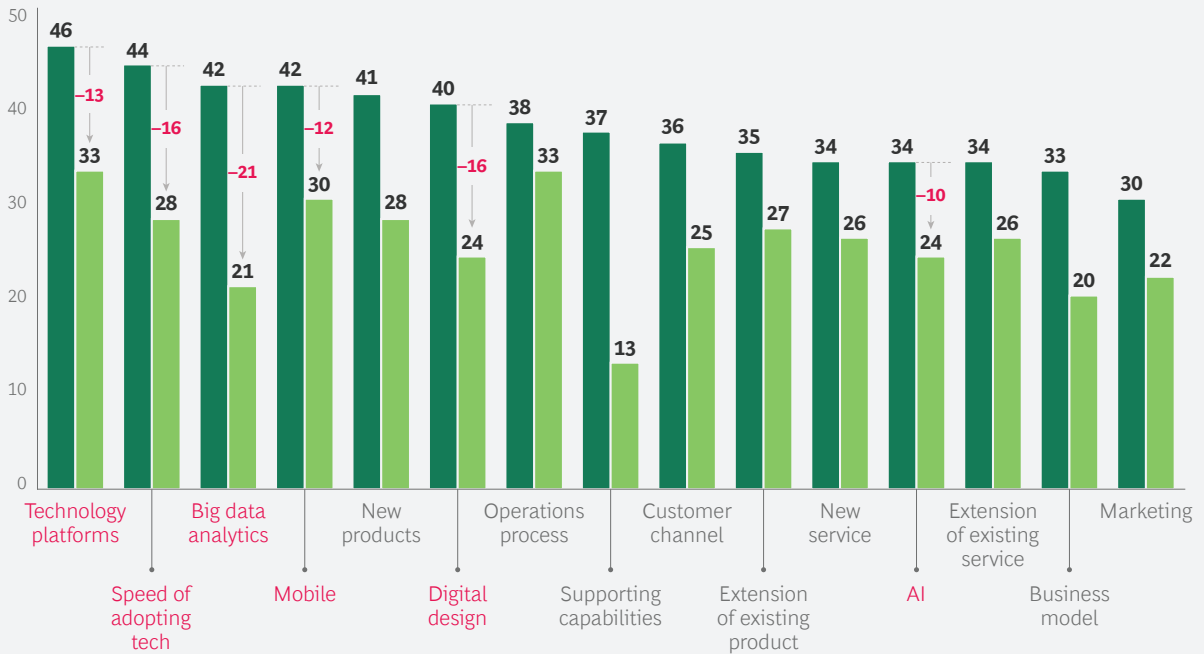


Sources: 2017 and 2018 BCG Global Innovation Survey.
 Note: Areas identified with red labels are digital innovation categories.

EXHIBIT 3 | Strong Innovators Are Optimistic and Committed on Platforms and AI

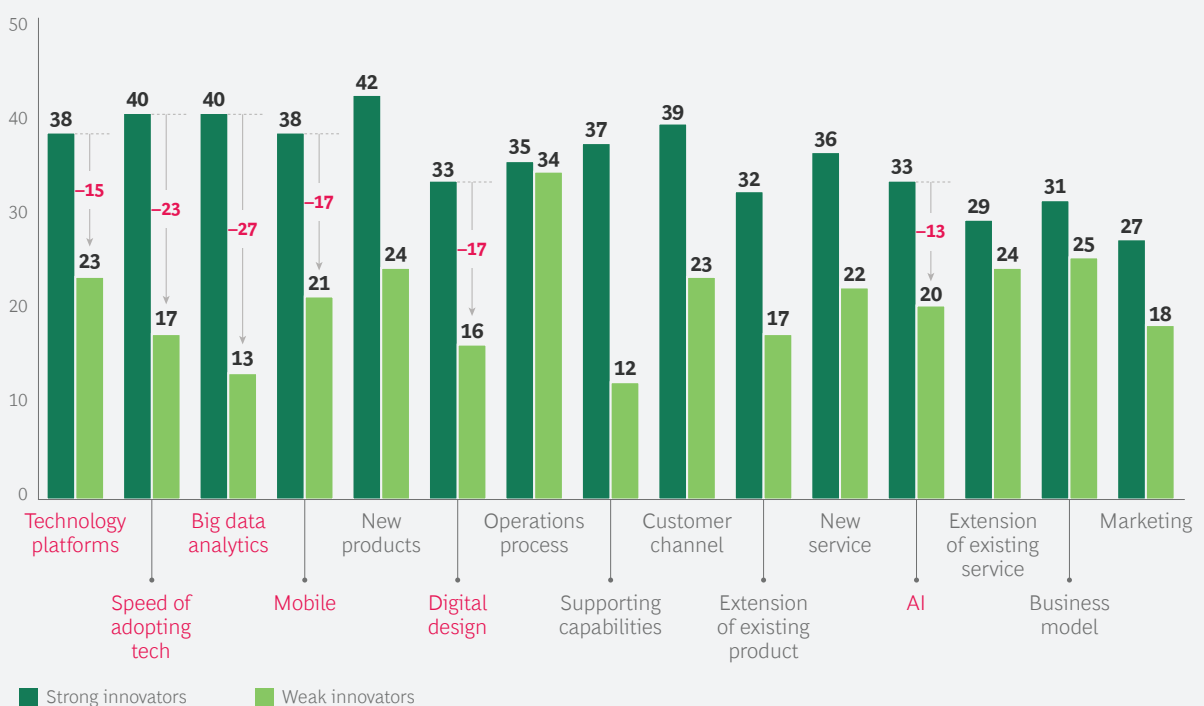
Which of the following areas of innovation/product development will be most impactful to your industry over the next 3–5 years?

Percentage of respondents



Which of the following areas of innovation/product development are you actively targeting?

Percentage of respondents



Source: 2018 BCG Global Innovation Survey.
 Note: Areas identified with red labels are digital innovation categories.

a range of software and services from their cloud platforms.

Ecosystems go a step further and leverage a range of partners that pull together the underlying technologies, applications, software platforms, and services needed to produce an integrated solution. (See “The Emerging Art of Ecosystem Management,” BCG article, January 2019.) The two main mobile operating systems—Google’s Android and Apple’s iOS—have grown into complex ecosystems of telcos, device manufacturers, service providers, and application developers, among others. Rapidly changing technologies and growing customer demand for a highly customized user experience further amplify the need for partnerships.

The opportunity to innovate entirely new revenue streams, business models, and sources of continuing advantage is particularly strong for B2B businesses, thanks to the masses of data that devices connected to the Internet of Things (IoT) generate. Data ecosystems will play a critical role in defining the future of competition in many B2B industries. (See “How IoT Data Ecosystems Will Transform B2B Competition,” BCG article, July 2018.)

The challenge is to set up and manage these ecosystems effectively and use them strategically to maximize value and gain a competitive edge. (For a look at how leading companies are building their own collaborative networks or joining existing ones to drive competitive advantage, see the third chapter, “How Platforms and Ecosystems Are Changing Innovation.”)

One Additional Thought

A final observation—one that we have written about before—bears repeating, especially with regard to the four companies in this year’s top ten list that were also in the top ten back in 2005. These companies are serial reinventors. Google constantly revises its algorithms and offerings. Amazon continuously invents new categories, services, models, and ways of engaging its customers. Microsoft has successfully transitioned from its longtime reliance on the Wintel partnership in PCs to become a cloud-based tech company. And IBM has reinvented itself multiple times, from mainframes to PCs to services to the cloud, AI, and platforms and ecosystems.

The tools and technologies of innovation evolve. The basic orientation toward change—never being satisfied and always being willing to reinvent oneself—remains part of some companies’ lifeblood.

AI POWERS A NEW INNOVATION MACHINE

INNOVATION, MEET AUTOMATION. THIS could be the beginning of a beautiful friendship.

In a few short years, artificial intelligence (AI) and its subfield, machine learning (ML), have gone from futuristic vision to near-mainstream capability at many large companies, including in their innovation programs. A quick scan of BCG's 50 most innovative companies for 2019 shows that top innovators are also AI leaders (Google, Amazon, Apple, Microsoft, Netflix, and IBM, for openers) and that many others—including plenty of companies from traditionally nondigital industries (Boeing, Siemens, Marriott, BP, and multiple automakers, for example)—are actively leveraging AI.

Like any powerful new technology, AI is the subject of lots of hype. But in this case, real fire lies behind the smoke. The rapid ascent of AI in business is well chronicled in two reports by BCG and *MIT Sloan Management Review (SMR)*.¹ The more recent of these reports found that AI leaders are deepening their commitment to the technology (as evidenced by funding) and seeking ways to apply AI at scale. Our current research into AI in innovation reveals similar trends. Nine out of every ten respondents to our innovation survey reported that their companies are investing in AI. More than 30% expect AI to be among the areas of innovation with the highest impact on their business in the next three to five

years. And almost 30% are actively targeting AI in their innovation programs. Strong innovators are particularly active.

The 2018 *SMR-BCG* report also identified a performance gap associated with this critical new capability, indicating that AI “pioneers” appear to be “pulling further away” from their less aggressive peers. We see a similar pattern with respect to AI in innovation, which carries two key implications. First, AI is not a plug-and-play capability. Second, ML is inductive—that is, machines learn by doing, and they need to be fed large amounts of data to get smarter. Tortoises will have a tough time catching up with hares in this race. But hares can't afford to become complacent, because AI is truly disruptive and can propel long leaps forward.

What are the leaders doing?

A Strong Correlation

Our most recent innovation survey found a strong correlation between companies that consider themselves strong innovators and those that see themselves as being good at AI. (See Exhibit 4.) About 30% of respondents rate themselves as strong innovators, and about 25% as being better than average at AI. Almost 20% see themselves as both; we call this group “AI leaders.” Nearly 17% of the respondents in our survey assess their orga-

EXHIBIT 4 | Nearly 20% of Companies Rate Themselves as Both Strong Innovators and Above Average at AI

Percentage of respondents identifying their company as:

Better than average at AI (%) 25.4	0.2	6.0	AI leaders 19.2
	1.9	46.6	9.6
Average at AI (%) 58.1			
Worse than average at AI (%) 16.5	7.1	<i>AI laggards</i> 8.7	0.7
	Weak innovator (%) 9.2	Average innovator (%) 61.3	Strong innovator (%) 29.5

Source: 2018 BCG Global Innovation Survey.

nizations as being below average on AI; we call this group “AI laggards.” AI leaders are more likely than laggards to consider AI important to their organizations’ future growth (94% versus 56%), which suggests that more than half of laggards will face a widening competitive disadvantage unless they step up their AI game.

AI leaders tend to see themselves as being good at embracing new technologies such as AI to enhance customer offerings or streamline the development process (89% versus 24%). AI leaders and laggards allocate their spending roughly equally among radical innovation; major new products, services, and internal process changes; and improvement of existing products, services, and processes.

But AI leaders are far more likely than laggards to apply big data and advanced analytics throughout the innovation process—from identifying new themes (91% for leaders, 30% for laggards) to informing investment decisions (92% to 27%). (See Exhibit 5.) In addition, by margins of 42% to 19%, and 42% to 24%, respectively, AI leaders are more likely than laggards to be actively pursuing the related avenues of big data and tech platforms.

Where to Focus?

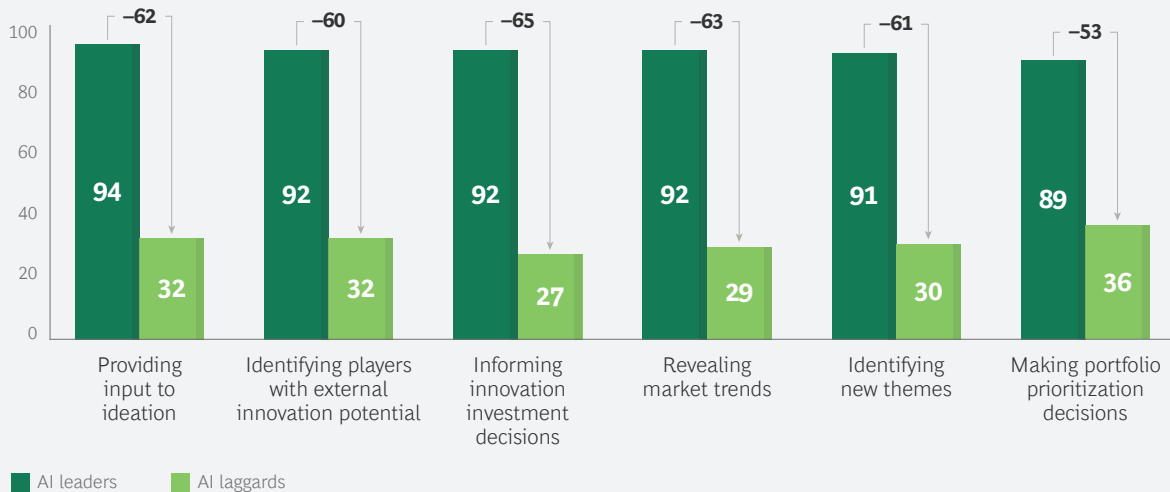
All companies face choices about where to apply resources and where AI might make the most impact. New examples emerge every day. BP (number 46 on the 2019 most innovative list) is using ML to improve its prediction models for oil and gas reservoir recovery. General Motors (number 40) used AI-aided design to reduce the weight of traditionally designed and manufactured parts by 40% while increasing their strength by 20%. Experts predict multiple areas of impact for AI in health care, including improving radiology diagnoses, making medtech devices smart, and identifying new infection patterns. In financial services, Chinese insurer Ping An, a digital native, developed predictive models and leveraged face and voice recognition as foundations of its business. The vice president and chief data scientist at Ant Financial, another Chinese digital financial services leader, told *SMR*, “AI is being used in almost every corner of Ant’s business. We use it to optimize the business and to generate new products.”

Early AI programs tend to focus on improving operational efficiencies, perhaps because companies can demonstrate success relatively quickly in these areas. The 2018 *SMR*-BCG re-

EXHIBIT 5 | AI Leaders Use Data Throughout the Innovation Process

How would you rate your company's skill at leveraging big data and advanced analytics to help with each of the following aspects of innovation?

Percentage of respondents selecting "Strong" or "Very Strong"



Source: 2018 BCG Global Innovation Survey.

port found that many early AI initiatives were pilots or tests designed to solve a particular problem as companies focused their early attention on gathering low-hanging fruit and making moves with near-term impact. Nearly two-thirds of the AI leaders in our study report that their innovation-related use of AI aims to improve internal processes.

As significant as the impact of AI will be on business processes, however, its area of greatest potential lies in developing new products and services that can evolve into major revenue streams over time. Most of the AI pioneers in the SMR-BCG study prioritized revenue-enhancing applications, which is where 72% of respondents expect the big AI gains to originate. In our survey, the AI leaders reported much higher percentages of sales driven by AI-enhanced products or services introduced in the past three years: 46% of AI leaders say that 16% or more of sales are AI-generated, compared with only 10% of AI laggards). AI leaders also expect a much greater percentage of sales to come from the introduction of AI-enhanced products or services over the next five years (54% of AI leaders anticipate that 16% or more of sales will come from these sources, compared with 22% of AI laggards).

Despite ample evidence of impact, AI still garners its share of skepticism, which is one reason that laggards are falling behind. Research by BCG and Google in the consumer products sector found that by applying AI and advanced analytics at scale, consumer packaged goods (CPG) companies can generate more than 10% of their revenue growth through multiple means, including more predictive demand forecasting, more relevant local assortments, personalized consumer services and experiences, optimized marketing and promotion ROI, and faster innovation cycles. (See "Unlocking Growth in CPG with AI and Advanced Analytics," BCG article, October 2018.) Yet in our innovation survey, only 23% of CPG respondents said that they believe AI will have the greatest impact on innovation and product development in the industry over the next three to five years, and a similarly modest percentage are actively targeting AI in their innovation programs. Both figures are about 10 percentage points below the cross-industry averages.

AI at Scale

AI forces business executives to deal simultaneously with technology infrastructure and more traditional business issues. Typical IT

systems—which consist of data input, a tool, and data output—are relatively easy to modularize, encapsulate, and scale. But AI systems are not so simple. AI algorithms learn by ingesting data, and training data is an integral part of both the AI tool and the overall system. The entanglement is manageable during pilots and isolated uses but becomes exponentially more difficult to address as AI systems interact and build on one another. This leads to what our colleagues have termed the “AI paradox”—the ease of achieving powerful results with AI pilots and the difficulty of replicating those results at scale. (See *The Big Leap Toward AI at Scale*, BCG Focus, June 2018.)

Talent is a major issue for most organizations. Data scientists and software engineers aren’t the only high-demand personnel. Companies also need people who combine business skills with an understanding of AI. Companies that are moving toward AI-centric innovation processes must consider how the transformation will affect their staffing in terms of skill shortages, job elimination, or both. In pharma, for example, as AI algorithms learn to identify the types of people and conditions that are best suited for clinical trials—a major process innovation—the need for human involvement in this critical function changes. Banks and other financial services companies are already feeling the impact of voice recognition and credit-scoring systems that use AI technology to automate customer service.

As AI becomes a more critical element of innovation, the talent challenge may widen the gap between strong and weak innovators. After all, Exhibit 4 indicates that more than 65% of strong innovators already see themselves as above average on AI, versus just 2% of weak innovators.

Build Versus Buy

One talent-related issue with immediate impact is the question of whether to build or buy AI capabilities. In our survey, 55% of AI leaders extensively use external vendors for AI projects—36% relying exclusively on them, and 19% relying mostly on them. This approach may help leaders climb the AI curve quickly, since expertise is still in short supply.

But because of AI’s heavy reliance on data, companies need to be careful about the agreements they construct with their suppliers and partners. They must protect their ownership of internal data, control how vendors use that data, and ensure their own continuing access to data from outside sources. (See “The Build-or-Buy Dilemma in AI,” BCG article, January 2018.)

Companies need people who combine business skills with an understanding of AI.

AI leaders often rely on ecosystems. Digital natives, such as those leading our list of most innovative companies, grew up in ecosystems. Companies such as Amazon, IBM, and Microsoft offer AI capabilities for sale or rent through their cloud-based platforms. Some industrial companies—automakers and aircraft manufacturers, for example—are accustomed to working in broad partnerships of multiple companies, with all the collaboration and technology and data sharing that these arrangements entail. Others have less experience—but as we explore in the next chapter, “How Platforms and Ecosystems Are Changing Innovation,” the fast-rising importance of technologies such as AI will all but force them to explore such alliances.

“Alexa, Innovate!”

A fascinating battle for AI-enabled smart-home systems is brewing among Amazon (Alexa), Google (Google Assistant), Apple (Siri), Microsoft (Cortana), and others as each company seeks to capture the biggest share of end-user households for its voice-recognition technology. The battle is a critical early-stage skirmish in a much longer conflict to determine how and for what purposes these systems will be used. At this point, streaming music is the most widely used application, but the larger competition may take a generation to decide. The plan appears to be for each company to open its smart-home platform to others, which will innovate actual use cases for consumer testing. Winners can be

scaled up quickly and losers tossed aside with equal dispatch.

Consider Alexa and Google Assistant. These classic platforms enable others to innovate inexpensively on top of them. By opening their platforms to others, Amazon and Google can harness others' innovations—much as Apple and Google did with their mobile platforms, and as Microsoft did with Windows. The platforms, provided at little or no cost to app developers, take care of the basic plumbing, and the platform owners derive value from having a richer set of services available than they would have had with their own apps alone. In this case, the stakes are high, as use of smart-home systems is expected to increase exponentially as today's young people grow up talking to, learning from, and coming to depend on these devices.

In China, Baidu uses a similar open-AI platform strategy in the B2B or industrial internet marketplace. Baidu provides access to AI services such as voice and image technology and natural-language processing, which companies are using in such diverse fields as agriculture, manufacturing, and health care, where these innovations have helped reduce the misdiagnosis rate for diabetes-related eye disease to less than 5%. (See “Get Ready for the Chinese Internet's Next Chapter,” BCG article, January 2019.) Open platforms such as these will affect not only how consumers and businesses access AI applications but also how companies build their own AI capabilities.

It's still the early days in AI. But after years of development, actual use of the technology is catching on fast. Laggards need to get into the game, and leaders need to accelerate their efforts. The platforms offered by Amazon, Google, Baidu, and others may well make some kinds of experimentation and testing and learning easier. But the big issues of access to data and talent won't get any less challenging over time; if anything, competition for these vital assets will only increase. Companies that hope to rank among the most innovative of the future need to place their AI bets now.

NOTE

1. See S. Ransbotham, P. Gerbert, M. Reeves, D. Kiron, and M. Spira, *Artificial Intelligence in Business Gets Real*, *MIT Sloan Management Review* and Boston Consulting Group report, September 2018; and S. Ransbotham, P. Gerbert, M. Reeves, and D. Kiron, *Reshaping Business with Artificial Intelligence*, *MIT Sloan Management Review* and Boston Consulting Group report, September 2017.

HOW PLATFORMS AND ECOSYSTEMS ARE CHANGING INNOVATION

IN 2016, A GROUP of Finnish medical researchers won a global competition whose goal was to accurately predict prostate cancer survival rates. From an innovation perspective, two facts stand out. First, the competition was virtual: it was hosted and managed on a cloud-based platform that facilitates scientific collaboration. Second, before entering the contest, the Finnish team had not been active in cancer research.

More and more frequently, innovation today comes from outside the company.

As we noted in our 2016 report on the most innovative companies, innovation today can come from anywhere—and more and more frequently, it comes from outside the company. (See *The Most Innovative Companies 2016: Getting Past “Not Invented Here,”* BCG report, January 2017.) Technology has helped level the competitive playing field, making it easier for anyone anywhere to gain access to the hardware, software, and tools they need to develop new ideas and business models and connect with other people and organizations.

At the same time, companies can use an array of tools to cast wide innovation nets and get

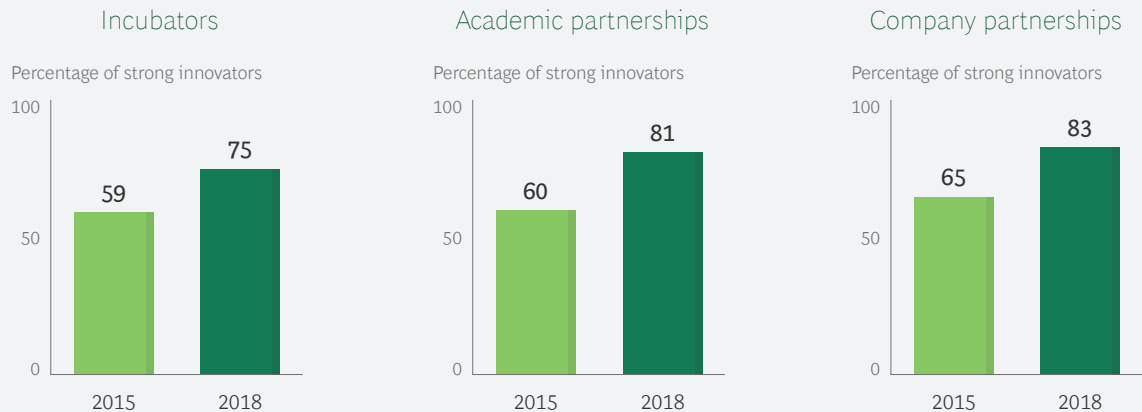
an early look at what’s happening in their targeted fields of R&D. (See *How the Best Corporate Venturers Keep Getting Better*, BCG Focus, August 2018.) It’s a powerful combination—if companies create the organization, processes, and incentives needed to bring outside ideas inside without killing them along the way.

It’s an External Game

In business life today, companies need to look beyond their own walls for new ideas. We have seen big increases in the use of such partnership models as corporate venture capital, incubators, and accelerators. Our current innovation survey found that incubator use among self-described strong innovators rose from 59% in 2015 to 75% in 2018, that tapping into academic relationships jumped from 60% to 81% during the same period, and that formation of company partnerships increased from 65% to 83%. (See Exhibit 6.)

The increasing use of platforms such as Synapse, which hosted the prostate cancer challenge, is making innovation more multiparty and collaborative. There are many types of platforms—such as computing, technology, service, content, and marketplace—but all of them serve a similar purpose. Users access platforms because platforms combine aggregated supply or demand with high service levels and reduced friction. They can also facilitate collaboration and the development of

EXHIBIT 6 | Strong Innovators Are Increasingly Embracing Ideas from External Sources



Sources: 2015 and 2018 BCG Global Innovation Survey.

new ideas. For example, many of the longest-tenured companies on our most innovative companies list use platforms to gain access to different capabilities and sources of data, which they then use to build new business models or develop new products and services.

Developers of voice-recognition-based smart home platforms, including Amazon and Google, make it easy for others to create new consumer services that use their AI-enabled platforms—and in the process to attract the critical mass of applications needed to make their platform a clear leader.

Digital technologies enable collaboration platforms, and collaboration platforms enable ecosystems that bring together a group of organizations to build a new capability or product or service offering, or to help a new field of science or technology advance. Some ecosystems represent expansions of traditional ways of organizing and doing business; they tend to have an orchestrator at the center, with which all the other participants interact, along with established hierarchies and structures.

Other ecosystems—including many that are involved in the early research phase of R&D—tend to be more dynamic, less reliant on a central orchestrator, and more dependent on multifaceted interactions among participants. Various types of glue bind ecosystem participants. Money is one type of glue, of course, but knowledge, data, skills, and community can be equally important.

Just as multiple types of platforms exist, ecosystems may be formed to serve different purposes. Here are some of the most common ones that are relevant to innovation.

Building Capabilities. Many ecosystems are set up to bring in expertise from other industries. BCG research shows that 83% of digital ecosystems involve partners from four or more industries and 53% involve partners from six or more industries. For instance, a household electronics manufacturer might partner with sensor and camera manufacturers, an AI software provider, and research facilities to bring an advanced vacuum robot to market. In the past, to enter a new market (such as China), automakers either formed a joint venture or alliance with an OEM or established contractual relationships with hundreds of suppliers to secure parts. These traditional partnerships still exist, but today a typical auto company draws on an ecosystem of more than 30 partners across five different industries and several countries to make their cars connected, electric, and autonomous. The auto company acts as orchestrator, organizing and managing the ecosystem, defining the strategy, and identifying potential participants.

For example, Caterpillar's smart-mining ecosystem involves four types of collaboration, with a strong focus on flexible deal structures such as partnerships and minority investments, along with joint ventures and M&A. Caterpillar has forged partnerships to improve its proprietary industrial IoT platform's tech-

nology, and it has made minority investments to expand the platform's automation, optimization, and analytics capabilities. For most companies, these types of flexible deals require a different approval process than prevails in traditional contracting and M&A—one that is faster, leaner, and closer to the business. (See “The Emerging Art of Ecosystem Management,” BCG article, January 2019.)

Developing New Products and Services.

Ecosystems can offer multiple players a powerful way to build new revenue streams from products and services that they could not develop and bring to market on their own. For example, Alibaba's ecosystem provides a range of services for Alibaba platform users: travel, entertainment, gaming, finance, transportation, and e-commerce. It's an eclectic mix, and it generates a wide-ranging array of data that Alibaba collects and analyzes centrally. By capturing data from multiple sources, Alibaba can tailor individualized offers to users—timing them for maximum effectiveness—and provide tools that help its online sellers enhance their own businesses. The results, in turn, provide more data for the ecosystem.

In recent years, Alibaba has expanded on this model to build Ant Financial Services (originally Alipay) into a major force in financial technology; today, it is the world's most valuable fintech company, with more than 520 million users. Using machine learning technology and data from the Alibaba ecosystem, Ant provides an array of financial services to an underbanked market. Alibaba's data and analytics capabilities enable Ant to assign credit scores to individuals and small businesses, and the company has ventured from payments into online wealth management and consumer and small-business lending. In 2017, Ant launched two new initiatives: a payment option that uses facial recognition technology; and Ant Forest, which uses digital gaming technology to enable users to track their carbon footprint. The service has already attracted some 200 million users. (See “Digital Innovation on the World Stage,” BCG article, May 2018.)

Collecting and Using Data. Data ecosystems will play a critical role in defining the future

of competition, particularly in many B2B industries, because they enable companies to build data businesses. Such businesses are valuable not only because they generate recurring high-margin revenue streams, but also because they create competitive advantage. New data-driven products and services deliver unique value propositions that extend beyond a company's traditional hardware products, deepening customer relationships and raising barriers to entry by others. They also build highly defensible positions rooted in economies of scale and scope, similar to positions based on proprietary intellectual property (IP) or trade secrets. (See “How IoT Data Ecosystems Will Transform B2B Competition,” BCG article, July 2018.)

Ecosystems enable players to develop new products and services collaboratively.

Gaining Access to IP. Shifts in the IP marketplace are creating new opportunities for companies that are long on IP to cooperate with traditional companies that may be short on it. Many tech companies, for example, have a surplus of IP, while industrial goods companies may face a deficit. In the IoT world, they can work together to expand the market for sensor-enabled and location-aware goods and services. Classic, exclusionary IP strategy is not dead, but companies need to master a more sophisticated and nuanced playbook for creating competitive advantage through IP. (See “The New IP Strategy: Make Love Not War,” BCG article, June 2018.)

Merging Physical and Digital Channels. B2B and B2C companies are finding new ways to combine the digital world and the physical one to provide new services, more seamless customer experiences, and—in some cases—new business models. Amazon (with its acquisition of Whole Foods), Siemens (IoT), and the auto industry (connected cars and autonomous vehicles) offer examples. Emerging opportunities at the intersection of the digital and the physical give incumbents the chance to innovate and build valuable eco-

systems by defining new niches and new rules. (See “Getting Physical: The Rise of Hybrid Ecosystems,” BCG article, September 2017.)

Advancing New Technologies. Companies that have a stake in basic scientific advances or in the development of new technologies such as quantum computing or synthetic biology may want to explore emerging deep-tech ecosystems—groups of entrepreneurs, startups, investors, corporate and academic partners, and others that join forces to research and develop a particular technology. Such technologies differ from others in their expected impact, in the time they take to reach market-ready maturity, and in the significant amount of capital (and investor patience) required to bring innovations to market. The ecosystems represent a new model that is far more fluid and dynamic than the methods used to conduct technology

R&D in the past. (See *The Dawn of the Deep Tech Ecosystem*, BCG report, March 2019.)

Some Rules of Ecosystem Engagement

An ecosystem often operates differently from other types of business partnership, and in ways that can be foreign to big companies. Because ecosystems are dynamic environments that tend to contain lots of varied entities, they have multiple sources of influence, and no one party absolutely controls their direction. They trade in multiple currencies, not all of which are financial. Because they exist to create value through collaboration, they are the opposite of zero-sum congregations; when the ecosystem wins, each of the participants wins as well. And they evolve, acquiring new members and missions over time. (See the sidebar.)

NTT DOCOMO'S EVOLVING MOBILE ECOSYSTEM

Today it sounds like something from a distant era. In 1999—eight years before the launch of the iPhone—NTT Docomo (number 36 on the list of 2019's most innovative companies) built the first mobile internet ecosystem in Japan.

The leading telco developed a vertically integrated ecosystem based on partnerships and acquisitions that provided valuable services and experiences to feature phone users. Part of its plan was to drive “innovation through the convergence of mobile with other industries and services, thereby creating new values and markets.” (See *Through the Mobile Looking Glass*, BCG Focus, April 2013.) Consumers flocked to new services such as mobile email, contactless payments, and, in time, streaming live video—all part of Docomo's “i-mode” ecosystem, which helped propel mobile phones to become Japan's most widely owned device and spurred traditional industries to go mobile. Docomo pioneered the technological innovation of mobile payments, leveraged local market dynamics, and achieved critical mass through partnerships with established

players (often industry leaders). Establishing mobile payment capabilities for rail service helped seal other deals in the finance, retail, and hospitality sectors, among others, and helped attract more than 500,000 merchants to Docomo's mobile payment service.

Since the advent of smartphones, Docomo's ecosystem has undergone major evolutionary changes a couple of times. The first major change involved creating a mobile content hub through alliances with publishers, media companies, and other content producers. Docomo now offers more than 400 magazines online, as well as Japan's largest anime library. Its dTV service has a similar number of subscribers to Netflix in Japan. As the content business has become more competitive in recent years, Docomo has moved to the latest iteration of its ecosystem, which relies on its strengths in payments, user identification, customer loyalty, and other areas to offer promotional support and services to an expanding network of third-party e-commerce partners.

Companies that are considering orchestrating a new ecosystem or joining an existing one should take a number of steps in advance to prepare themselves:

- Make sure that you have a sharp, clear innovation strategy that identifies the innovation domains on which you will be concentrating.
- On the basis of your innovation strategy, clearly articulate an ecosystem strategy: what value you want get out of an ecosystem, and what you need to achieve in the ecosystem to support your broader innovation goals.
- Identify the types of players with which you will interact. These may extend beyond the obvious choices to companies in other (unrelated) industries, universities and research institutions, startups, and venture investors, among others.
- Think about how you will enlarge the ecosystem pie other than by simply maximizing value for your company alone. Consider how the ecosystem as a whole will create value and how the participants will share that value.
- Note the locations of current innovation hot spots around the world for the domains you are targeting. The US and China are primary hubs for many fields of new-technology R&D, but many other countries are active in particular fields and are developing serious centers of excellence. (See “A Deep Dive into Deep Tech Investing,” BCG infographic, forthcoming.)
- Determine the kinds of relationships that will provide the foundation of the ecosystem, and decide on the nature of your involvement. For example, do you foresee a series of passive corporate venture-capital investments or active investments and collaborations? Is access to data more important than financial return?
- Align and manage your innovation vehicles (including their geographic locations, search patterns, guidance, and budgets), according to your answers to the preceding questions.
- Set clear goals, review achievements regularly, and don’t be afraid to adjust your ecosystem strategy on the basis of real-world results.

THE use of platforms and ecosystems will undoubtedly expand as more companies experiment with both types of vehicles and develop more successful use cases. The relentless advance of technology will also play a role. The more complex the technology, the narrower the expertise—and the more likely it will be that companies must look outside their own organizations for the skills needed to use the latest developments. But gaining access to the latest science is one thing. Bringing that science inside and integrating it with existing programs and processes is another. The latter remains the area where most companies will face their biggest challenges.

NOTE TO THE READER

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