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Operations Practice

A new era for industrial R&D in Japan

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Japanese industry once led the world in research, product development, and innovation. It could do so again.

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Japan's industrial R&D departments are no longer achieving world-beating performance. At the macro level, the evidence has been clear for some time. The country has slipped in global rankings for productivity growth and intellectual-property generation, even as R&D expenditure remains high. And at the micro level, our research reveals that R&D leaders in Japan have lost confidence in the ability of their organizations to meet the challenges they face.

This article takes a deep dive into the company-level factors that may be hampering the success of industrial R&D in Japan. We have identified five key areas where Japanese companies have the opportunity to close gaps between their current R&D practices and those of today's highest-performing global R&D organizations.

The rewards could be significant. For example, our experience elsewhere in the world leads us to believe that adopting best-in-class practices can lift R&D productivity by 30 percent. Across Japan's private sector, that could free up ¥1 to 2 trillion (approximately $9 to $18 billion) a year for reinvestment in fundamental research, innovation, or new product development projects.

R&D challenges in a changing world

Over many decades, Japan has built a strong reputation for delivering technological advances and products that make a difference to people's lives. Its cars, motorcycles, electronics, medical devices, cameras, and more have defined their categories for several generations.

The country's manufacturers continue to perform well in many areas of product development, achieving extremely high levels of quality, often through consistent, incremental improvements that have helped leading players sustain competitive advantage for protracted periods of time. Corporate cultures that prize careful planning, consensus-building, and attention to detail have also helped many Japanese firms manage complexity very effectively—especially for products that integrate numerous components and systems with complex interfaces and dependencies, as in the automotive sector.

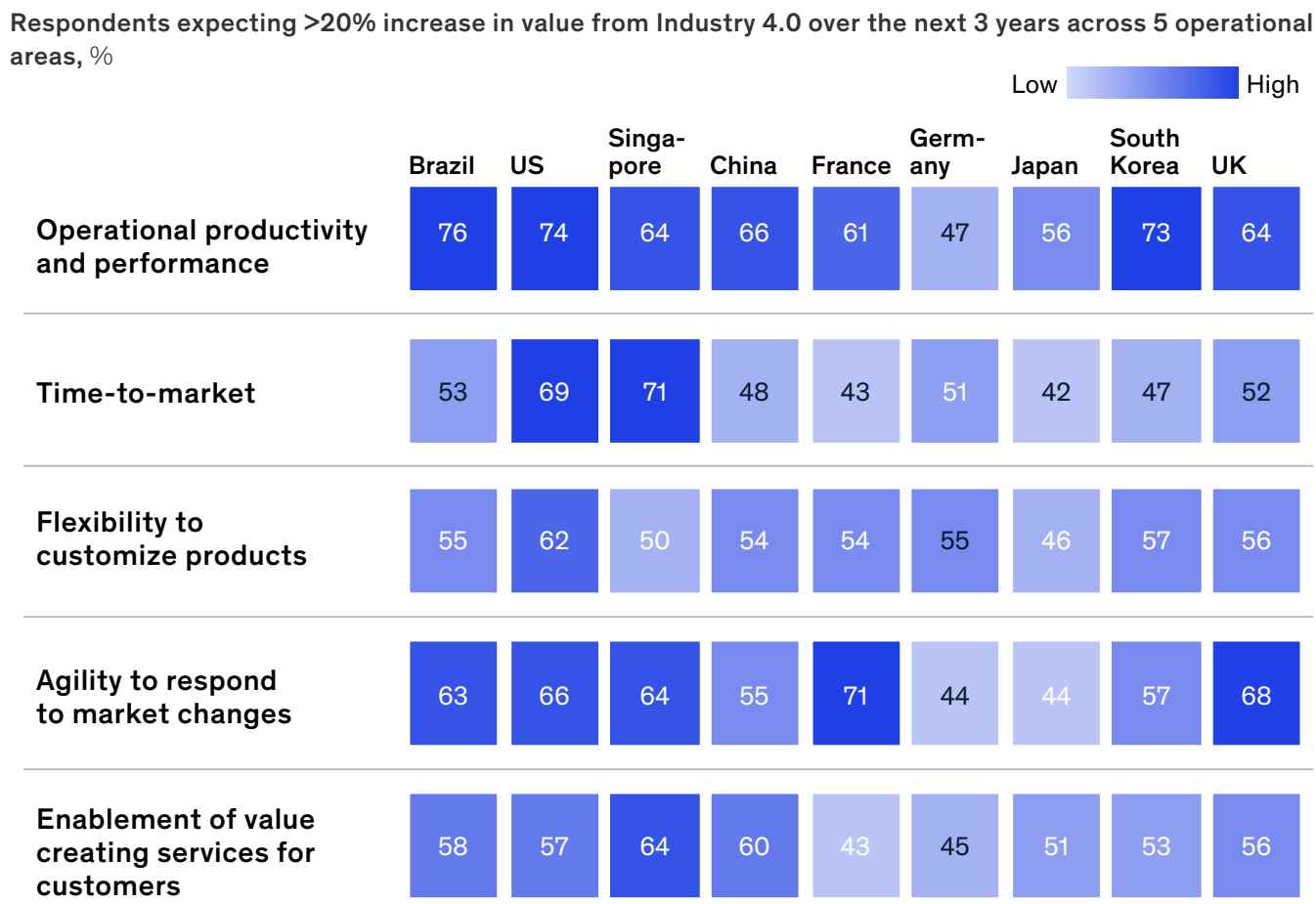
Still, the world is changing at a vertiginous speed. Technologies that used to be mere buzzwords—digital, advanced analytics, robotics, machine vision, additive manufacturing—are upending one industry after another. Everywhere you look, companies are offering new types of products and services, finding new ways to engage with their customers, and transforming the way they operate internally.

Capturing the resulting opportunities is a central plank of the Japanese government's strategy to boost growth, in particular with the promotion of a future "Society 5.0" that builds on artificial intelligence, sensors, automation, and other technologies to drive the convergence of physical and cyber spaces. In addition, Prime Minister Shinzo Abe's "Abenomics 2.0" program, adopted in 2017, aims to "accelerate our efforts towards comprehensive reforms in three vital areas: 1) boosting productivity, 2) driving innovation and trade, and 3) energizing corporate activities." The government's policy document cites "Applying the innovations created through the Fourth Industrial Revolution across all industries and all aspects of daily life" as a major driver of demand and investment in the coming years.

In this highly dynamic environment, the approaches that helped Japanese companies achieve their leading positions may no longer be sufficient. Japanese executives have sensed the change for some time: for example, in a 2016 global survey that our colleagues conducted of executives with research and product development responsibilities, only 14 percent of Japanese respondents said they felt their organizations were sufficiently prepared for the impact of the megatrends reshaping product development. More recently, a McKinsey survey of attitudes toward Industry 4.0 technologies found that Japanese executives were less optimistic than their counterparts in other parts of the world about these new approaches' potential to improve time-to-market, manufacturing flexibility, or organizational agility (Exhibit 1).

Exhibit 1

Japanese executives were the least optimistic in a survey about Industry 4.0's potential to raise productivity and performance.



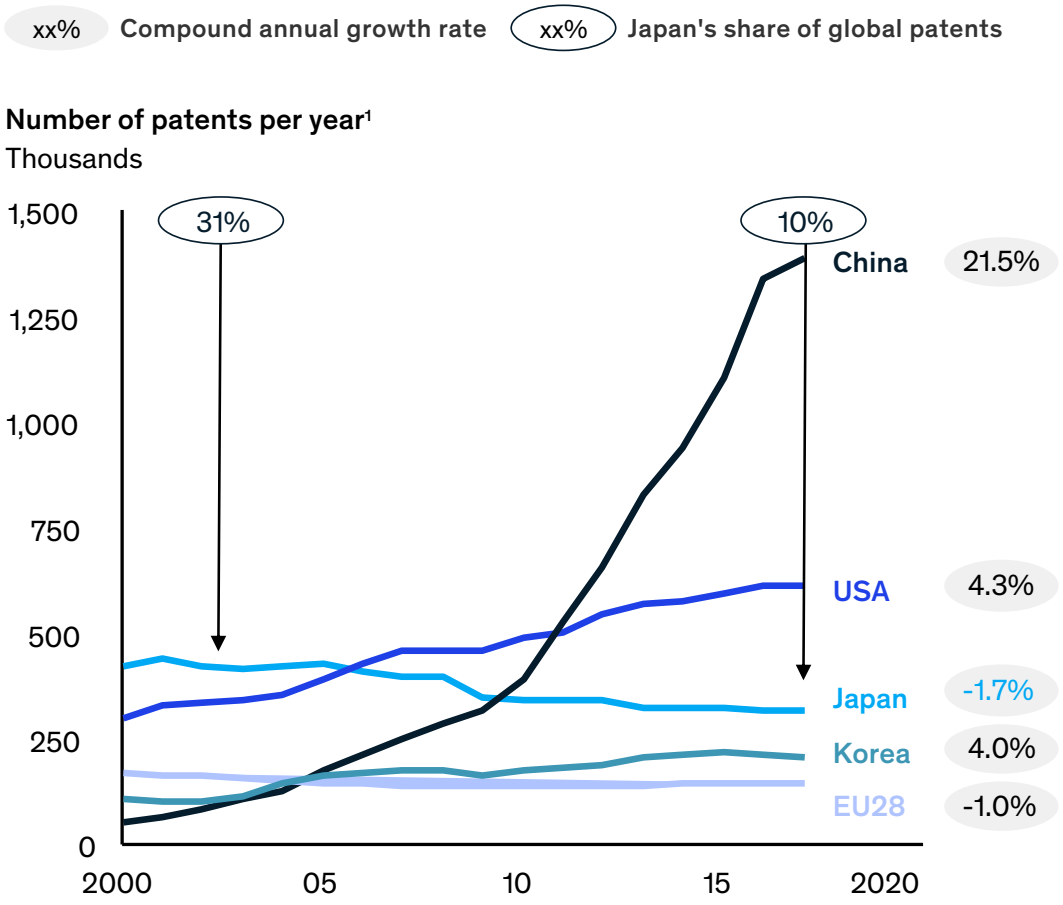
Source: McKinsey Industry 4.0 Global Survey 2019

The R&D performance gap

Japanese companies understand the vital importance of research and product development. At over 3 percent of GDP according to the World Bank, Japan's annual level of R&D expenditure is one of the highest in the world. Yet over the past two decades, the country has struggled to turn that effort into tangible results. In 2000, Japanese companies and research institutions accounted for more than 30 percent of the patents awarded every year (Exhibit 2). The country's overall share has now fallen to 10 percent. By industry, the picture is a little more nuanced. The country retains its patent-leadership position in semiconductor technology, for example, and its share of medical-technology patents has risen slightly. However, it has been overtaken by others—notably China—in a number of key sectors, including audiovisual technology, computing, and telecommunications.

Exhibit 2

Since 2000, Japan's share of new patents has fallen.



1 Number of new patents per year according to country of origin of inventor
Source: World Intellectual Property Organization

Effective R&D investment is considered to be one important driver of productivity growth, but the relationship between R&D expenditure and productivity in Japanese companies has weakened. Since 1996, total factor productivity growth in Japan (a measure of productivity that accounts for differences in both labor and capital inputs) has lagged behind its main industrial peers (Exhibit 3).

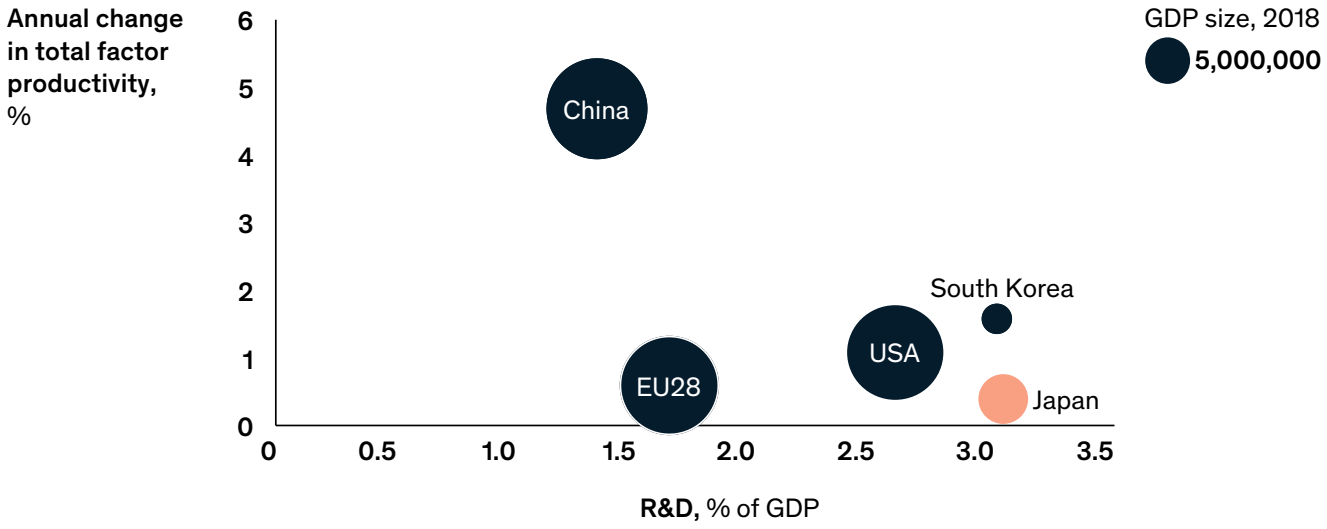
According to research by the Bank of Japan (BoJ), while US companies with the highest level of R&D expenditure achieve faster productivity growth than their rivals, Japanese companies do not see the same payback for their R&D investments.[1] To explain the reasons for this gap, the authors of the BoJ study point to three factors common to much Japanese R&D activity: a focus on incremental improvement over the creation of innovative

[1]Koji Nakamura, Sohei Kaihatsu, and Tomoyuki Yagi, *Productivity improvement and economic growth*, Bank of Japan, May 2018, boj.or.jp.

Exhibit 3

Despite heavy R&D investment, Japanese firms have seen minimal productivity gains.

Domestic investment in R&D vs total factor productivity,[1] %, 1996~2018



1 Total factor productivity (or multifactor productivity) is a measure of technological progress that measures increases in output after taking labor and capital inputs into account
Source: OECD, Economist Intelligence Unit

products, the creation of products that do not appropriately meet customer needs, and low levels of collaborative innovation with outside companies and research institutions.

Where could Japan do better?

High-performing industrial R&D departments aim to beat their competitors across three primary dimensions. Higher productivity means they do more useful R&D work with the resources available to them. A shorter time-to-market allows them to capture early-mover competitive advantage and reduces the lag between R&D investment and financial return. And with a higher rate of innovation, companies generate additional value for customers by turning more—and better—ideas into products and services.

In practice, the three dimensions are interrelated. Higher productivity allows an organization to accelerate its R&D efforts, for example, helping it to reach its time-to-market goals. A company that is good at identifying valuable ideas, and abandoning underperforming ones, will achieve higher returns when more of its projects succeed in the market. Achieving excellence in any or all of these dimensions requires organizations to get multiple things right, from the way they use data and digital tools in product development activities to their ability to attract and retain talent.

In 2019, we conducted a survey with chief technology officers (CTOs) and heads of R&D at 18 major Japanese companies, in sectors including automotive, industrial, energy and materials, telecoms and technology, healthcare,

and research and academia. We asked them to rate and comment on the current performance of their organizations across of a range of factors that are associated with strong R&D performance.

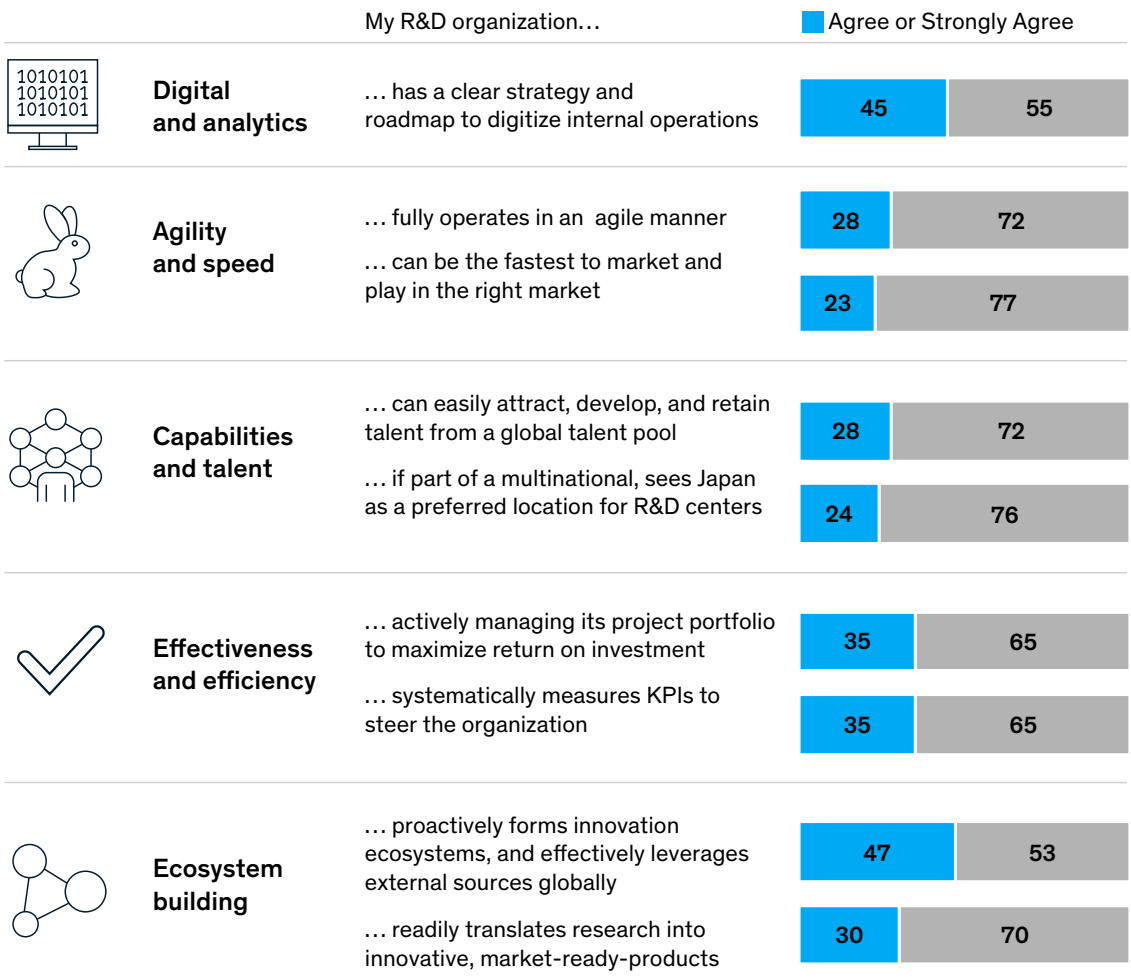
This survey, combined with additional qualitative data gathered through in-depth interviews, roundtable discussions with Japanese CTOs, and our work with R&D leaders in the country, helped us to identify five main areas in which Japanese R&D organizations are struggling to match the practices and performance of today's global best-in-class companies (Exhibit 4).

Digital and analytics

The challenge of digitization is not unique to Japanese companies. Around the world, R&D departments are trying to employ new digital tools in an effort to streamline their workflows and facilitate efficient information exchange among teams, business functions, and external stakeholders. But success has proved elusive:

Exhibit 4

Survey data illustrate that Japanese R&D organizations face five main challenges.



Source: Survey conducted with CTOs and heads of R&D at 18 large Japanese companies, May 2019; results normalized to exclude "don't know/not applicable" answers

when our colleagues at the McKinsey Global institute asked more than 2,000 senior executives about their digital initiatives, less than 15 percent of respondents said their digital transformation programs had led to sustained performance improvements.

In our survey, only 45 percent of Japanese R&D executives felt their organizations had a clear strategy and roadmap for the digitization of their internal operations. In interviews, respondents cited challenges that included the need to integrate multiple legacy systems—many of which were bespoke or highly customized in the past but are poorly supported today—along with difficulties persuading staff to adopt new digital processes and working methods, and a lack of good data to support decision-making.

Agility and speed

Respondents to our survey were most pessimistic about matters of agility and speed. Only 23 percent of them thought that their companies were good at outsprinting their competitors to be first into new markets and segments. And less than 30 percent said their organizations had successfully adopted the agile working methods that have become standard in software engineering over the past two decades, and which leading companies are now starting to adopt in hardware engineering too.

Why have Japanese companies been slow to embrace agile? The approach owes much to the incremental, continuous-improvement philosophy that underpins lean management, as pioneered by Toyota and widely used by the country's manufacturers. It is possible, however, that the informal, flexible, and continually evolving working structures adopted by agile teams are a poor fit with the culture of many Japanese firms, where organizations tend to be hierarchical and emphasize detailed planning prior to execution. In interviews, executives also cited challenges around the use of agile in projects with a significant hardware element, noting the need to freeze specifications early enough to allow products to transition smoothly from prototype to high-volume production.

Capabilities and talent

Japan faces a looming talent crisis. Only 28 percent of the respondents to our survey thought their companies were capable of attracting and retaining the best engineering talent available. Only 24 percent of those working in a multinational organization said their companies would pick Japan over other countries as a preferred location for R&D activities.

Japan's talent challenges are multifaceted (Exhibit 5). Part of the problem is demographic: An aging population means the number of people of working age is expected to decline from 75 million in 2018 to 69 million in 2030. Engineers and skilled R&D staff take years to develop their skills, making it difficult for companies to replace senior R&D staff as they retire.

Changes in technology are also playing a role. The country already has an estimated shortage of 240,000 skilled IT professionals, and that number is expected to rise to almost 600,000 by 2030. In interviews, Japanese R&D executives told us that despite changes to their HR and hiring strategies, they were struggling to fill roles in key areas such as software engineering and project management.

Rising demand for digital skills is also having knock-on effects elsewhere. One executive we spoke to noted that high-potential graduates are increasingly attracted to fashionable fields such as AI, making it harder to fill more traditional mechanical or electronics engineering roles.

Meanwhile, Japan seems poorly positioned to compete for talent on a global stage. The country ranks 20th among OECD countries in attractiveness for highly skilled talent. And despite efforts to change its business culture, average working hours in Japan are still higher than the OECD average.

Effectiveness and efficiency

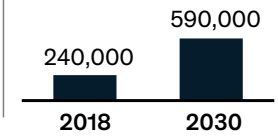
Only one-third of respondents believed that their organizations were actively managing their R&D project portfolios to maximize return on investment (RoI). Some respondents suggested

Exhibit 5

Japanese companies face multiple recruitment and retention challenges.

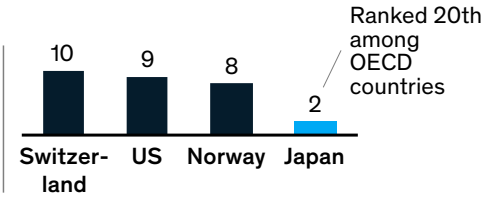
Increasing need for engineers to cover broader market with more tailored products and services

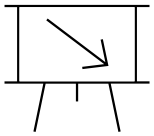
Shortage of IT talent in Japan



Japan is not in a good position to attract talented people in the global market

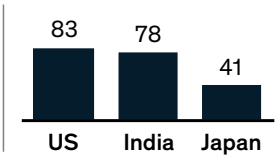
Attractiveness to highly skilled talent, 10-point scale



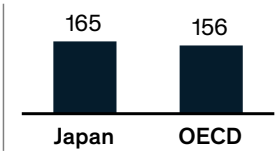


Retention of engineers

IT talent satisfied with coaching environment at work, %



Monthly working hours, hours



that this was down to a lack of good data for making RoI decisions. Others noted that decision-making was complicated by factors beyond RoI, such as the need to offer products in strategically important niches, or to meet requests from key customers.

Whatever the reason, the outcomes of suboptimal portfolio management tend to be similar. Companies struggle to prioritize R&D activities or allocate resources effectively. In many companies' portfolios, a small minority of the products is responsible for the overwhelming majority of the profits. And some respondents feared that their R&D investment decisions tended to prioritize short-term performance over long-term health, spending heavily in the departments and product categories that are profitable today while underfunding those that will become more important in the future.

Two-thirds of respondents also felt that their organizations lacked the means to steer and manage the performance of ongoing R&D projects. Without mechanisms such as an effective set of KPIs to measure project performance, R&D efforts can easily take too long, cost too much, and return too little. One respondent noted that the culture of his organization made it easier to commit to new large-scale investments than to exit existing ones that underperformed.

Ecosystem building

Innovation—meaning the identification and commercial exploitation of new ideas—is an essential R&D goal at the overwhelming majority

of companies. But respondents were pessimistic about their organizations' ability to deliver on this front. Only 30 percent of executives thought their companies created a sufficient number of innovative new products.

Moreover, the era of purely in-house innovation is over. Most of today's innovations are collaborative efforts involving a network of stakeholders, from academic research departments and start-ups to specialist engineering consultancies. Leading companies therefore put significant emphasis on the creation of such networks as a critical growth driver. And while surveyed executives were more positive on this point than about their organizations' innovation efforts in general, only 47 percent felt that their companies were sufficiently proactive in forming innovation ecosystems, or sufficiently effective at making use of them.

In interviews, executives cited their organization's difficulty in finding suitable collaborators. Although several respondents noted that their organizations had recently launched innovation labs in technology hotspots such as Israel or Silicon Valley, the relationships fostered in these units had yet to translate into commercial products. Other respondents suggested that collaborative efforts were hampered by lengthy and unwieldy processes needed to evaluate potential partners and set up the necessary agreements.

The way forward

The challenges outlined above are holding Japanese R&D back, but they are by no means insoluble. Companies can look around the world to find examples of best practice in each of the five major areas. Better still, Japanese firms already have many characteristics that position them well to take the leap to a new level of R&D performance. In the following sections, we look at some solutions for closing the gap to global top performing R&D organizations.

Transforming R&D with digital and analytics

New digital approaches can help companies address many of their R&D challenges. Digital tools—from advanced simulation systems to generative design algorithms—make R&D activities more efficient and more effective. Digital communication technologies aid information exchange among teams, functions, and collaborating organizations. Data and analytics provide the fact base needed for better portfolio and resource-allocation decisions, as well as for understanding and addressing the main bottlenecks to engineering productivity or time-to-market.

One luxury automotive manufacturer applied advanced analytics to optimize product development time. Its first step was to build a data lake composed of several existing and diverse sources of data, such as R&D project plans, staff timesheets, CAD design versions, and email and calendar metadata. The second step was to build an analytics model that could not only prove (or disprove) hypotheses on which levers mattered for development-time optimization—but could also quantify each lever's impact.

The effort enabled the company to cut development time by approximately 100 days.

Japan already has an estimated shortage of

240,000

skilled IT professionals

Many of the levers that drove this improvement would have been difficult to design without advanced-analytics support in identifying the discrete problems the company needed to address. For example, analytics revealed that the digital files containing the CAD designs for each part of the car were frequently modified after the stage gate where they should have been frozen—and that this phenomenon correlated strongly to project delays. Analysis of email traffic also detected important gaps in communication among different engineering groups.

Digitizing an R&D organization is a significant challenge in its own right, however. Many companies have learned to their cost that piecemeal or ill-thought-out approaches can struggle to deliver promised benefits. A successful digital transformation must be a well-structured, multidimensional effort.

— The first step is to establish a **vision and roadmap** by identifying the main issues affecting R&D's performance, and prioritizing the digital and analytics use cases that can best address those issues. This effort should encompass the R&D function as a whole: the full potential of digital R&D will not be reached by addressing only one or two use cases.

— Second, the organization should shift to a **state-of-the-art data and technology platform**. A fast-paced, high-impact rollout of digital and analytics use cases in R&D requires several technology enablers, such as cloud infrastructure and new specialized tools. Companies may therefore need a new class of external partners that can help them get a head start on these requirements.

— Third, the R&D digital transformation requires **new capabilities** in areas such as advanced analytics, software development, or user-experience design. The organization will need data engineers develop to more efficient IT systems, such as databases, fast data processing, or new, more reliable data sources. It will require the data scientists who use those systems to unlock new insights or new knowledge from the data by developing analytical techniques and efficient algorithms. Critically, projects also require people whose skills bridge these different groups. These "translators" frame business problems in a way that digital specialists understand, and use their domain knowledge to evaluate and continuously refine the resulting digital solutions. In Japan, many companies have traditionally outsourced IT responsibility to external vendors, leaving significant in-house technology capability gaps. Acquiring and nurturing the necessary digital skills should be a high priority for companies in the coming years.

Finally, a digital transformation can only be successful with a significantly different and more agile operating model, described below.

Embracing agility in the R&D operating model

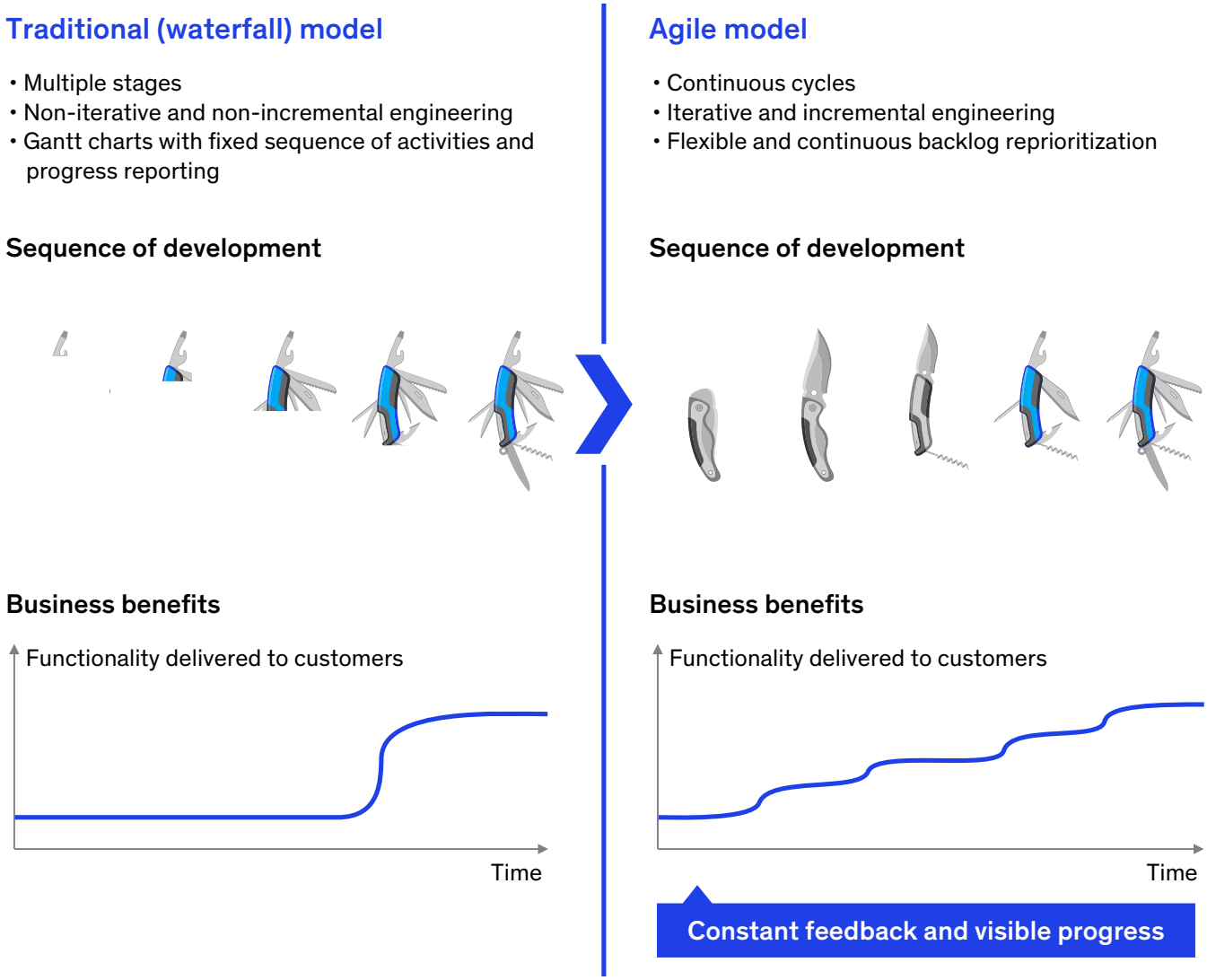
The agile methodology began as a reaction to the slow, inflexible, and error-prone methods that once characterized big software-engineering projects. Since then, the approach has been expanded into a broader organizational philosophy. An agile organization is one that is able to quickly reconfigure its strategy, resources, and organization to succeed in a rapidly changing environment—without losing efficiency.

To outsiders, the speed and relative informality of agile can give the impression that work is chaotic or poorly controlled. In practice, however, agile organizations combine dynamic capabilities with a backbone of stable, standardized processes, structures, and systems that ensure quality and productivity.

In agile environments, stability start at the top, with actions and tasks cascading from a clearly defined strategic direction or "north star." This approach is one that will feel very familiar to Japanese organizations, having clear parallels with hoshin kanri, or "policy deployment"—an approach that underpins the well-established lean and total quality management philosophies. Likewise, agile' s emphasis on process standardization and repeatability owes much to lean working methods.

Exhibit 6

Agile teams move as quickly as possible to a minimum viable product, which is frequently tested with customers and improved over time.

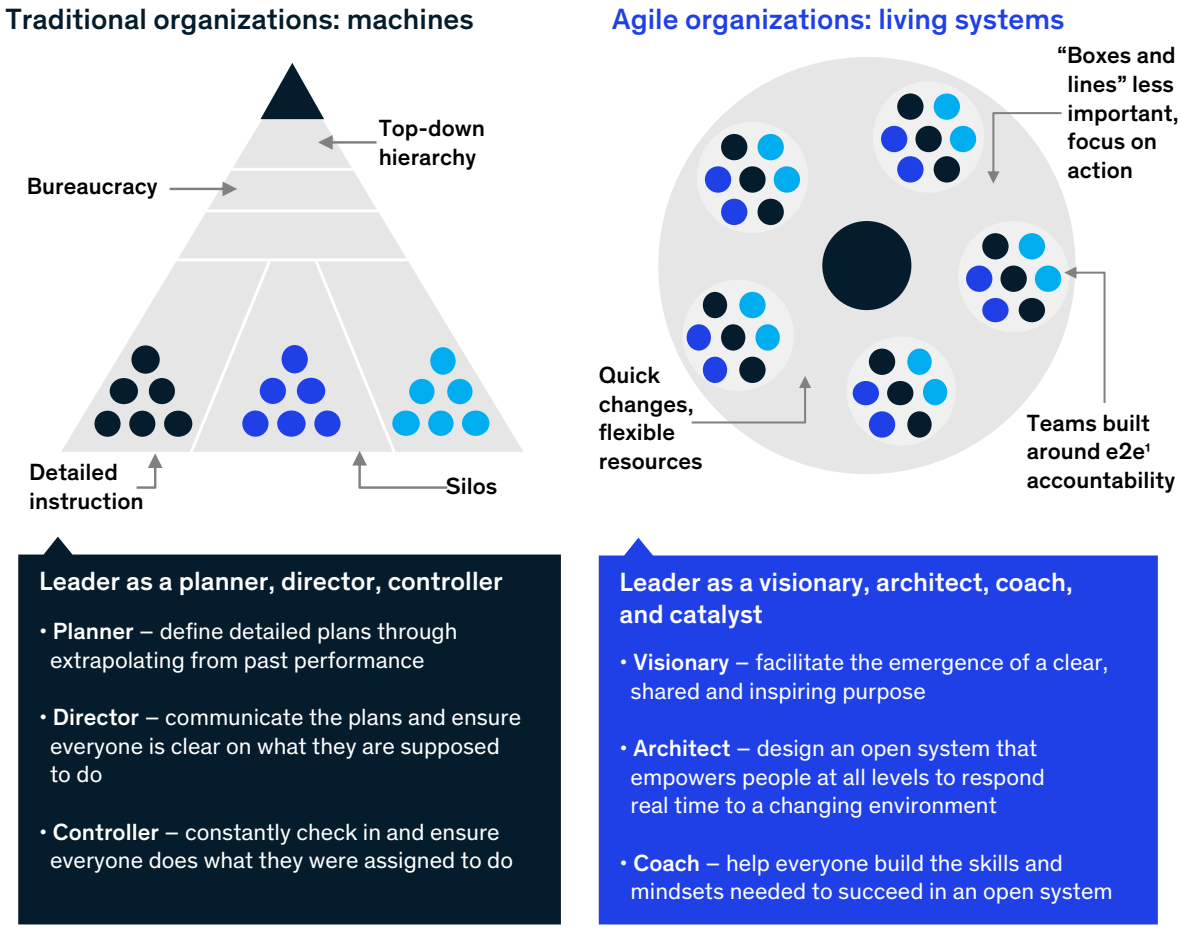


For Japanese companies, the introduction of agility into the R&D function can build on these traditional strengths, adding some new elements while tweaking others. One key change involves team structures. Agile uses small, cross-functional teams of eight to ten people, which stay together for a meaningful period of time. Another is the pace of work and review cycles. Agile "sprints" are short, typically two weeks in software development, longer in hardware projects, and they culminate in a rapid review process that sets the direction for the next package of work. Teams move as quickly as possible to a minimum viable product, which is frequently tested with customers and improved over time (Exhibit 6). That approach contrasts sharply with normal practice in Japan today, where progress is evaluated at a few major quality gates.

Agile also requires a more collaborative form of leadership. Leaders in a traditional R&D

Exhibit 7

Agile requires a more collaborative form of leadership.



[1] End-to-end

organization define detailed project plans, communicate them top-down to the frontline engineers, and constantly check that everyone is following their respective assignments. Leaders in an agile R&D organization focus on empowering and coaching the frontline engineers, as well as on removing the obstacles that may impair progress in product development (Exhibit 7). For traditionally hierarchical Japanese R&D organizations, this evolution will demand a significant shift in leadership style.

Agile engineering approaches have a positive impact on multiple areas of R&D performance, including time-to-market, productivity, quality, and customer satisfaction. They also lead to significant improvements in employee satisfaction, as R&D engineers feel much more trusted and accountable for their work assignments.

One global leader in the semiconductor industry transformed its full R&D organization into an agile model. The top R&D managers were initially skeptical about the transformation, with many questions about its real benefits. What finally convinced them, however, was the impact of the new approach on employee satisfaction and accountability. Given the opportunity to play an

active role in setting their own goals and timescales for R&D tasks, engineers were much more willing to take ownership of them. For the first time, engineers would confidently step forward in planning meetings and commit to a certain scope of delivery for the next development period.

Some executives in our survey questioned the applicability of agile methods to the development of hardware products. In particular, managers often worry that R&D teams working on complex hardware will be unable to generate meaningful outputs at the end of every two to four weeks, which is one of the pillars of the agile methodology.

Several elements come into play to address this concern. First, those very frequent outputs can come in a variety of value-adding forms: for example, a new version of a CAD design for a certain part, or the conclusion of a technology-feasibility study, rather than exclusively as physical artifacts. Second, R&D organizations can now use new technologies, such as 3D-printing systems, to accelerate hardware prototyping. Third, the adoption of agile in hardware engineering is often part of a larger systematic effort to increase digitization of the product development process, such as through the use of simulation technologies and other virtual testing and validation methods. A defense manufacturer provides prime example, applying agile methodologies in everything from software development and hardware engineering to fuselage design in the development of a new aircraft at a fraction of the development cost of other products in the segment.

Several decisions by the manufacturer were especially important. One was to define a modular architecture for the new aircraft and to align the organizational design accordingly, enabling each team to have clear responsibilities and be reasonably independent from each other. Another was investment in advanced virtual simulators of the aircraft, which provided every team with the ability to evaluate their latest design choices in short feedback loops. The company also located its test pilots at the same site as the engineering teams, promoting a tight collaboration between pilots and engineers, and allowing feedback to be provided at the end of every development sprint.

Redefining the employee value proposition

Competition for talent is rising worldwide, driven by factors ranging from demographic shifts to the growing need for staff with the specialized digital-technology skills. Companies with the most advanced talent-management systems treat talent like capital. They think hard about allocation, such as by identifying the 50 or so roles that will create the most future value, or by supporting enterprise-wide people agility and the purposeful movement of personnel. They use data to evaluate performance and aid recruitment, development, and progression.

In Japan, with its rapidly aging population, the need to increase diversity in recruitment is particularly acute. Against this background, companies' traditional employee value proposition (EVP), with an emphasis on job security and seniority-based progression, is no longer sufficient to attract and retain the best talent.

That's especially true for important groups of staff such as millennials, who tend to prioritize meaningful work, personal growth and development, and a supportive environment. To create a more attractive working environment, companies will need to define a holistic EVP covering four main dimensions: great company (e.g., culture, values, reputation, lifestyle), great people (senior managers as true role models, respectful interactions, praise and recognition), great job (for example by offering additional flexibility, rotational assignments, mentoring, and opportunities for entrepreneurship), and great rewards (both financial and non-financial).

Exhibit 8 shows how a major software company identified the needs and preferences of the type of people it wanted to attract and retain at a global level, and designed its EVP accordingly.

There are also opportunities for Japanese companies to improve the way they develop and manage talent. The absence of such elements as formal job descriptions, predefined career paths, and performance reviews, makes it harder for companies to understand the distribution of specific skills across their organizations.

Exhibit 8

A major software player created a thoughtful employee value proposition (EVP).

Building detailed role profiles, including both technical capabilities and critical soft skills such as leadership and problem solving, helps companies tailor staff-development activities to fill capability gaps and develop people for future roles. Designing compelling career paths, along with a transparent, fact-based performance review system, helps R&D personnel understand clearly what is expected from them and what career progression they can achieve, motivating them to perform at their best.

A step-change in effectiveness and efficiency

The complexity and uncertainty inherent in product development activities means there is no silver-bullet solution to guarantee the effectiveness of R&D investments. Nevertheless, leading companies apply a set of building blocks that give them the best possible chance of making good decisions about how and where they focus their resources. First, they develop and maintain a robust fact-base to support decision-making processes. Then, they continually test and adapt

their R&D plans on the basis of those facts, using a well-structured, cross-functional governance to fine-tune their portfolios and project plans, and robust performance management to track progress.

One consumer packaged goods company in the Asia-Pacific region was struggling to deliver on its roadmap of product development projects. Time-to-market for new products was twice as long as that of industry competitors, and the R&D team was significantly fragmented with each employee handling anywhere between three and seven projects at a time. The company's management decided to run a thorough analysis of the portfolio, looking at how much budget was going to be consumed by each product development project, and what net present value (NPV) would be generated by those investments.

The results were striking. More than 50 percent of the active projects offered an unacceptably low return on investment. Deprioritizing those projects released around 20 percent of the organization's R&D budget, which was then reinvested to accelerate the remaining high-value projects, as well as to resource new high-potential innovations.

The best companies also ensure that everyone in the R&D organization understands the part they need to play and is able to operate efficiently. They clearly define the roles and responsibilities of teams and individuals within the organization and create a strong product management function with ultimate accountability for the commercial success of each product.

Rigorous performance management can transform R&D productivity. One major automotive company introduced a suite of seven KPIs to measure the cost, quality, and lead-time performance of all its engineering teams. On the basis of these metrics, it identified the highest-performing teams in its R&D organization, which it studied to isolate the practices that underpinned their superior results.

One example of those best practices was the creation of a central, dedicated team workspace, where all the engineers working on a project were co-located. This facilitated collaboration and ensured all team members could access visual project-status boards pinned up on whiteboards and walls. Another was the cultivation of deep relationships with the team's external and internal customers, which provided engineers with a much more concrete project-scope definition.

The company then coached its lower-performing teams, helping them understand and adopt the best practices. Closing the gap between top-performing teams and the rest was the key to a 20 percent overall improvement in R&D productivity—a significant achievement in an organization with around 15,000 engineers and a past record of strong R&D performance.

Most Japanese companies already have many of the basic building blocks of R&D productivity in place. A tradition of careful planning and structured, consensual decision-making gives them the basis for an effective R&D governance system, for example. But they could improve those planning and decision-making activities by bringing more data to the table. Access to a comprehensive, up-to-date fact base gives companies the best chance of avoiding bias and making the right choices. This is an area where digitization has significant potential to deliver value.

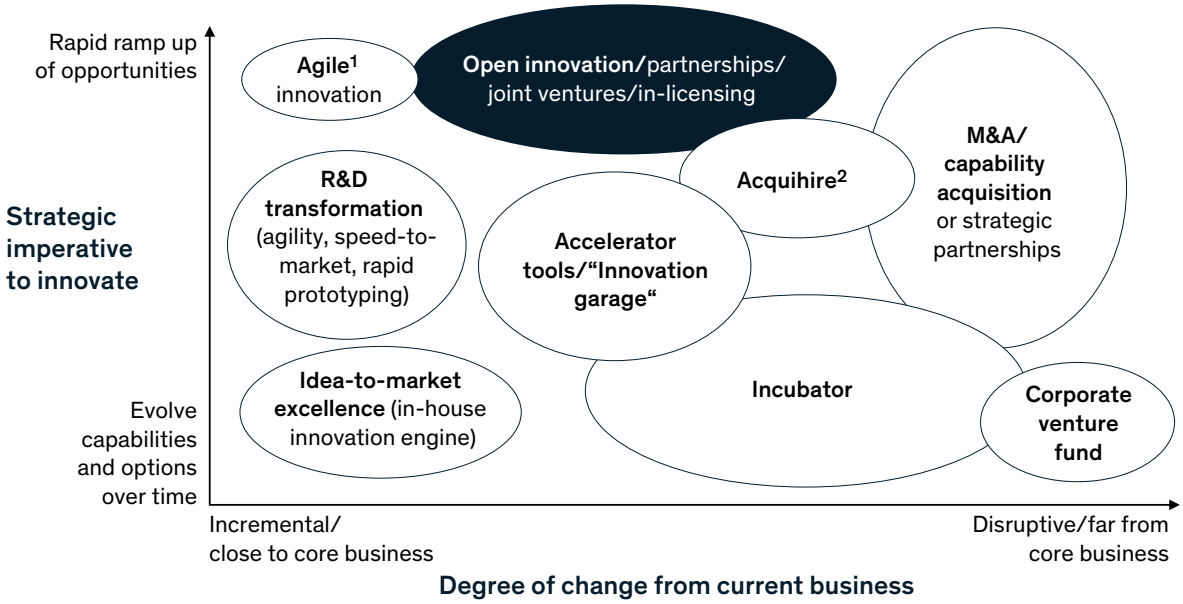
Another major opportunity lies in the development of the product manager role, which is still uncommon in Japanese organizations. In many high-performing companies around the world, the product manager has become a pivotal individual. Acting as a "mini CEO" for a product, the product manager takes ultimate responsibility for product's commercial and technical success.

From closed innovation to open ecosystems

Organizations seeking to accelerate their rate of innovation can pursue a multitude of different strategies, from transforming their internal R&D function to acquiring organizations with complementary assets (Exhibit 9). Increasingly, companies around the world are recognizing that innovation is most effective when it is a collaborative activity. Accessing ideas, talent, and technologies from outside the organization can boost the speed, value, and success rate of innovation efforts.

Exhibit 9

Successful innovation operation models increasingly involve collaboration with outside organizations.



1 Implement agile organization for innovation/R&D teams
2 Acquire small organizations mainly for the their talent

Source: McKinsey

In some industries, collaborative innovation has become the norm. Take the pharmaceuticals sector. Organizations that partner with external players during the development of new drugs have more than twice the success rate of those that go it alone. In the US and Europe, pharmaceutical companies are moving beyond the sector's traditional collaboration approaches, such as in-licensing or acquiring assets. Instead, they are taking actively engaging with partners to create and shape their own innovation ecosystems. In Japan, however, uptake of such approaches has been slow. Compared to overseas rivals, for example, Japanese pharma companies have out-licensed fewer assets to biotech companies, with only three such deals recorded between 2009 and 2018, in contrast to more than 30 in Europe and more than 100 in the US.

Japanese industry also lags many of its overseas counterparts in the adoption of organizational entities designed to actively develop ecosystems of new potential partners. For example, while some companies have developed corporate venture-capital arms to provide funding to promising start-ups, this activity tends to be focused in overseas innovation, rather than in Japan.

There are many other ways to create innovation ecosystems. Support in kind, knowhow sharing, and publicity opportunities can be equally valuable ways to help potential innovation partners. German automaker Daimler, for example, has established a "Startup Autobahn" that provides small technology companies with workspaces, tools and access to key personnel. In the pharmaceutical sector, Johnson & Johnson's JLabs operate in a similar

way, with participating companies receiving access to elements of the company's extensive library of novel compounds.

Another effective way of creating new products and services is the use of "innovation garages." Some of the world's most successful corporations, especially in the technology industry, were started in physical garages. Innovation garages attempt to emulate the same environment and culture by building on the latest concepts around design thinking and agile: a cross-functional, co-located team; extensive ethnographic research (to understand and map customer journeys, needs and preferences); co-creation with consumers, suppliers and other industry stakeholders; and workshops that generate new ideas based on the collision of customer, business, and technology insights.

A large Japanese producer of packaged foods deployed an innovation garage to develop new product prototypes, each composed of brand definition, food form, packaging and flavor profile, and all of them applying a specific food-processing technology that the company owned. Over the course of just five weeks, the innovation Garage went through ethnographic research, collision workshops, development of product and brand concepts, testing and refinement with customers. The compressed effort generated five new brand concepts, catering to different but well-defined customer segments and needs, along with several product prototypes for each of the brands.

Advanced economies depend on high-performing R&D capabilities to sustain growth and competitive advantage. Yet R&D excellence is a complex, multidimensional topic. While the goals are simple—to bring more and better ideas to market faster than competitors—achieving them requires companies to excel in many areas, from process and organizational design to digitization and talent management. Around the world, companies face significant challenges driving by the need to update their research and product development capabilities in the face of rapid technological and commercial change.

In Japan, these challenges feel all the more acute as the country has seen its traditional R&D leadership position eroded in recent years. We believe, however, that the country's long industrial heritage is a major asset. Japanese companies have already mastered many of the components of modern, high performing R&D. If the sector can build on its traditional strengths by incorporating new tools, organization approaches, and practices, it will be well positioned to enter the new R&D era with confidence.

The starting point in any transformation of R&D performance is a detailed and unbiased understanding of the organization's current strengths and development opportunities. Which facts and hard data do we use to define our R&D portfolio? How often are we surprised with unexpected delays in new product launch? What are the top five issues slowing down our R&D projects? How many R&D tasks have we already optimized with digital and analytics? CTOs and heads of R&D must know the answers to these and other questions if they are to drive their engineering organizations to become truly world-class.

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