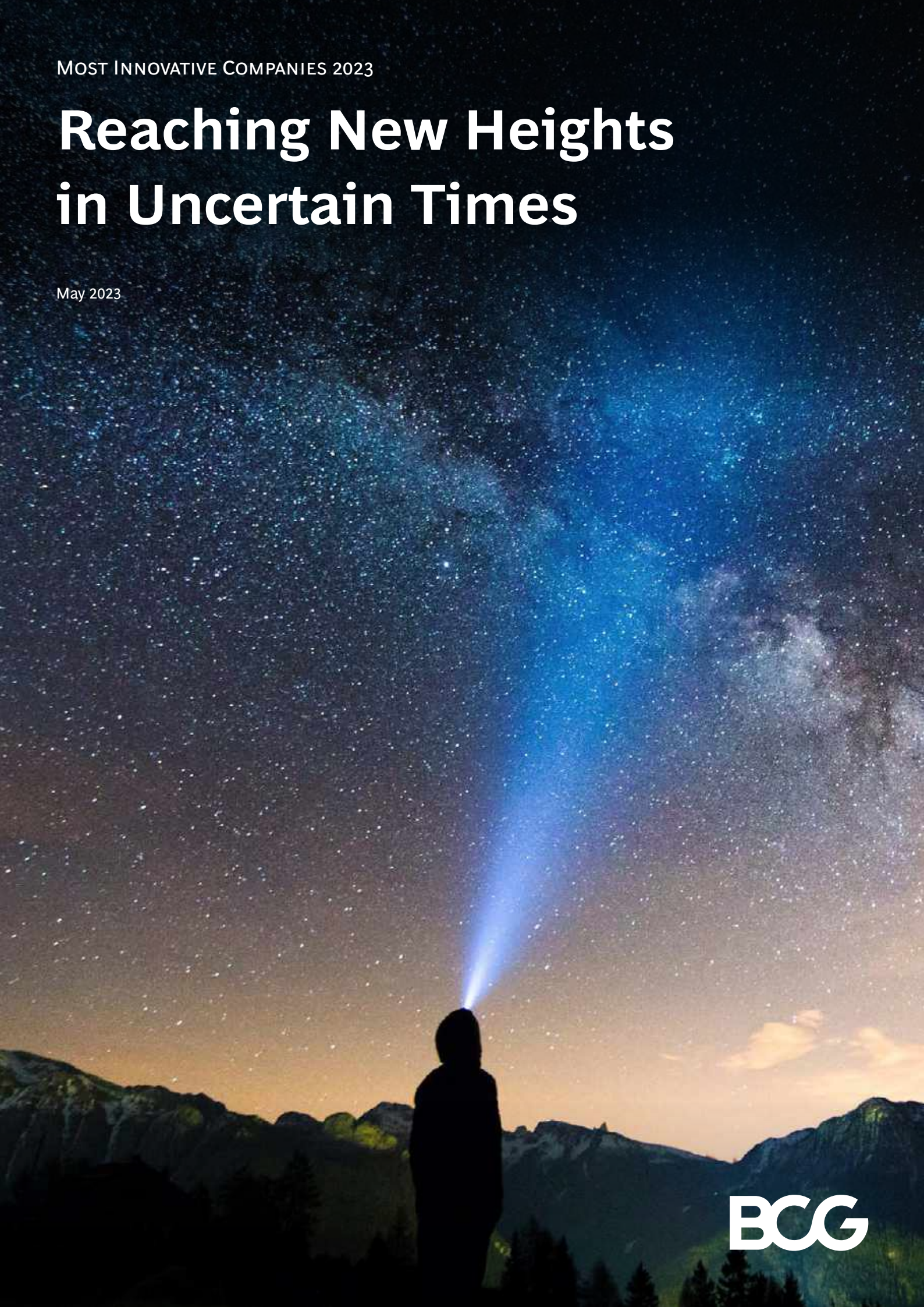


MOST INNOVATIVE COMPANIES 2023

Reaching New Heights in Uncertain Times

May 2023

A full-page background image showing a person's silhouette standing on a mountain peak at night. The person is shining a flashlight upwards, illuminating a path through the dark sky towards the Milky Way galaxy. The sky is filled with stars and the galaxy's structure is clearly visible. The mountains in the foreground are dark and silhouetted against the night sky.

BCG

Contents

01	The Formula for Innovation from Leading Companies	14	How Early Winners Are Unlocking AI's Potential
	• What Winners Are Doing • Bosch: A Culture of Innovation • The 50 Most Innovative Companies of 2023 • Innovation and Performance • Samsung: Leading the Commercialization of Consumer Tech		• From Implementation to Impact • H&M: Leveraging AI and Human Input for Amplified Intelligence • Four Impact Success Factors • Moderna: Pioneering AI-Driven Innovation in the Fight Against Cancer
07	A Downturn Ups the Stakes in Innovation	19	Methodology
	• A New Outlook? • Investing with Focus • McDonald's: Driving Growth with Digital Innovation • Good Advice (Updated) Stands the Test of Time	24	About the Authors
		25	Acknowledgments



The Formula for Innovation from Leading Companies

By Justin Manly, Michael Ringel, Amy MacDougall, Will Cornock, Johann Harnoss, Konstantinos Apostolatos, Ramón Baeza, Ryoji Kimura, Michael Ward, Beth Viner, and Jean-Manuel Izaret

For the third straight year, the evidence is mounting: companies that both prioritize **innovation** and make sure that they are ready to act are widening the gap over less capable competitors. The leaders at these firms are consistently delivering new products, entering new markets, and establishing new revenue streams. The laggards struggle to make headway beyond incremental improvements.

This year, the findings from our global innovation survey dovetail with other new BCG research showing that companies built for the future share a common set of attributes that enable them to exhibit superior performance, be more resilient to shocks and disruptions, and exploit innovation faster for value-creating growth. In addition to people and technology capabilities (including, importantly, AI), one of these attributes is an innovation-driven culture.

In this year's Most Innovative Companies report, we examine what innovation-ready leaders (those that are ready to develop product, process, and business model innovations that can deliver sustainable impact) are doing to pull ahead and how innovation is building their resilience to economic uncertainty and fueling their pursuit of lower emissions. In "A Downturn Ups the Stakes in Innovation," we explore how a potential downturn in 2023 is evoking a much different response than did the 2009 financial crisis, especially among leading firms. In "How Early Winners Are Unlocking AI's Potential," we dig into the critical role of artificial intelligence (AI) in innovation as in many other areas of business today.

What Winners Are Doing

Despite global economic uncertainty, innovation rose as a top corporate priority in 2023, with 79% of companies ranking it among their top three goals. (See Exhibit 1.) This is up from 75% in 2022 and close to 2019's high of 82%. The top areas of innovation emphasis are new products and exploring adjacent business models. Cost is a key driver for 62% of respondents and a top reason for innovation. Companies remain bullish on their innovation prospects: 42% expect to significantly increase spending this year, a jump of 16 percentage points over the last economic downturn in 2009.

These are impressive figures, especially in the current macroeconomic and geopolitical environment. But there is also an emerging group of companies that is going much further and putting innovation front and center in their future growth strategies.

Two years ago, as the world began to emerge from the pandemic, we observed that successful innovation takes three things: making innovation a priority, committing investment and talent to it, and being ready to transform investment into results. We found that only about one company in four was “innovation ready”—that is, it met all three criteria, particularly possessing the elements of leadership and teaming that enable effective execution of a company's innovation

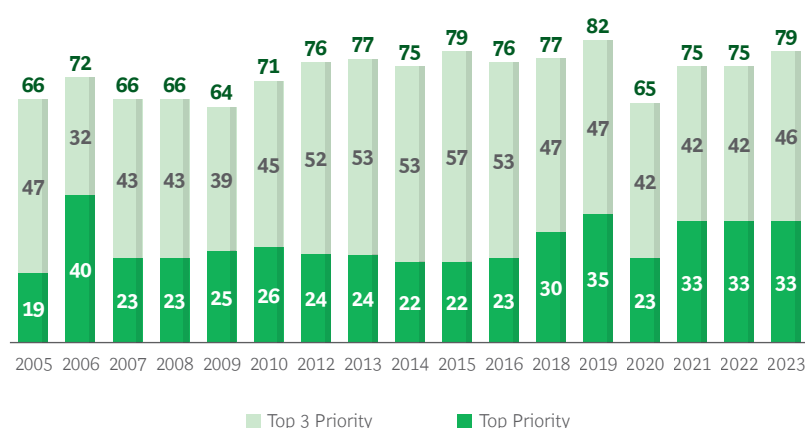
ambitions. Last year, we examined companies' readiness in the context of climate and sustainability (C&S), which two-thirds of companies ranked as a top corporate priority. Only about one in five companies was ready to take effective action.

This year, two out of three ready companies rank innovation as their top priority, and 90% expect to increase spending—almost all by more than 10%. (See Exhibit 2.) Moreover, while all companies on average expect to allocate more money toward incremental innovations close to the core (an understandably conservative approach in uncertain times), ready companies are allocating fully one-third of spending toward developing breakthrough innovations. Expanding into adjacent business models is also a priority in 2023. And 89% of ready companies prioritize C&S compared with 58% of all companies.

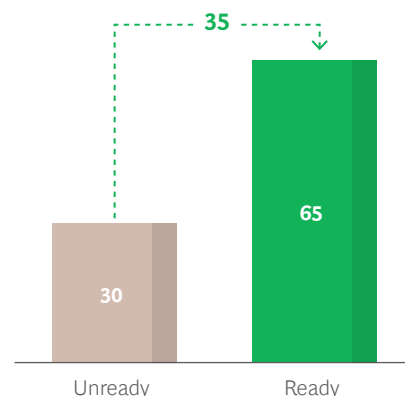
Ready companies use a wide array of strategic tools to strengthen their innovation platforms and practices. They access capabilities and expertise from outside their own walls, and they have systems in place to leverage these tools for value. These companies are much more aggressive in their use of M&A, for example, targeting innovative technologies or processes or acquiring leaders and employees with a demonstrated ability to innovate. They are also more likely to involve innovation experts in target analysis and selection.

Exhibit 1 - Nearly 80% of Respondents Named Innovation as the Top-Three Priority, While Two-Thirds of Ready Companies Ranked It as Top Priority

Where does innovation, R&D, and product development rank among your company's priorities? (%)



Respondents who cite innovation, R&D, and product development as their company's top priority (%)

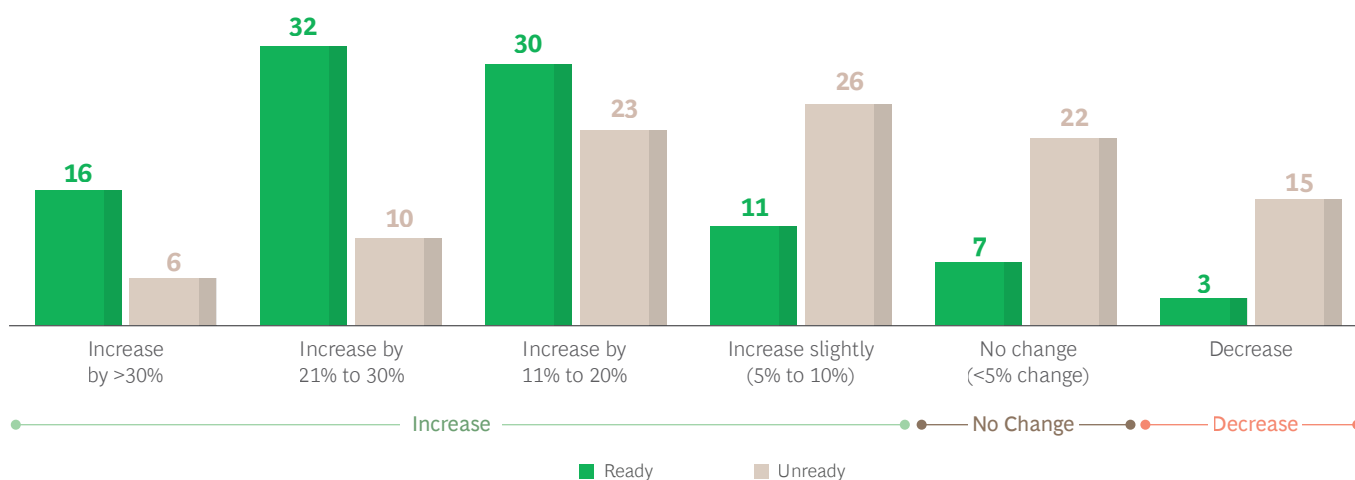


Sources: BCG Global Innovation Survey 2023; BCG analysis.

Note: n = 1,023 for global respondents. No data for 2011 and 2017 available. Totals may not sum due to rounding. “Ready” companies are those that are ready to develop product, process, and business model innovations that can deliver sustainable impact.

Exhibit 2 - Nearly 90% of Ready Companies Plan to Increase Innovation Spending

How will your company's innovation, R&D, and product development spending change this year in response to macroeconomic factors? (%)



Sources: BCG Global Innovation Survey 2023; BCG analysis.

Note: n = 1,023 for global respondents. Totals may not sum due to rounding. “Ready” companies are those that are ready to develop product, process, and business model innovations that can deliver sustainable impact.

For similar reasons, they also are more likely to orchestrate or participate in ecosystems, engaging with external partners, even competitors, on innovations. They determine what they need, whether it’s technology, data, or something else, and then work out the most effective way to access it.

They drive digital innovation with a clear bias towards new digital products, agile teaming, and improving customer and marketing insights. They regularly review the performance of innovation units or vehicles (such as venture capital funds, accelerators, incubators, and R&D) and shift resources toward centers of success. And they understand that effective portfolio governance and management, especially with respect to data transparency, are key to driving impact.

Bosch: A Culture of Innovation

The Bosch Group (number 37 on the 2023 Most Innovative Companies list) states in its annual report that “the basis for the company’s future growth is its innovative strength.” While Bosch has a special ownership structure that facilitates long-term planning and up-front investments, it is a strong culture of innovation that underpins.

Bosch has a global R&D organization of about 84,800 employees, 44,000 of whom are software developers, in 130 locations. From 2018 through 2021, the company has maintained steady R&D spending as share of sales at between 7.6% and 8.2%. A core pillar of Bosch’s innovation

strategy is its centralized Bosch Research unit. With 1,800 highly specialized employees, this unit generates about a quarter of all Bosch patents. Bosch Research focuses on enabling technologies that can be applied across The Bosch Group, such as AIoT, which combines AI and the Internet of Things, to move from fundamental research to actual product innovation and large-scale commercialization. Bosch builds on a broad ecosystem of internal business units and external partners to generate innovation ideas.

While three-quarters of R&D spending has been devoted to the company’s Mobility Solutions business and topics such as electrification, driver assistance systems, semiconductors, and sensors, Bosch supplements internal R&D investments with targeted acquisitions to support high-priority areas, such as its automated driving product portfolio.

In 2022 alone, the company made three investments to acquire IP for the next generation of mobility, consistent with its goal of making Bosch a one-stop shop for “all the necessary building blocks of automated driving—from actuators and sensors to software and maps,” according to Mathias Pillin, president of the Cross-Domain Computing Solutions division.

For example, Bosch’s Semiconductor Ideas to the Market team specializes in high-frequency-processing “System-on-Chips” used in control units for the automotive industry. Its FiveAI unit provides a modular cloud platform designed for building software components and development platforms

for safe automated driving systems, particularly supporting solutions used in complex urban environments. “We want Five to give an extra boost to our work in software development for safe automated driving,” said Markus Heyn, member of the Bosch board of management and chairman of the Mobility Solutions business. Bosch’s Atlatec team, meanwhile, creates high-resolution digital maps that are critical to automated driving functionality.

The 50 Most Innovative Companies of 2023

The 50 most innovative companies for 2023 are a geographically diverse group, roughly evenly split between North America and the rest of the world. Europe and Asia are well represented, and the Middle East joins the list for the first time with Saudi Aramco at number 41. (See Exhibit 3.) Auto companies held multiple positions in the 2022 list; international energy companies hold five spots this year. This may be a sign of respondents’ concerns over climate change and the fact that they are looking to the energy industry to be a large and creative part of the solution. In spite of the market headwinds that they experienced in 2022, tech companies continue to dominate the top 50, including the top ten.

The big story, though—this year and for most of the past decade—is the ability of innovation to drive performance. Since 2005, our portfolio of the 50 most innovative companies has outpaced the broader market in shareholder returns by a significant margin—an average of 3.3 percentage points per year. (See Exhibit 4.)

Innovation and Performance

The consistent outperformance of BCG’s most innovative companies compared with the broader market is one indication of the correlation between superior innovation capabilities and performance. There are others.

New BCG research into the shifting drivers of **performance and sustainable competitive advantage** show that the ability to innovate consistently over time is fast rising in importance. Traditional markets have plateaued, and growth, which accounts for 60% to 70% of shareholder returns in the medium term, is found primarily in new markets, including those created by technology disruption, such as e-commerce, streaming media, cloud-based interactions, mobility solutions, and smart energy solutions. A small number of companies that have embedded the capabilities that enable them to exploit innovation for value-creating growth are widening the performance gap with their competitors and generating shareholder returns almost three times greater than those of the S&P 1200.

These new bases of advantage are rooted in superior capabilities, especially those related to digital, AI, and innovation. These capabilities are more difficult to establish but much more enduring for two reasons. First, technology is evolving rapidly, and proficiency in a technology today, such as AI, means that as the technology grows more powerful, a company can be faster at deploying it. Second, companies that have these capabilities benefit from a flywheel effect: they can invent, deploy, adapt, and reinvent more quickly and with greater impact than their competitors can. They also get better at co-creating with customers and ecosystem partners and at democratizing the use of data throughout their organization.

Samsung: Leading the Commercialization of Consumer Tech

Consumer electronics giant Samsung is an example of a company that uses all the tools available to drive performance by innovating at multiple stages of the value chain. Samsung regularly brings new technology to the mass market through a focus on component-level technology innovations and advances in scaled manufacturing. Over the years, as its core products and markets (such as smartphones and TVs) have matured, Samsung, known for its dizzying array of products, has proved adept at pushing into adjacent markets and developing new business models.

Samsung innovates along two dimensions: component-level advances (improving existing technologies with innovations, such as foldable phones), and adoption (increasing accessibility to products through mass production, lower costs, and technological advancements). The company is a global innovation leader across R&D, patents, and innovation vehicles such as labs and incubators. It invests heavily in R&D, spending more than \$17 billion (9% of sales) in 2021 alone, making it the largest non-US R&D spender. Boasting about 10,000 researchers and developers dedicated to the development of future tech, the company has developed a robust patent portfolio: it was granted 6,300 patents in 2022, the most in the US.

As Samsung has developed new products and sought out new markets, it has moved from displays and electronic components into robotics, smart home products, connected cars, medical equipment, virtual assistants, and 5G connectivity. The company has captured significant shares of the global market for smartphones, QLED TVs, and IoT products.

The connection between innovation and both growth and advantage is becoming stronger than ever. Winners understand this and invest in their innovation engines accordingly. They will continue to widen their lead over others until the laggards reset their own priorities and investments for the future.

EXHIBIT 3

The 50 Most Innovative Companies of 2023

Ranking

1–10 1 Apple 2 Tesla (+3) 3 Amazon 4 Alphabet 5 Microsoft (-3) 6 Moderna (+1) 7 Samsung (-1) 8 Huawei 9 **BYD Company** 10 Siemens (+10)

11–20 Pfizer (+7) J&J (+15) **SpaceX** Nvidia (+1) **ExxonMobil** Meta (-5) Nike (-5) IBM (-8) 3M (+18) **Tata Group**

21–30 **Roche** Oracle (-3) **BioNTech** **Shell** **Schneider Electric** P&G (+8) Nestlé (+22) General Electric (+1) Xiaomi (+2) **Honeywell**

31–40 Sony (-22) **Sinopec** Hitachi (+6) **McDonald's** **Merck** ByteDance Bosch (-11) Dell (-24) **Glencore** **Stripe**

41–50 **Saudi Aramco** Coca-Cola (-6) **Mercedes-Benz Group¹** Alibaba (-22) Walmart (-32) **PetroChina** **NTT** Lenovo (-24) **BMW** Unilever

xxx - Returnee

xxx - New entrant

Sources: BCG Global Innovation Survey 2023; BCG analysis.

Note: +/- indicates change from 2022 MIC ranking.

¹Mercedes-Benz Group was previously identified as Daimler.

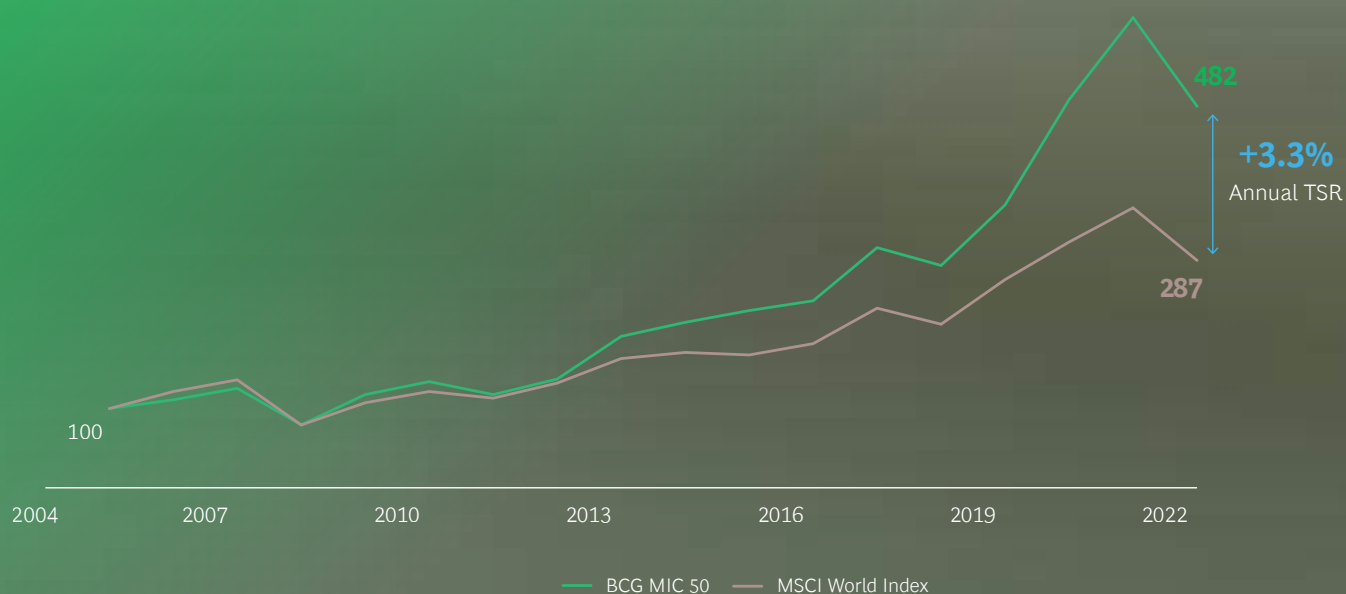
EXHIBIT 4

Innovators Create Value



Total shareholder return

2005 = index 100



Sources: BCG Innovation Journey Analytics Database; CapitalIQ.

Note: Total shareholder return (TSR) performance of publicly listed MIC top 50 companies. Chart compares their one-year TSR performance for that year against global performance index (MSCI World). We reweight the MIC 50 basket annually to reflect changes to the list. BCG MIC 50 has outperformed the index in 12 of 17 years.



A Downturn Ups the Stakes in Innovation

By Justin Manly, Michael Ringel, Amy MacDougall, Will Cornock, Johann Harnoss, Konstantinos Apostolatos, Ramón Baeza, Ryoji Kimura, Michael Ward, Beth Viner, and Jean-Manuel Izaret

From an innovation perspective, this downturn (if it occurs) looks to be very different from others. During the last recession, in 2009, companies reined in spending. The innovation plans we reported on [in that year's Most Innovative Companies report](#) reflected that belt tightening. Less than two-thirds of companies ranked innovation as a top-three priority that year, and only 58% planned to increase spending. Nearly 15% expected to cut innovation investment. This year, by contrast, 79% of companies see innovation as a top-three priority—15 points more than in 2009—and 66% plan to increase spending, 42% by more than 10%. (See [Exhibit 5](#).)

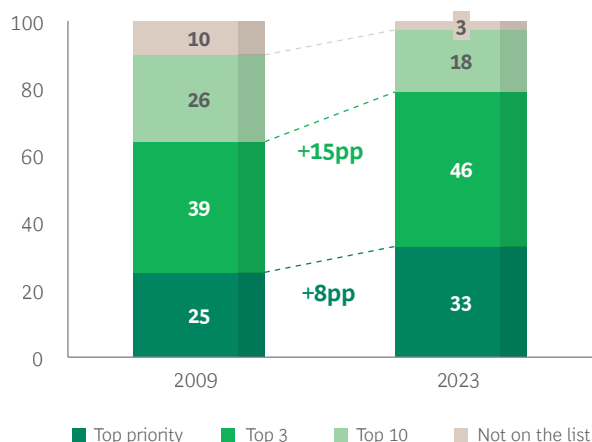
A New Outlook?

What's going on in 2023? For one thing, as growth has slowed in core markets, the importance of being able to innovate new products and services that carry companies into new markets with new business models has increased. [We reported in 2021](#) that most companies are at least gradually or partially altering their core business models, with digital opportunities and the sustainability imperative as two key forces driving the change. This dynamic continues today.

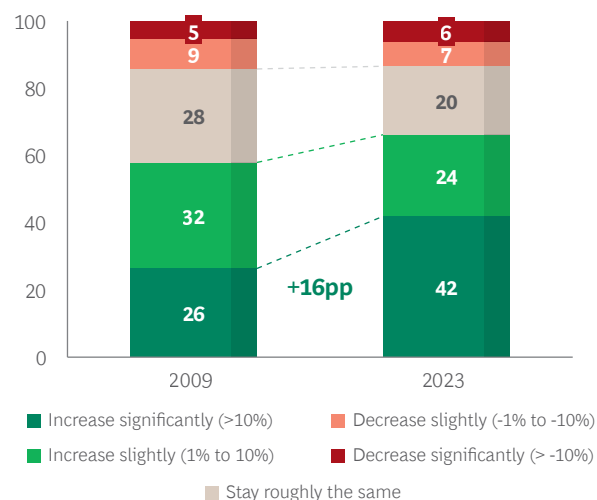
More companies are building adjacent and new-frontier business models to serve as growth engines. Many firms are also planning to increase their spending on such tools as M&A, innovation labs, and open innovation ecosystems, despite the possible downturn. (See [Exhibit 6](#).)

Exhibit 5 - Innovation Priority and Spending Plans Are Much Stronger in 2023 Than They Were in 2009

Where does innovation, R&D, and product development rank among your company's priorities? (%)



How will your company's innovation, R&D, and product development spending change this year in response to macroeconomic factors? (%)



Sources: BCG Global Innovation Survey 2023; BCG analysis.

Note: n = 1,023 for global respondents. pp = percentage points.

Companies are raising their commitment to innovation, although many are not improving their capabilities as fast as they would like. Last year, for example, nearly 80% (39) of BCG's 50 most innovative companies ranked among the top climate and sustainability (C&S) innovators, according to global peer votes. Fully 60% of high-emitting companies were targeting deep-tech innovation, and deep tech was the number one or number two innovation focus for those firms. In addition, many more committed C&S innovators are leveraging external innovation vehicles that are typically used for longer term or more technologically advanced solutions.

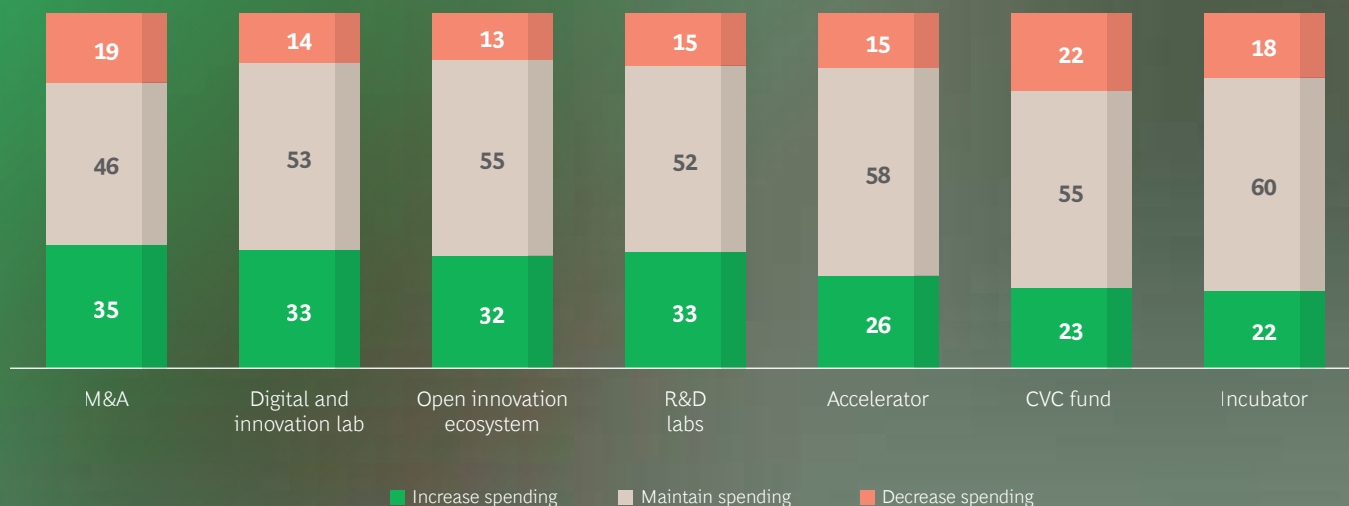
Separate BCG research has shown that a group of companies representing about 25% of the S&P 1200 have put in place the capabilities that enable them to pivot from shoring up the digital basics of their value chains to **focusing on growth from innovation**. Some are on the leading edge of disruption in their sectors and demonstrating considerable resilience in the face of uncertainty. These companies are delivering impressive results, far outpacing their peers on such key metrics as shareholder returns and revenue and earnings growth.

In addition, the old adage about downturns separating winners and losers may be gaining real traction this time around. Top performers realize that **playing a game of wait and see can easily backfire** in unstable times, as it gives forward-looking competitors more time to position themselves to win. For example, leaders know that building medium- to long-term resilience requires ongoing focus on C&S: 89% of innovation leaders cite it as a top-three priority, and 49% of all companies have confidence in their C&S investment decisions (up from just 23% last year). Among those prioritizing C&S, average "C&S readiness" increased to 37% in 2023 from 28% in 2022, based on BCG's innovation to impact (i2i) parameters.

EXHIBIT 6

Companies Expect to Increase Spending On Key Innovation Enablers, Even in the Face of a Downturn

How do you anticipate the use of innovation vehicles to change in response to macroeconomic factors such as a potential downturn, inflation, or uncertainty? (%)



Sources: BCG Global Innovation Survey 2023; BCG analysis.

Note: n = 1,023 for global respondents.

Investing with Focus

This year's survey found a significant percentage of companies that are not only prioritizing innovation but investing in it. They are also focusing their investments for greater impact and managing their portfolios for improved results, perhaps directly in response to economic uncertainty or the prospect of turmoil. They understand that innovation leads to advantage, or as Eric Schmidt, former chairman and CEO of Google, recently observed in *Foreign Affairs*, "The main reason innovation now lends such a massive advantage is that it begets more innovation."

Innovating through uncertainty requires tough prioritization around portfolio management, rigorous governance, investment in M&A opportunities, and the continuous building of talent and internal capabilities. In practice, this means companies should focus on five things.

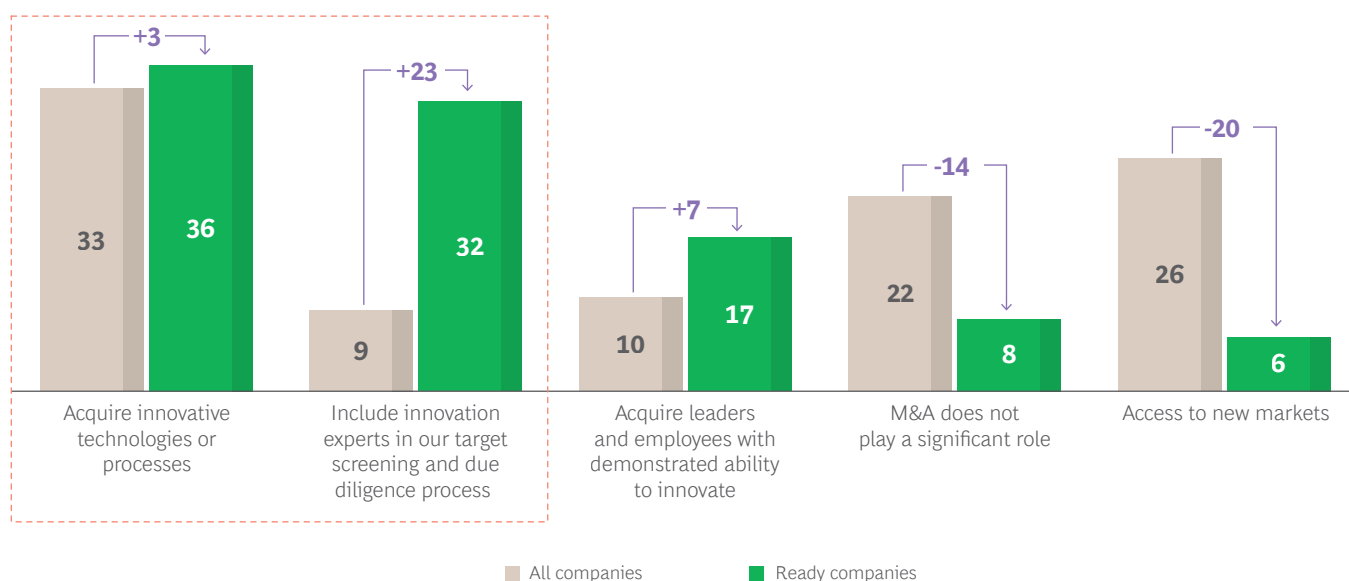
M&A. Leaders look to acquire missing technologies, capabilities, and talent. Our research found that innovation-ready companies (those that are ready to develop product, process, and business model innovations that can deliver sustainable impact) use a wide array of strategic tools to strengthen their platforms and practices. They are much more aggressive in their use of M&A to further objectives by accessing new technologies and processes or acquiring leaders and employees with a demonstrated ability to innovate. (See Exhibit 7.) They are also more likely to involve innovation experts in target analysis and selection.

Microsoft (which has ranked among the top five innovative companies since the first edition of this report in 2005) is famous for using M&A as well as partnerships and alliances to fill strategic needs that further its innovation agenda. The most recent example is the company's investments in OpenAI and the integration of ChatGPT into multiple Microsoft product offerings.

Another example is Siemens (number 10 this year and in the top 50 for 13 of the previous 16 years), which uses M&A in various ways. In 2018, it spun off 25% of its Siemens Healthineers medical device business to spur entrepreneurial independence. Siemens Healthineers has taken advantage of the flexibility to pursue big bets in health care, continuing through the pandemic. In August 2020, it announced the acquisition of longtime partner Varian Medical Systems for \$16.4 billion. The Varian acquisition positioned Siemens Healthineers as the player with the most comprehensive integrated cancer care portfolio, across screening, diagnostics, and treatment. It has allowed the company to realize innovation synergies, combining Siemens' imaging technology with Varian's therapeutic technology and AI to enhance existing products and create new ones. For example, Siemens Healthineers' new radiotherapy product combines imaging capability with AI to do rapid assessments and real-time optimization of treatment while patients are receiving therapy.

Exhibit 7 - Companies Use M&A to Access Innovative Technologies and Processes, and They Involve Innovation Experts in Target Selection

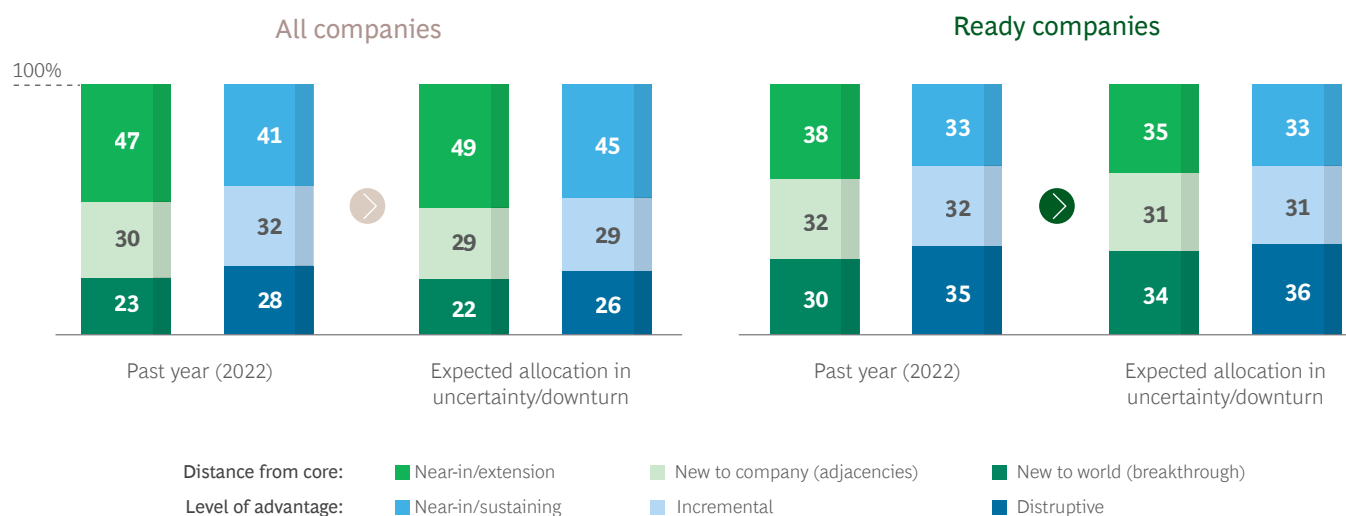
What role do M&As play in your company's innovation strategy during times of downturn, inflation, or uncertainty (select one)? (%)



Sources: BCG Global Innovation Survey 2023; BCG analysis.

Note: n = 1,023 for global respondents. "Ready" companies are those that are ready to develop product, process, and business model innovations that can deliver sustainable impact.

Exhibit 8 - Ready Companies Lean Away from the Core Toward Breakthrough Innovations



Source: BCG Global Innovation Survey 2023; BCG analysis.

Note: n = 1,023 for global respondents. Totals may not sum due to rounding. “Ready” companies are those that are ready to develop product, process, and business model innovations that can deliver sustainable impact.

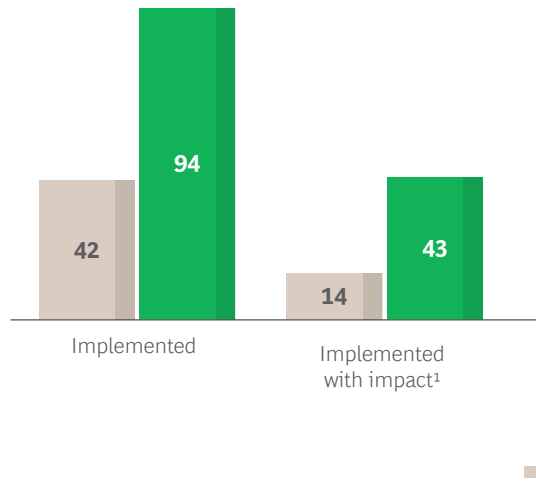
Portfolio Prioritization. Innovation-ready companies emphasize breakthrough or disruptive innovations, while less-sophisticated innovators allocate resources more heavily to “near-in” or sustaining innovation. Significant percentages of all the companies in our 2023 survey are increasing their focus on digital product innovation (34%), adjacent new business models (30%), lowering costs (23%), and new ways of working (30%). Innovation-ready companies are shifting their allocation of resources away from incremental innovations that sustain current positions or advantages toward breakthrough or disruptive innovations that create new markets or revenue streams. (See Exhibit 8.) In the event of a downturn, ready companies expect to allocate 50% more investment toward breakthrough innovations (34% versus 22% for other companies) and almost that much more toward disruptive innovations (36% versus 26%). Ready companies are planning to increase downturn spending in both areas while others tread water or retrench.

Portfolio Management. Embedding effective portfolio management and governance helps ensure ROI. The availability of end-to-end tracking tools for innovation portfolios actually declined from 2022 to 2023, and only 38% of companies report a strong reliance on metrics to inform decision making and governance. Less than a quarter of survey respondents said they have successfully implemented clear KPI and decision-making criteria to make portfolio decisions, and only 23% use stage-gate processes with clearly defined decision criteria, reporting requirements, and performance metrics. By contrast, almost all innovation-ready companies employ end-to-end tracking to assess progress and make informed decisions about an initiative’s value. (See Exhibit 9.)

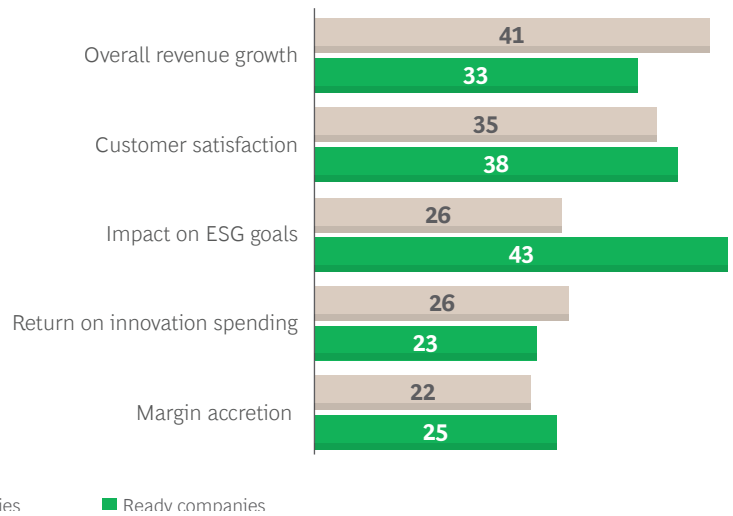
Overall revenue growth and customer satisfaction remain the top metrics for innovation success, used by 41% and 35% of companies, respectively. These are the same metrics, used by roughly similar percentage of companies, as we recorded during the last recession in 2009. Impact on environmental, social, and governance goals jumped into the top-five success metrics tracked this year and is the most common among ready companies.

Exhibit 9 - Nearly All Ready Companies Have Implemented End-to-End Portfolio Tracking

Have you implemented a holistic view of the portfolio with end-to-end tracking available centrally as a source of truth to guide portfolio decisions? (%)



What metrics does your company use in innovation, R&D, and product development (select up to three)? (%)



Sources: BCG Global Innovation Survey 2023; BCG analysis.

Note: n = 1,023 for global respondents. “Ready” companies are those that are ready to develop product, process, and business model innovations that can deliver sustainable impact.

¹“Implemented with impact” includes the subset of companies implementing portfolio transparency that also saw impact from those efforts.

Data, Targets, and Collaboration. Ready companies emphasize use of fundamental tools and ensure greater data transparency, clearer portfolio targets, and more collaboration. Three-quarters have full data transparency to support decision making, compared with only 35% of not-ready companies. Almost 60% have clear portfolio targets, and more than half use regular portfolio meetings to assess process. (See Exhibit 10.)

Innovation-Focused Talent and Culture. For many “almost ready” companies, talent and culture is the dimension holding them back from realizing the full potential of their innovation function. In fact, companies that are almost ready (according to BCG’s i2i assessment) lag ready companies more on talent and culture than on any other dimension. Ready companies focus on an innovation-focused culture and talent pipeline. They are three to four times as likely as their almost-ready counterparts to have successfully implemented a strong innovation-focused recruiting and talent acquisition foundation across all stages of the talent pipeline. And, as we will see in “How Early Winners Are Unlocking AI’s Potential,” the third article in this year’s report, companies that realize impact from AI have more than three times as many people dedicated to innovation as those who don’t.

The war for talent is a perennial issue. The job market is still strong, but it has softened in many parts of the world, meaning it may be easier now to build or strengthen internal teams. The same conditions that provide opportunities for M&A also offer the opportunity to acquire qualified, innovation-focused talent.

McDonald’s: Driving Growth with Digital Innovation

Consider the case of McDonald’s (number 34 on the 2023 top 50 list), a restaurant industry frontrunner in technology innovation and investment, which has combined many of these practices to bolster its leading position in the industry. McDonald’s spends heavily on innovation through partnerships, labs, digital tools, and acquisitions. It was investing in AI (through M&A) as early as 2019 when it acquired Apprente, which develops voice-based, conversational technology, and personalization startup Dynamic Yield to better customize the drive-through experience.

Exhibit 10 - Ready Companies Rely on Full Data Transparency, Clear Portfolio Targets, and Regular Portfolio Meetings

How do you support effective decision making on your innovation portfolio? (%)



Sources: BCG Global Innovation Survey 2023; BCG analysis.

Note: n = 1,023 for global respondents. “Ready” companies are those that are ready to develop product, process, and business model innovations that can deliver sustainable impact.

When the onset of the pandemic threatened its in-restaurant business, McDonald’s launched the “Accelerating the Arches” growth strategy, doubling down on digital, drive-through, and delivery. Digital innovations cut 30 seconds off drive-through ordering times during the pandemic, enabling the restaurant chain to move more cars through its windows when indoor dining was limited. McDonald’s also has created a customer experience team to improve diner engagement on the premises and digitally by combining data analytics and global marketing insights. The company has similarly been using AI-driven prediction and recommendation algorithms to decide what customers are most likely to want to buy and displaying it prominently on digital menus.

Good Advice (Updated) Stands the Test of Time

Successful companies make a commitment to long-term innovation while also taking advantage of near-term opportunities, such as weakened competitors, to improve their positions. In our 2009 report, we offered “seven aggressive innovations strategies,” both long term and short term, for leading out of the downturn. Nearly a decade and a half later, those approaches are still valid, although they could be updated to add the following strategies to reflect today’s more technology- and data-intensive environment:

- **Stay aggressively invested.** Maximize the impact of your investments by optimizing the innovation pipeline and funnel.
- **Alter your business model in strategic, game-changing ways.** Choose game-changing technology, or combinations of technologies, that secure sustainable advantage.

- **Go bargain hunting.** Find attractive acquisitions and build innovation into the M&A process by including innovation expertise on M&A teams and targeting new technologies and talent.
- **Acquire intellectual property (IP) on the cheap.** Go after complementary ideas or capabilities and monetize off-strategy IP assets. For example, investors are already rewarding smart climate moves in their valuations.
- **Raid competitors’ talent pools.** Don’t be afraid to find talent wherever it may be—and locate talent pools in other industries—to build your own capabilities.
- **Stage a network invasion.** Intervene in ecosystems to expand access to external capabilities and talent.
- **Use innovation to attack competitors’ profit strongholds.** Your innovation investments can disrupt the strongholds of others (as well as your own) by entering new markets with new models.

Some companies already have the tools to execute these recommendations and to do so with speed. Catching up with the leaders is much more challenging than it used to be, because moving fast requires sophisticated capabilities that are neither easy nor quick to acquire. If downturns do in fact separate winners and losers, then winners are sitting pretty—and that could make their competitors sitting ducks.



How Early Winners Are Unlocking AI's Potentials

By Justin Manly, Michael Ringel, Amy MacDougall, Will Cornock, Johann Harnoss, Konstantinos Apostolatos, Ramón Baeza, Ryoji Kimura, Michael Ward, Beth Viner, Jean-Manuel Izaret, Wendi Backler, Vlad Lukic, Sylvain Duranton, and Romain de Laubiart

Artificial intelligence (AI) is having a big impact on how companies approach innovation, but are companies achieving big innovation impact from AI? The evidence is mixed.

The question isn't whether AI can have an impact. While technical challenges that may prevent achieving full value persist, many companies have realized some benefit—and often with [minimal investment](#). It's more a matter of whether companies are using AI properly and for use cases with the potential to drive real business value.

The varying results that companies are achieving so far with AI further increases the distance between organizations that have well-functioning innovation engines and those that do not ([See “The Formula for Innovation from Leading Companies” in this report](#)). Indeed, given AI's transformational potential (which anyone can experience by taking ChatGPT for a spin), failing to master the technology could ultimately prove fatal to a firm's innovation program. Widening the divide further, we are now entering a new world of AI that is rapidly expanding the possibilities for how users engage and experiment with technology. Whereas “old” AI relied heavily on databases and supervised learning models, the emerging “new” AI is more accessible and offers the potential to unlock broader insights. ([See the sidebar “Defining AI in Innovation.”](#))

Defining AI in Innovation

Artificial intelligence (AI) is at its core a set of algorithms that classify, process, and manipulate data. “Random forests,” “neural networks,” and “generative AI” are all examples of the algorithms on which AI use cases are built. While AI is continually evolving, the taxonomy is subject to change. BCG categorizes AI use cases into five broad domains:

Computer Vision and Hearing. These capabilities involve identifying objects and individuals and extracting text from images, speech, and handwriting (finding a specific element in an image, for instance).

Natural Language Processing (NLP). This domain involves translating human (or “natural”) language into machine-understandable inputs—and vice-versa—and understanding and extracting meaning from natural language (such as identifying positive or negative sentiments in user product reviews). Combining capabilities across multiple domains unlocks additional use cases. For example, apps that allow users to point their camera at a street sign in a foreign language and translate it into their own utilize both computer vision and NLP capabilities.

Machine Learning. Gartner describes machine learning, the backbone of many companies’ applications, as a set of algorithms and techniques that operate guided by lessons from existing information. Commonly used techniques are unsupervised, semi-supervised, and supervised learning.

Decision Making. This set of capabilities makes decisions based on databases of similar cases or sets of human-defined rules. Decision making can be combined with machine-learning techniques to yield a self-learning expert system.

Responding and Generating. This domain includes, among other techniques, the generative AI family of algorithms (used by such systems as DALL-E and ChatGPT). They are capable of generating seemingly new, realistic content, including text, images, or audio, from the vast quantity of unlabeled data they are trained to interpret. They also use reinforcement learning techniques (also used in machine learning), which are based on “learning by doing,” as opposed to learning by observing.



In the third article of this year's Most Innovative Companies report, we look at the current state of play of AI in innovation and what early winners are doing right.

From Implementation to Impact

A majority of companies (61%) have invested in AI. In fact, AI is attracting investment from more companies than any other technology. (See Exhibit 11.) While most of these firms have systematically implemented AI in one or more use cases (83%), far fewer (45%) have managed to translate this into business impact. (See the sidebar "Implementing AI with Impact.")

The most common innovation-focused AI use cases (which 54% of respondents have implemented) are revealing market trends and competitor activities, but few companies use AI for just one thing. About 70% of those implementing AI in innovation are experimenting across a range of use cases. (See Exhibit 12.) The number achieving impact is consistently much lower, indicating that, not surprisingly, integrating the new technology into existing innovation processes is a challenge. Among the biggest hurdles we've heard cited are leadership's lack of willingness to invest, access to training data, the expense of data storage, and regulatory complexities.

The top three use cases with the most AI impact are making portfolio prioritization decisions (40% of companies implementing AI for that use case achieve impact), identifying players with external innovation potential (38%), and revealing market trends and competitor activities (37%). But success varies across sectors. (See Exhibit 13.) Companies in the medtech (51%), materials (48%), and chemicals (47%) industries are the most successful at achieving impact from AI. These sectors show roughly a 1.5 times higher likelihood of AI impact for innovation than the overall average across all industries. Previous BCG research has shown that a strong digital foundation is key to being able to [scale AI](#), and medtech, chemicals, and pharma (which ranks fourth for impact) are all R&D-focused sectors. These companies

are therefore more likely to be better able to couple advanced digital capabilities with new product development.

Companies' ability to invest in other, related technologies is another indicator of success. Those that invest in four or more advanced technologies in addition to AI are three times more likely to see impact than those that invest only in AI, and success rates climb with the number of technology fields receiving funding. (See Exhibit 14.) "We use AI as a tool to enable such domains such as robotics, IoT, and communications," the R&D director at a European durable goods company told us. Chemicals and telecommunications (seventh for impact) are heavy users of the Internet of Things (IoT). Similarly, pharma, finance (sixth) and transportation (fifth) invest quite heavily in robotics compared with other industries. Some chemicals and pharma companies are experimenting with the combination of AI and quantum computing in the hunt for new materials and medicines.

Large gaps between use case implementation and impact indicate a use case without a strong value proposition, an industry unable to capitalize on AI, or both. The industries with the biggest divide between implementation and impact are the public sector, wholesale and retail, and media and entertainment. Certain industry and use case combinations are especially effective at driving greater rates of impact. For example, 73% of medtech companies that implement AI to reveal market trends realize impact, the highest rate of all industry-use case combinations. Second place belongs to pharma companies: 63% that use AI to identify players for external innovation potential realize impact from its use, which perhaps isn't surprising given the need to navigate the complex R&D ecosystems in this field.

A great deal of untapped potential exists for some industry-use case combinations, especially in sectors where a particular use case demonstrates outsized impact. For example, only 30% of travel companies use AI to support the idea creation process, even though travel companies that do apply AI realize impact at the highest rate in the industry. Only 39% of telecom companies use AI to identify new

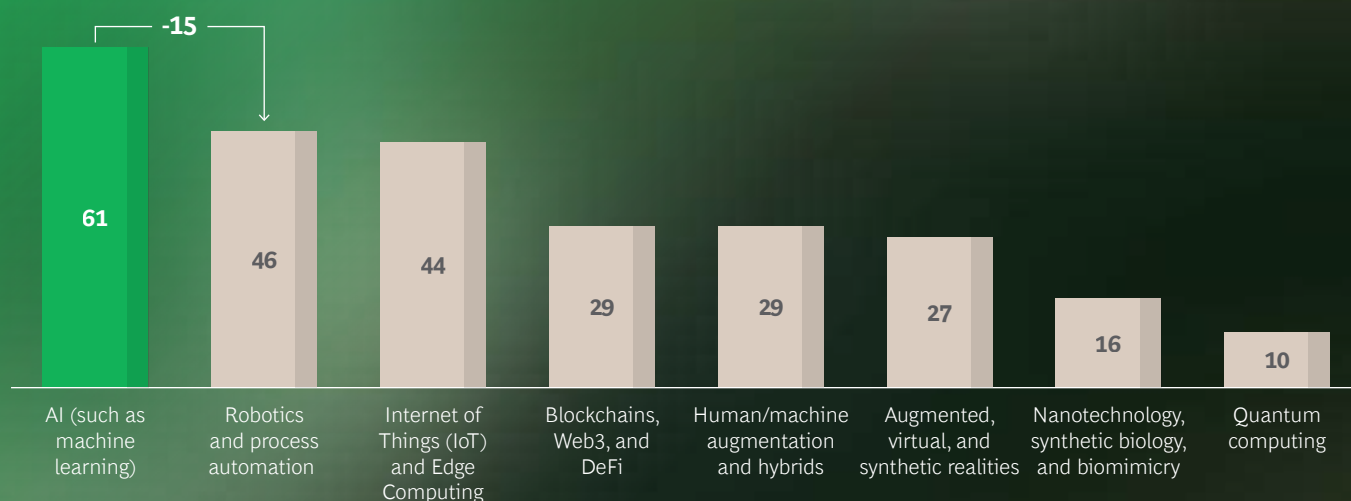
The question isn't whether AI can have an impact. It's whether companies are implementing AI for use cases with the potential to drive business value.

EXHIBIT 11

More Companies Are Investing in AI Than in Any Other Technology



Which technology categories are you investing in this year? (%)



Sources: BCG Global Innovation Survey 2023; BCG analysis.

Note: n = 1,023 for global respondents.

Implementing AI with Impact

In the 2023 innovation survey, we asked respondents to rate their company's use of AI across six use cases:

- Revealing market trends and competitor activities (such as domains, topics, and technologies)
- Making portfolio prioritization decisions
- Identifying players with external innovation potential (such as alliances, partnerships, venturing, and M&A)
- Informing innovation investment decisions (such as starting an R&D project in a particular field)
- Identifying new innovation themes, domains, adjacencies, and technologies
- Providing input to support idea creation (such as surfacing or validating ideas)

We also asked respondents to rank their companies' skill at leveraging AI from one to five, with one meaning that they hadn't implemented that use case and five signifying they had implemented the use case with impact.

Companies that implemented use cases with impact (level five) believe that "the codified and implemented practice is generally viewed within the company as a driver of innovation impact," consistent with the company's innovation ambitions.



Exhibit 12 - Many Companies Are Using AI to Support Innovation, but Few Are Achieving Impact

How would you rate your company's skill at leveraging big data, advanced analytics, and AI to help with innovation? (%)



Sources: BCG Global Innovation Survey 2023; BCG analysis.

Note: n = 1,023 for global respondents.

innovation themes, despite the fact that 50% of implementors realize impact from this use case. The use cases with the most untapped potential across all industries include identifying players with innovation potential, supporting the idea creation process, and identifying new innovation themes.

H&M: Leveraging AI and Human Input for Amplified Intelligence

Take the example of fashion retailer H&M, which leverages AI to optimize business processes, enhance personalization, and drive amplified intelligence with human collaboration. The company began exploring AI in 2016, using the vast data it had available to enhance communication, personalization, and offerings for customers. Management sought to embed the use of AI throughout the organization by addressing various existing business challenges across the entire value chain rather than focusing on a single use case. Working with AI has helped H&M optimize various aspects of its business, from fashion forecasting and

quantification to pricing and personalization. The successful implementation across the organization has led to a reduction in waste associated with raw materials and logistics, bringing H&M closer to reaching its sustainability goals.

H&M combines AI and human input for amplified intelligence; the combination of data-driven AI and human intuition has proven to be more effective than either capability on its own. One example is in end-of-season sales, where AI improved pricing and sales, but when it was combined with human input the results were twice as impressive as with AI alone. In implementing these AI solutions, H&M strongly emphasized ownership for employees, trusting them to drive the execution by following an approach it calls “tight, loose, tight,” which has concrete strategies and metrics.

Exhibit 13 - AI's Impact on Innovation Varies Significantly by Industry and Use Case

AI use case implementation and impact by industry (%)

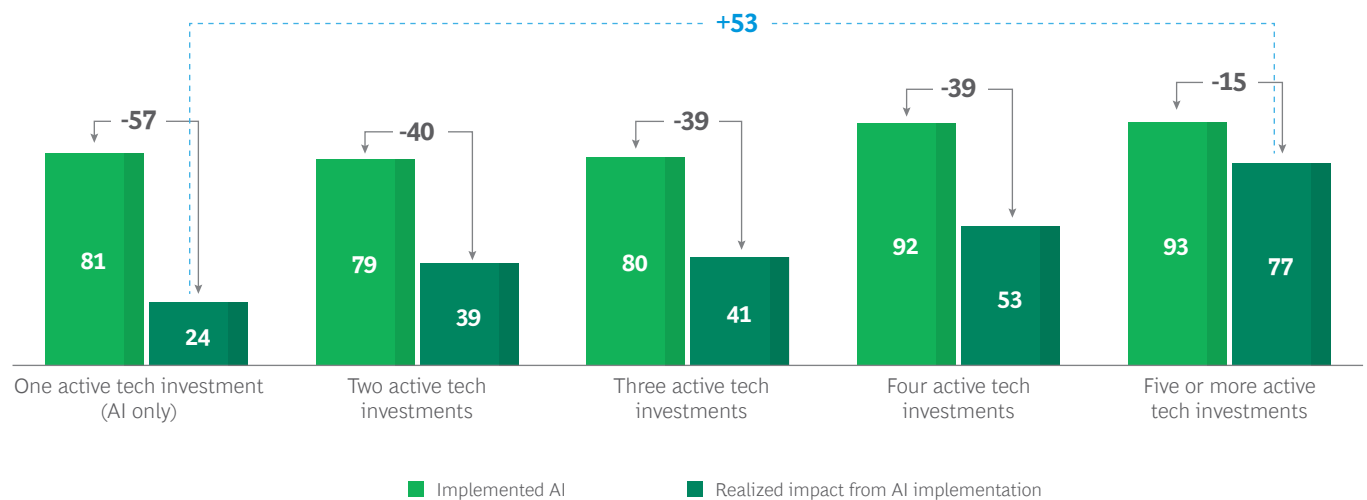


Sources: BCG Global Innovation Survey 2023; BCG analysis.

Note: n = 1,023 for global respondents.

Exhibit 14 - Investing in Other Technologies Concurrently with AI Increases the Rate of Achieving Impact

How would you rate your company's skill at leveraging big data, advanced analytics, and AI to help with innovation (out of respondents that invested in AI and in a number of other tech categories)? (%)



Sources: BCG Global Innovation Survey 2023; BCG analysis.

Note: n = 1,023 for global respondents.

H&M adopts an agile approach, implementing AI in waves through iterative testing and learning cycles, a methodology it describes as “dream big, start small, and scale fast.” H&M’s entrepreneurial culture helped employees adapt and take pride in their work alongside AI systems, emphasizing the importance of value over technology capabilities.

Four Impact Success Factors

AI alone won’t supercharge an innovation program. Companies must have the right **platforms and practices** in place. In our experience, companies that successfully scale AI typically dedicate 10% of their investment to algorithms, 20% to technology, and **70% to people and embedding AI into business processes**. AI can also accelerate the ability to access external sources of input, speed the generation and evaluation of ideas, and inform decision making. Through our research and case work, we have identified four key factors to help companies successfully incorporate AI into their innovation efforts.

A Strong Digital Backbone and Data Pipeline. To enable AI, companies must have established digital and data capabilities. Leaders make data and technology accessible across the organization, avoiding siloed and incompatible tech stacks and standalone databases that impede scaling. Our research into AI scaling has shown that companies that make more than 75% of technology and data widely available have a 40% greater likelihood of realizing AI use cases at scale than those that make 25% or less widely available. The survey reveals that among companies that have invested in AI, those that have successfully implemented AI in their innovation processes are 1.5 times as likely to prioritize full data transparency and effective digital tools for decision making. They are also twice as likely to have an active digital innovation laboratory, and they invest in an average of 2.5 times as many complementary technologies (such as IoT and augmented reality). These complementary technologies in turn generate data to enhance AI algorithms, creating a positive feedback loop as algorithms learn from what they do.

Multiple Technology Initiatives. Companies that achieve the most impact from AI also invest in other advanced technologies and combine these initiatives with AI. Since AI algorithms learn from what they do, use cases that require technologies such as robotics, automation, or high-throughput sensors that facilitate data collection fuel the AI learning and development process. The most common technologies to pair with AI investment are robotics for process automation and IoT. The success rate from investing in additional technologies rises fast: each additional technology increases the likelihood of realizing impact from AI by 26%.

A Robust Innovation Funnel. The executives and experts that we interviewed for this report cited three questions they ask when prioritizing investments in AI:

- Is this technically feasible given our digital foundation?
- What is the business value and how fast can we realize it?
- Will this investment develop a core capability that can be leveraged for other use cases?

Companies that realize impact from AI become idea generation powerhouses with robust innovation funnels that both incubate new ideas and rigorously prioritize investment. (See Exhibit 15.) These firms generate more than five times as many ideas than others and incubate more than twice as many minimum viable products. With more than three times as many people working in innovation-related functions, these organizations apply demanding feasibility criteria for new ideas and are twice as selective as companies that don't realize impact from AI. The best AI innovators develop a virtuous cycle or flywheel effect: more ideas mean greater likelihood of finding the best use cases for AI, and implementing AI helps generate more ideas. Some companies have begun incorporating generative AI into the idea creation phase, leveraging the technology to stimulate their teams' creativity.

Clear Articulation of Purpose and Responsibility.

Visible leadership from the top matters. Our research shows that when the CEO personally articulates the purpose of innovation for the organization, the likelihood of the company achieving impact from using AI nearly doubles. Driving impact from AI includes not only the immediate results, but also the downstream implications. Companies need to factor into their decision making how the use of AI will play out over time. Leaders are already instilling the policies and practices of **responsible AI (RAI)**.

Successful RAI begins with a set of clearly articulated principles and is operationalized by translating principles into policies and training, establishing clear governance mechanisms, building tools for end-to-end case reviews, and integrating RAI considerations into existing tools and methods. RAI is not just a risk mitigation tool but a mechanism to accelerate innovation. By providing a framework with clear guardrails, RAI allows innovators to experiment with confidence and catch failures faster. In a joint BCG-MIT Sloan Management Review **global survey** in 2022, half of responsible AI leaders reported having developed better products and services as a result of their RAI efforts compared with only 19% of nonleaders. More than 40% of RAI leaders cited accelerated innovation as a benefit compared with 17% of nonleaders.

Given the accelerating pace of advancement in AI, it is imperative for corporate leaders to establish mechanisms to monitor these new capabilities, evaluate risks and opportunities for their business, and ensure that they are **leveraging the technology** in the most promising use cases.

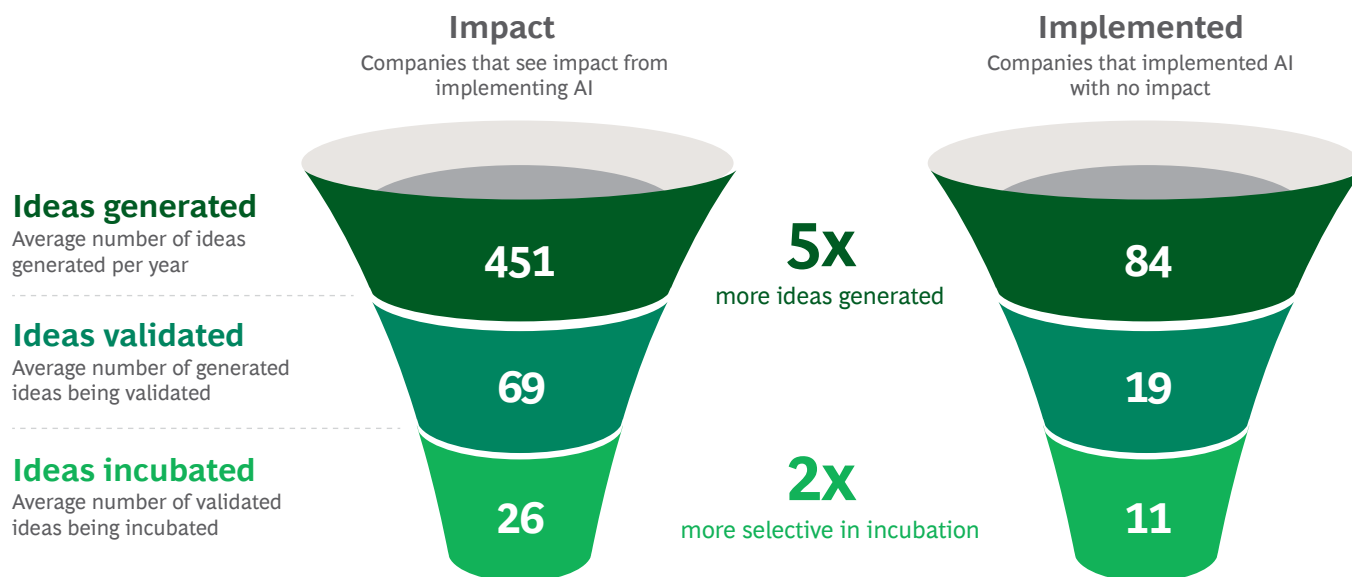
Moderna: Pioneering AI-Driven Innovation in the Fight Against Cancer

One of the most powerful examples of AI impact is Moderna's use of the technology in the development of vaccines and therapeutics. Moderna famously leveraged digital technology and AI to accelerate the design of its mRNA vaccine against COVID-19, but the story goes much deeper.

Moderna is applying its technology platform to open a new frontier in cancer treatment: individualized neoantigen therapies. In collaboration with Merck, Moderna has joined the fight against skin cancer with an investigational mRNA-based therapy, which Phase 2b results suggest can reduce the risk of recurrence or death from melanoma by 44%. Leveraging a proprietary algorithm, the manufacturing process begins by analyzing the patient's tumor to identify the cancer-causing mutations and then crafts an individualized neoantigen therapy designed to maximize each patient's immune response to their specific tumor mutation signature. Taking this even further, Moderna recently announced a research partnership with IBM to leverage AI and quantum computing to advance and accelerate the development of breakthrough mRNA-based therapies.

Exhibit 15 - Companies That Successfully Implement AI Have Much More Productive Innovation Funnels

Characterize your product development funnel, starting with launched projects and then working backwards to idea generation



Sources: BCG Global Innovation Survey 2023; BCG analysis.

Note: n = 1,023 for global respondents.

Moderna's CEO, Stéphane Bancel, has publicly cited "going digital" as a key reason for the biotech's success. From its inception, Moderna built much of its drug discovery and manufacturing process in the cloud, incorporating AI throughout. By prioritizing a digitally enabled mRNA platform over any one particular product, Moderna has been able to deliver rapid vaccine and drug development that builds quickly on each consecutive success.

To achieve impact responsibly, AI needs leadership from the top, the right foundational capabilities, and strong guardrails. These elements require time and investment. But given the technology's transformational potential, especially for innovation, they are worth the effort.

About the Authors

Justin Manly is a managing director and partner in the Chicago office of Boston Consulting Group. You may contact him by email at manly.justin@bcg.com.

Michael Ringel is a managing director and senior partner in the firm's Boston office. You may contact him by email at ringel.michael@bcg.com.

Amy MacDougall is a principal in BCG's Los Angeles office. You may contact her by email at macdougall.amy@bcg.com.

Will Cornock is a partner in the firm's New York office. You may contact him by email at cornock.william@bcg.com.

Johann Harnoss is a partner and associate director for innovation in BCG's Berlin office. You may contact him by email at harnoss.johann@bcg.com.

Konstantinos Apostolatos is a managing director and senior partner in the firm's Brussels office. You may contact him by email at apostolatos.konstantinos@bcg.com.

Ramón Baeza is a managing director and senior partner in BCG's Madrid office. You may contact him by email at baeza.ramon@bcg.com.

Ryoji Kimura is a managing director and senior partner in the firm's Tokyo office. You may contact him by email at kimura.ryoji@bcg.com.

Michael Ward is a senior advisor in BCG's New York office. You may contact him at ward.michael@advisor.bcg.com.

Beth Viner is a managing director and partner in the New York office of BCG X. You may contact her by email at beth.viner@bcgdx.com.

Jean-Manuel Izaret is a managing director and senior partner in BCG's San Francisco office. You may contact him by email at izaret.jeanmanuel@bcg.com.

Wendi Backler is a partner and director, innovation analytics and IP, in the firm's Toronto office. You may contact her by email at backler.wendi@bcg.com.

Vlad Lukic is a managing director and senior partner in BCG's Boston office. You may contact him by email at lukic.vlad@bcg.com.

Sylvain Duranton is managing director and senior partner in BCG's Paris office and global leader of BCG X. You may contact him by email at duranton.sylvain@bcg.com.

Romain de Laubier is managing director and partner in BCG's Tokyo office. You may contact him by email at delaubier.romain@bcg.com.

Acknowledgments

The authors thank the following colleagues for their assistance with the preparation of this report: Faisal Akkawi, Gabe Bouslov, Jon Campos, Malvika Verma, Duc Anh Phi, Yohei Shoji, Philipp Strack, Michael Wahlen, and Gabriel Wang.

For Further Contact

If you would like to discuss this report, please contact the authors.

Boston Consulting Group partners with leaders in business and society to tackle their most important challenges and capture their greatest opportunities. BCG was the pioneer in business strategy when it was founded in 1963. Today, we work closely with clients to embrace a transformational approach aimed at benefiting all stakeholders—empowering organizations to grow, build sustainable competitive advantage, and drive positive societal impact.

Our diverse, global teams bring deep industry and functional expertise and a range of perspectives that question the status quo and spark change. BCG delivers solutions through leading-edge management consulting, technology and design, and corporate and digital ventures. We work in a uniquely collaborative model across the firm and throughout all levels of the client organization, fueled by the goal of helping our clients thrive and enabling them to make the world a better place.

Methodology

BCG's Most Innovative Companies ranking is based in large part on a survey of more than 1,000 global innovation executives who were polled in December 2022 and January 2023. We assess a company's performance on four dimensions and then take an average of normalized scores to calculate its overall ranking. These four dimensions are:

- **Global Mindshare**—the number of votes received from all global innovation executives
- **Industry Peer View**—the number of votes received from executives in a company's own industry
- **Industry Disruption**—the Diversity Index (Herfindahl-Hirschman) of votes across industries
- **Value Creation**—total shareholder return, including share buybacks, over the three-year period from January 1, 2020, through December 31, 2022

For information or permission to reprint, please contact BCG at permissions@bcg.com. To find the latest BCG content and register to receive e-alerts on this topic or others, please visit [bcg.com](https://www.bcg.com). Follow Boston Consulting Group on [Facebook](#) and [Twitter](#).

© Boston Consulting Group 2023. All rights reserved. 5/23

