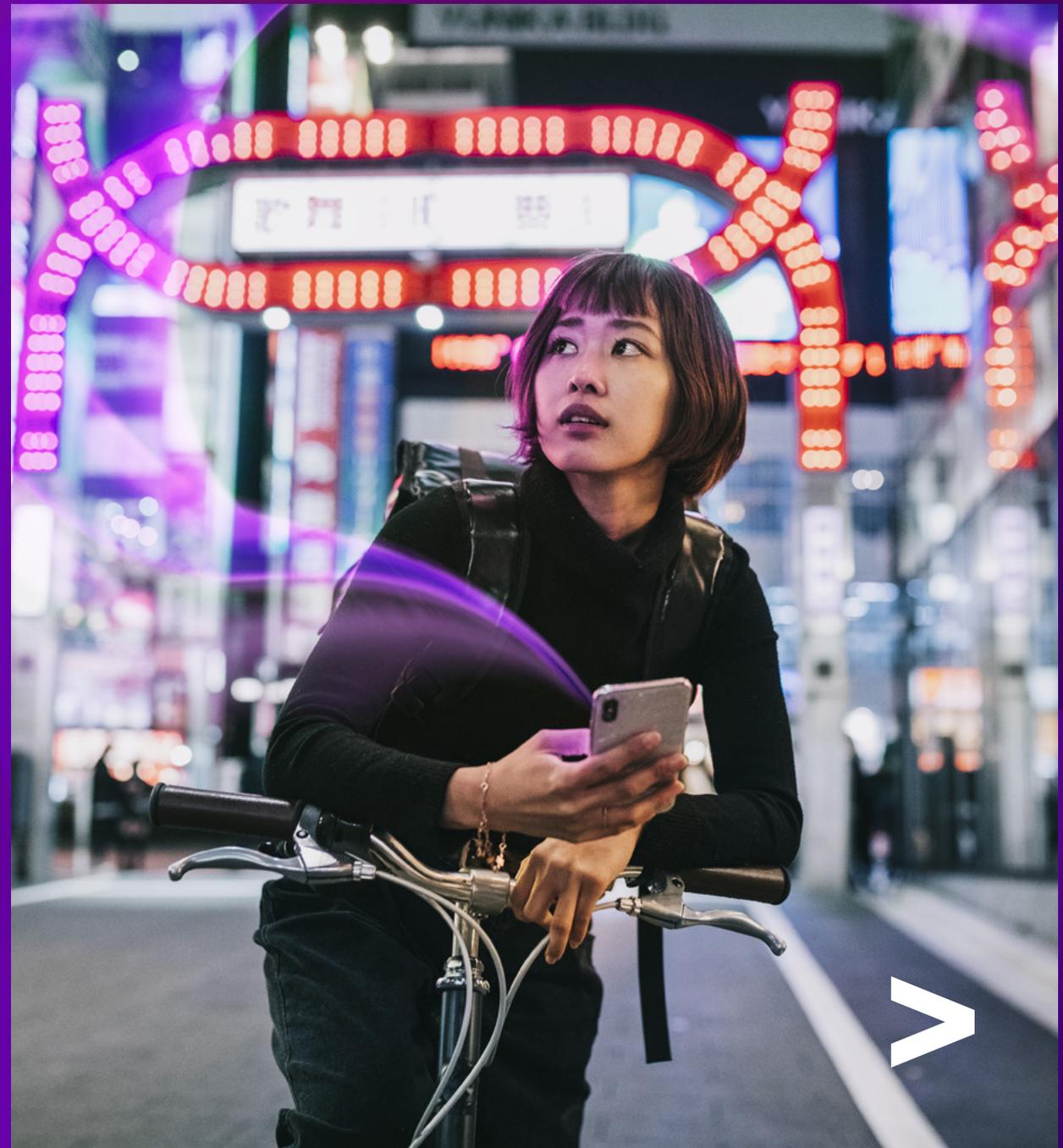# How to innovate your physical products to succeed in the digital future

Four actions to develop capabilities for engineering and manufacturing digital products and services in Japan.

Accenture Industry X

Foreword

It's very difficult to reach the pinnacle and stay at the top in any aspect of performance. And the pressure intensifies around high performers when the rules of engagement change dramatically.

Such appears to be the case for large Japanese companies. Leaders in innovation in the design and manufacture of physical products, they have struggled to innovate and succeed in the digital era.

To find out why, and what these once-leading organizations can do to reclaim their elite positions, Accenture Research undertook a survey of C-suite executives in 150 large Japanese companies with annual revenues exceeding $1 billion. These companies span eight industries: Automotive, Chemicals, Consumer Goods and Services, High-Tech, Industrial Equipment, Life Sciences, Medical Devices and Technologies, and Utilities.

At a high level, we found that most had simply failed to invest in digital products and services. Habit-driven and guided by processes and practices that drove their success in the era of physical products, they simply didn't focus on the rising digital era.

One small group, however, bucked that trend. These companies, which we call "Value realizers," did things differently than their peers. And as a result, their performance has remained strong in the digital era. Four strategic shifts in particular set them apart. First, their CEOs dared to articulate a bold and progressive vision. Second, their boards had considerable experience and a deep interest in the power and potential of cutting-edge technologies. Third, they introduced processes and practices in service of sustained and meaningful collaboration between their engineering and manufacturing functions. Fourth, they explicitly assessed the skills and expertise they would need to support digital innovation and customer service across product lifecycles—and moved aggressively to fill gaps.

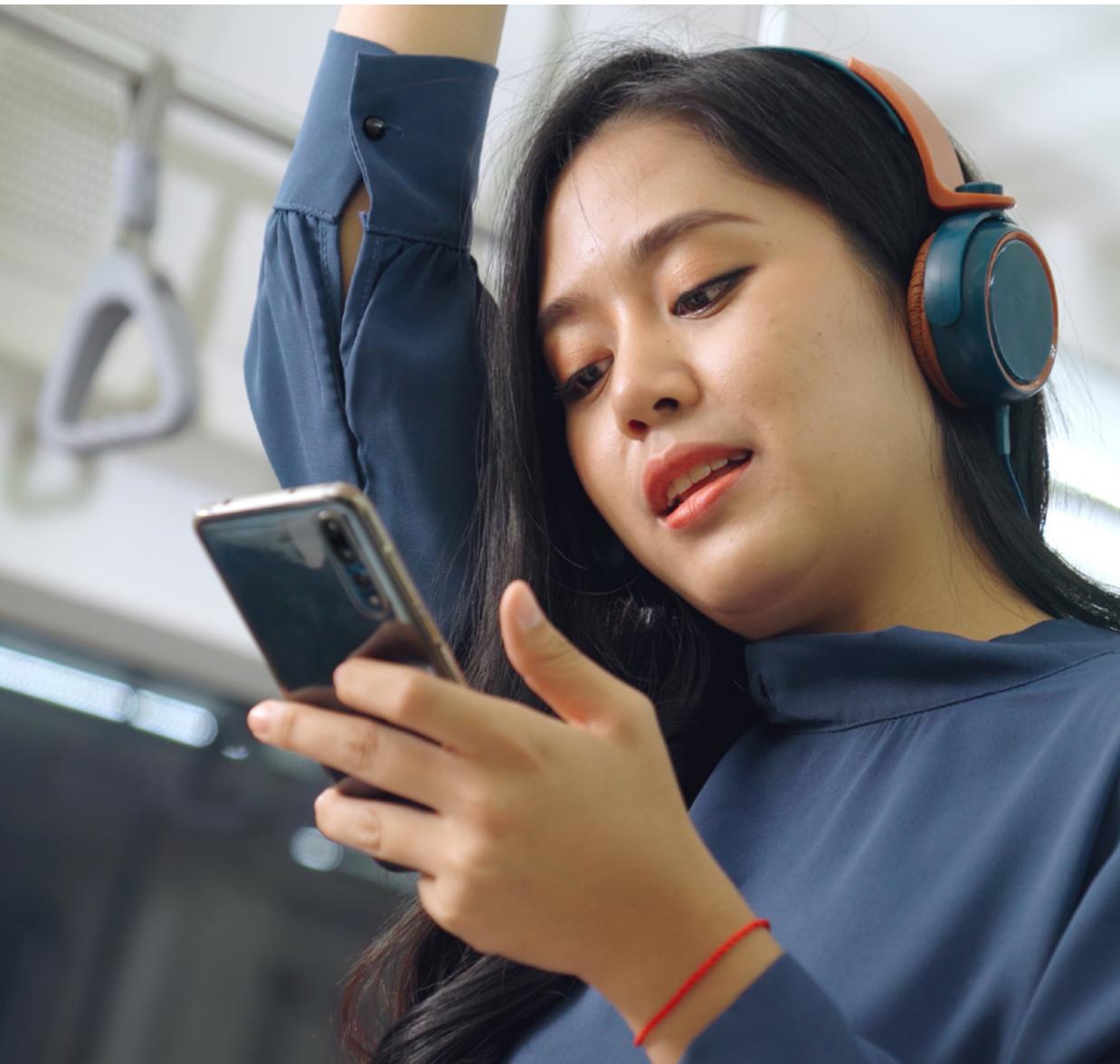> In this report, we detail how Value realizers are succeeding despite challenges.

Tatsuya Nakayabu
Industry X Lead,
Japan

Fay Cranmer
Industry X Lead,
Growth Markets

Contents

The bullet train, the pocket calculator and the Walkman. Blue LED light and industrial robots. These product innovations changed the world of travel, transactions, entertainment, TV-screens and automation. And they all came out of Japan.

More recently, Japanese companies have struggled. They're finding it hard to translate their leading innovation in the physical product era into the same level of success with digital. Our research found that many Japanese companies are following the same approaches to engineering and manufacturing that served them well in the past. These approaches created world-beating innovation then. But they're failing to deliver the same leading edge when it comes to digital products and services.

Behind the innovation curve

Across three key indicators, Japan has seen its performance decline over the past decade and more. In 2021, the country ranked 28th out of 64 in global digital competitiveness, behind China and South Korea.[1] The country's share of bilateral trade in information and communications technology (ICT) fell from 11% in 2000 to 2.4% in 2020.[2] Japan had the highest number of patents granted to any industrialized nation between 2000 and 2013—more than 30% of the global total. By 2020, that proportion had fallen to less than 17%. China's, in contrast, leaped from 1.2% in 2000 to nearly 30% by 2020.[3]

To find out why Japan appears to be struggling to innovate in the digital era, we investigated the state of product engineering and manufacturing. We surveyed 150 large Japanese companies with annual revenues exceeding $1 billion. We followed this with detailed financial and quantitative analysis of company-level data. These companies spanned eight key industries. They are Automotive, Chemicals, Consumer Goods and Services, High-Tech, Industrial Equipment, Life Sciences, Medical Devices and Technologies, and Utilities.

Our research reveals that most companies have not prioritized the engineering and manufacturing of digital products and services during the period 2018-2021:
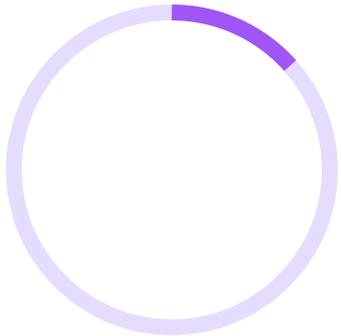
Only 13% invested more in engineering digital products and services than they did in physical products

Engineering

Scope for product innovation is limited to the specifications and concepts defined at the start of the innovation process **39%***

Innovation budgets get largely assigned toward improving and maintaining existing key products **35%***

There is limited investment in designing and engineering digital services to drive better customer experience across product life cycle **33%***

Only 16% invested more in digitizing manufacturing than in other technology investments

Manufacturing

There are hardly any/no software engineers in the manufacturing workforce **51%***

Manufacturing workforce is highly disciplined but lacks creativity **50%***

Manufacturing functions are left with a strong pool of only operationally skilled and quality conscious workforce **49%***
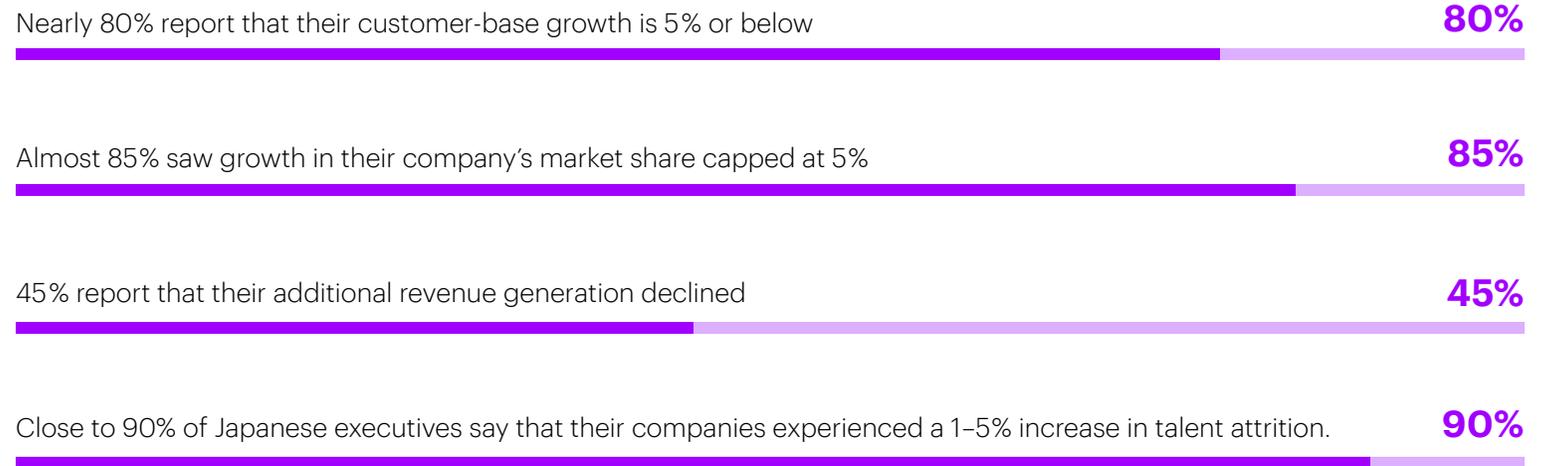
Source: Accenture Industry X Japan survey 2022

* % of total responses

The past is no guide to future performance

Using these same approaches to engineering and manufacturing—most of which are no longer relevant for the digital era—results in a number of problems. Products are specified at the start of the innovation process. Functions are siloed and don't drive collaboration with internal or external partners. Investments are focused on improving existing products rather than new products. And manufacturing functions are struggling to attract and retain the software and digital talent they need to succeed.

These challenges are feeding through into performance during the period 2018-2021:

Nearly 80% report that their customer-base growth is 5% or below

80%

Almost 85% saw growth in their company's market share capped at 5%

85%

45% report that their additional revenue generation declined

45%

Close to 90% of Japanese executives say that their companies experienced a 1–5% increase in talent attrition.

90%

Source: Accenture Industry X Japan survey 2022

Recognizing the need for change

However, most companies surveyed also recognize the need for change. They understand the need to make significant changes to their engineering and manufacturing. Nearly 90% expect to invest more in engineering digital products and services than physical between 2022 and 2025. And more than 80% of companies plan to make digitizing manufacturing a priority. Overall, companies expect, on average, to invest 1.25x more in engineering of digital products and services and digitizing manufacturing over the next three years. They expect they'll go from investing 4.4% of annual revenues at present to 5.5% by 2025.

> However, the key question is where they should direct those investments. And how can they best reorient their operations to become innovators in the digital era?

Follow the leaders

Our research has identified that a minority (13%) of Japanese companies are driving value and growth from their portfolios of digital products and services. Their example should prove instructive for companies seeking to make the required pivot to engineering and manufacturing digital products and services. These digital innovation leaders (Value realizers) are more heavily weighted to digital products. And they're achieving higher profitability and growth than their peers.

We examined the differences in the compounded annual growth rates (CAGRs) clocked by Value realizers and Japanese companies in the other three categories. We did this across two key variables, revenue and overall profitability (earnings before interest, depreciation, tax and amortization—EBIDTA).

We found that, during 2018-2021, Value realizers grew their revenues at a compounded annual growth rate of 9.7%. On the other hand, Value aspirants and Value novices experienced growth-contraction with revenue CAGRs of -2.4% and -1.4%, respectively during the same period. Value makers grew their revenues at a very low compounded rate of 0.2%. It displays the futility of the strategy adopted by them to earn higher revenues with physical products.

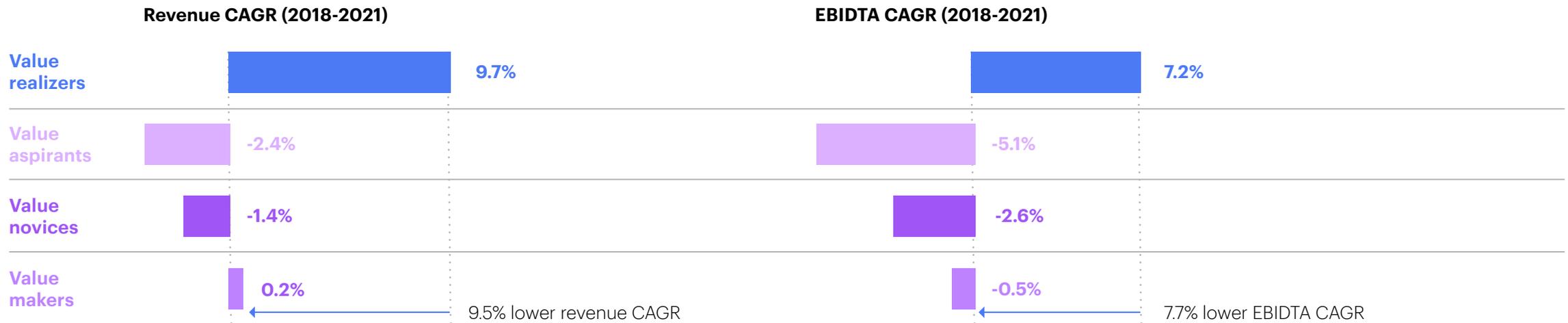Value realizers, makers, novices and aspirants
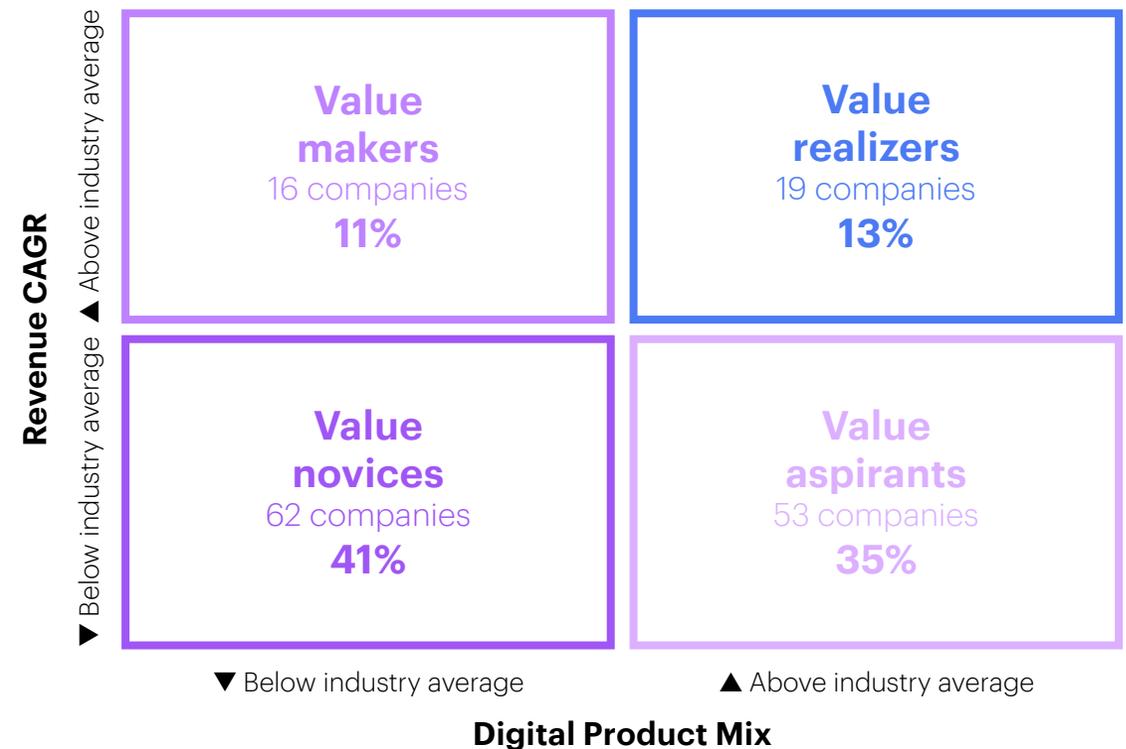
Source: Accenture Research analysis based on Accenture Industry X Japan survey 2022

A similar picture prevailed for the EBIDTA CAGR. Here, the Value realizers clocked almost double the EBIDTA CAGR, as compared with the Value makers.

Value realizers clearly outperform the "Others"—Value aspirants, Value novices and Value makers—on financial parameters. But Value realizers from our sample also outshine Others on the Environment, Social and Governance (ESG) dimensions of Accenture's 360° Value creation.

Comparison of the financial performances of Value realizers vs the Others (comprising of the Value aspirants, Value novices and Value makers)

Revenue CAGR (2018-2021)

Value realizers	9.7%
Value aspirants	-2.4%
Value novices	-1.4%
Value makers	0.2%

9.5% lower revenue CAGR

EBIDTA CAGR (2018-2021)

Value realizers	7.2%
Value aspirants	-5.1%
Value novices	-2.6%
Value makers	-0.5%

7.7% lower EBIDTA CAGR

Source: Accenture Research

Using data from publicly available databases, we analyzed the ESG-performance of Japanese companies from our sample during the period 2018-2021.

Environmental performance (emission reduction, efficient resource use, waste reduction and management as well as efficient water use): In comparison to 56% of Others, over three-quarters (67%) of Value realizers had an above industry-average score on the parameters related to Environmental performance.

Social performance (diversity of workforce, occupational health and safety, providing access to products and/or services for disadvantaged communities as well as human and labor rights): In comparison to 55% of Others, 60% of Value realizers posted an above industry-average score on the parameters related to Social performance.

Performance in the areas of Governance (business ethics, transparency and corporate governance): Compared to only 42% of Others, 53% of Value realizers outscored their industry average on the parameters related to Governance.

What's driving leaders' success?

Value realizers distinguish themselves from their peers through four actions

01
Their CEOs adopt and articulate a progressive vision of their company's digital future.

02
They build a tech-savvy board to help steer the vision through the enterprise.

03
They use the combination of technology and talent to drive seamless collaboration across engineering and manufacturing functions.

04
They continually build their data-driven capabilities to drive cross-functional collaboration and deliver the best designs, quality and services across product lifecycles.

01

Articulate
a clear vision

A clear vision sets the path for businesses to compete and differentiate in the market. A quick analysis of annual reports of companies in our sample reveals that CEOs have at least some sort of a digital vision. However, CEOs of many Value realizers excel at articulating it clearly and sharing the strategic organizational shifts required to thrive with digital products and services.

Case study

We looked at a leading Japanese high-tech company dealing in ICT products. At this company, the CEO himself drives the company-wide program to transform its products and services, along with the CIO. They recognize that this transformation needs to be paired with comprehensive reforms in their business processes, talent, evaluation frameworks and corporate culture.

The CEO wanted to provide an inclusive momentum to the reform agenda. To achieve this, the CEO instituted a steering committee. It consists of the CIO, COO, CFO, CHRO and CMO. Digital transformation officers are selected from the company's multiple units across different geographies. They're tasked with the execution of the reforms and they share their insights with the steering committee. It enables the committee to make better and more informed decisions.

One of the key projects under this program is the creation of a "common digital service." It sits across the business and collates feedback from customers and the workforce. The service will be used to collect and analyze quantitative and qualitative data frequently. Additionally, a range of non-financial indicators were introduced to complement the existing financial indicators. These additional indicators are designed to monitor the levels of trust shown by customers and employees and to track the progress of the program.

The company wants to help its workforce actively participate in such initiatives. To achieve this, it is simultaneously training all of its 100,000+ people globally. This training will equip its people with skills in areas such as data sciences and design thinking.

02

Build a tech-savvy board

CEOs may be able to articulate a distinctive digital product and service vision for their company. But realizing it will be hard without the buy-in and support of a tech-savvy board. Leaders outperform their peers here. On average, close to 20% of Value realizers' board members have relevant technology experience. It's almost twice the average compared to other companies surveyed.[4]

A detailed analysis of the board composition of one of the leaders from the high-tech industry revealed that six of its 13 board members have tech experience. Most of the members were from outside the company. Their "outside-in" perspective makes it easier for the company to think beyond its long-established solutions.

Technology experience of board members among leaders paves the way for the CEO to execute on the digital vision

19.4%

10.9%

1.8x

Value realizers

Others

Source: Accenture Research
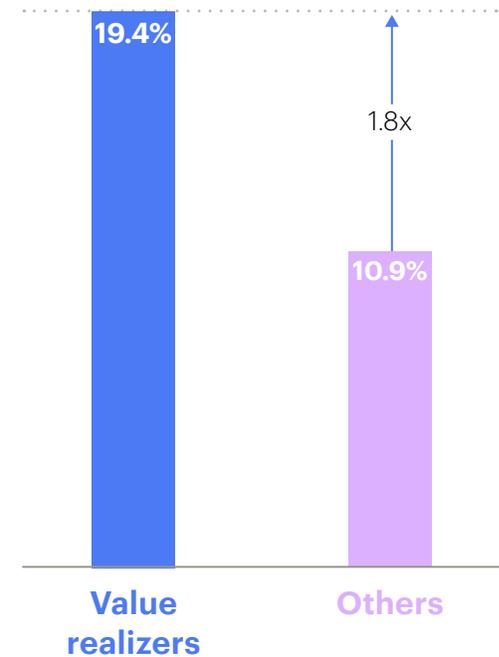
Example: Board composition of a Value realizer

Industry: High-Tech

Total board members: 13

No. of board members with technology experience: 6

Board members with technology experience:
• Independent outside directors
• Member of advisory board
• Senior adviser
• Advisor to board of directors
• Non-executive director

03

Drive collaboration across engineering and manufacturing functions

In 2020, <u>Accenture showed</u> how silos can defeat digital transformation. And Value realizers in Japan understand this much better than Others. They know that the siloed ways of working used for physical products hamper success in the era of digital products. As a result, they systematically enable seamless collaboration. And they do this across their entire manufacturing and engineering functions.

Value realizers work toward embracing a whole new culture. Such a culture brings the two functions together. It unifies their efforts, expertise, resources and data for a common mission of building and delivering digital products and services.

This shift starts with making the right technology choices. The next step is to create the right environment. It should support the combination of technology and talent to maximize the value of digital products and services.

Technology deployment

Value realizers use digital technologies to drive efficient digital product design. They also use them to automate repetitive product development tasks. Six out of 10 Value realizers have deployed artificial intelligence (AI) or AI-powered automation in comparison to just 4 out of 10 within Others. These technologies free up resources to focus on collaborative product innovation and delivery. And over 50% of Value realizers have deployed a digital thread. They provide access to cross-functional data and data-driven insights across the entire product lifecycle.
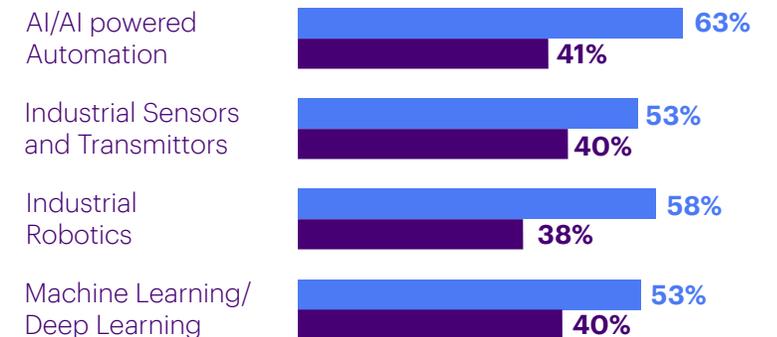
Similarly, in the manufacturing function, the majority of Value realizers are deploying digital technologies much higher in comparison to Others. These include AI or AI-powered automation, industrial sensors, industrial robotics and machine learning. Their aim is to drive better decisions and make the manufacturing shopfloor more efficient and collaborative.

Leaders are making technology choices that help them create a strong tech-foundation to drive intelligent and productive collaboration

Engineering

AI/AI powered Automation — Value realizers 63% / Others 40%

Digital Thread — Value realizers 53% / Others 42%

Industrial Robotics — Value realizers 53% / Others 38%

Cybersecurity Systems — Value realizers 53% / Others 41%

Manufacturing

AI/AI powered Automation — Value realizers 63% / Others 41%

Industrial Sensors and Transmittors — Value realizers 53% / Others 40%

Industrial Robotics — Value realizers 58% / Others 38%

Machine Learning/ Deep Learning — Value realizers 53% / Others 40%
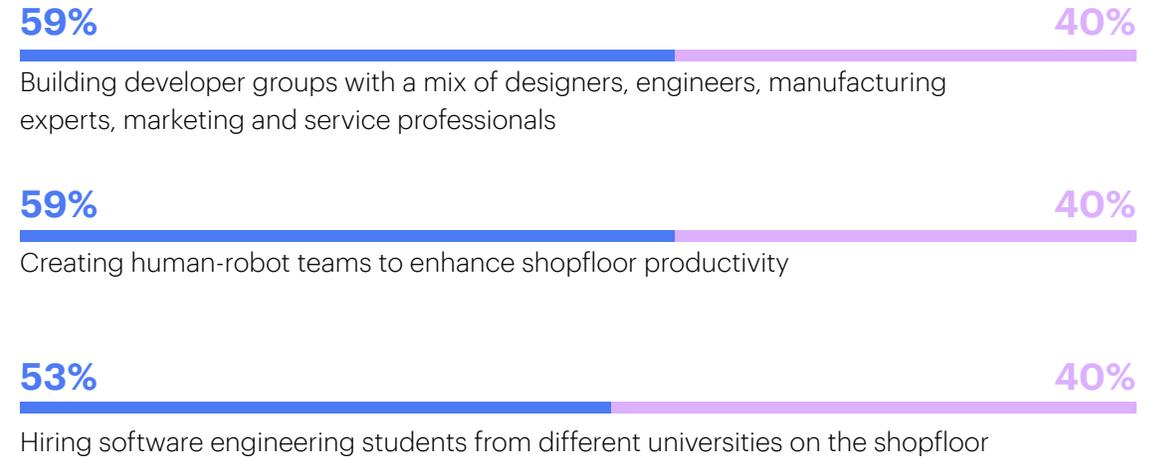
Value realizers   Others

Talent deployment

Value realizers also focus on intelligently pairing talent pools from within and outside their companies. They also create the right "human+machine" environment. It's key to unlocking greater productivity and agility across digital product innovation and delivery.

As many as 59% of Value realizers in comparison to just 40% of Others built multidisciplinary developer groups within their companies. These bring together designers, engineers, manufacturing experts, marketing and service professionals. These developer groups address all phases of the product lifecycle.

More than half of the Value realizers have also focused on recruiting software engineering students on to the shopfloor. Students bring in fresh thinking and help make the manufacturing environment younger and more experimental. Additionally, 60% of Value realizers are creating human-robot teams, compared with only 40% among Others. These teams will drive enhanced shopfloor productivity.

Leaders build a diverse talent pool—making the best of humans and machines

59% **40%**

Building developer groups with a mix of designers, engineers, manufacturing experts, marketing and service professionals

59% **40%**

Creating human-robot teams to enhance shopfloor productivity

53% **40%**

Hiring software engineering students from different universities on the shopfloor

Source: Accenture Research

■ Value realizers ■ Others

Case study

Consider Sumitomo Electric. The company is pushing ahead with the development of Internet of Things (IoT) technologies. They include sensing systems, wireless communication and big data analysis using AI to support the manufacturing function. The objective? To improve productivity, automate inspection, carry out predictive maintenance and enhance workplace safety.

Working toward these objectives, the company formed a collaborative team, called IoT R&D. It includes departments such as Plant & Production Systems Engineering, IoT R&D, and Information Systems. They work together to streamline the sharing of information between the manufacturing sites and the research department. This collaborative approach facilitates collection, storage and analysis of data from multiple sensors and devices across the manufacturing

network. It also facilitates the real-time sharing of worksite information with the IoT research department. This enables the department to develop IoT solutions unique to each site's circumstances.

The approach has proved particularly beneficial for the product inspection process. The team used AI-powered image recognition to detect product defects with greater accuracy and greater speed.[5] With these reductions in defects, Sumitomo Electric hopes to achieve a 1% reduction in its industrial basic units per year with FY2017 as the base year.

On the financial front, productivity-enhancing measures such as these helped Sumitomo Electric increase its operating income. The company went from a low of 7.7% in FY2018 to 10.7% by FY2020 (latest available), partly also absorbing the decline in optical fiber prices.[6]

04

Focus on building data-driven capabilities

Value realizers focus on realizing value across the product lifecycle. To achieve it, they build robust back-end data capabilities. Their engineering and manufacturing teams can use these to make informed decisions about new and improved product features and services throughout the product lifecycle.
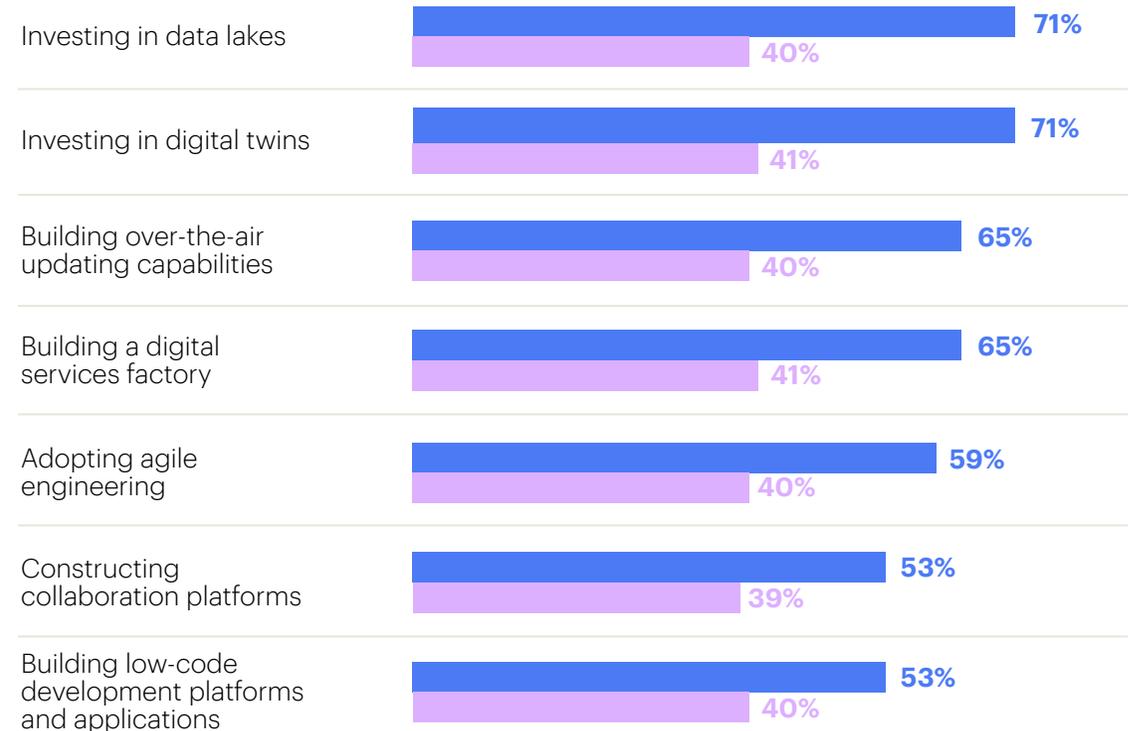
Our survey reveals that in the period between 2018-2021, Value realizers invested in data capabilities. These included digital twins (71% of Value realizers as compared to 41% of Others) and data lakes (71% of Value realizers as compared to 40% of Others) as well as low-code development platforms. The capabilities enable all teams to access the data they need. Alongside these data-driven capabilities, as many as 53% of Value realizers have built collaboration platforms. Their aim is to break down functional siloes and facilitate continuous, real-time interaction. As a result, 53% of Value realizers benefitted from greater data-driven decision-making over the past three years. This is compared with only 41% among Others.

They have also been able to develop over-the-air capabilities, such as security patches and product upgrades. And 76% of Value realizers have built these capabilities over the past three years, compared with only 40% of Others.

Digital services factories also distinguish leaders from others—65% of Value realizers have developed these factories in comparison to 40% of Others. They enable their companies to be more responsive to or even anticipate customer needs. Leaders also adopt agile engineering capabilities to help them innovate fast and build digital services at speed.

Leaders build a holistic set of capabilities that provide data-driven insights to keep products and services updated

Investing in data lakes
71%
40%

Investing in digital twins
71%
41%

Building over-the-air updating capabilities
65%
40%

Building a digital services factory
65%
41%

Adopting agile engineering
59%
40%

Constructing collaboration platforms
53%
39%

Building low-code development platforms and applications
53%
40%

Source: Accenture Research

■ Value realizers ■ Others

Case study

Daikin, the world's largest heating, ventilation and air conditioning company, and one of our Value realizers, is doing this well. In July 2018, the company established a co-creation platform for spatial data, called CRESNECT. Under this platform, Daiken works with a number of partner companies to analyze data gathered from air conditioners. It uses the data to study how to improve office productivity and maintain worker health.

Its first project under CRESNECT was the creation of "point 0 marunouchi." It's a coworking space that aims to provide highly personalized experiences to users, based on sensing data collected from devices and user preferences. The experiences created include the "Wind Creator" that produces the feeling of a natural breeze in an indoor space; and air conditioning sofas that individually adjust to the body temperatures of the people sitting on them.[7]

From an operational point of view, too, Daikin has been focused on building capabilities related to connected workers through "collaborative creation." One such capability is the THINKLET™. It's a smart wearable device, powered with multi-microphone and voice-edge AI technology. The company collaborated with Fairy Devices Inc., a venture company from University of Tokyo, to develop THINKLET™. The goal was to improve work efficiency and quality by connecting workers. Daiken's experienced service engineers pair the THINKLET™ smart wearable device with the technology stack developed by Fairy Devices and an online app. This technology enables the company to provide work support solutions and train their workers remotely.

Daikin aims to use this solution to quickly foster talented service engineers while also improving the technical skills and decision-making abilities of workers in Japan and beyond. In February 2021, Daikin invested approximately ¥500 million ($3.6 million) in a bid to expand the application of this solution in 13 countries in Asia, Oceania and Africa that are seeing rapid growth in the air conditioner market.[8]

Over the past few years, Daikin has engaged in several data-led co-creation initiatives with academia and external partners. Together, they have created new products, services and business models.

It is therefore no surprise that in 2020, Daikin was selected as one of the Digital Transformation Stocks (DX Stocks) 2020 by Japan's Ministry of Economy, Trade and Industry and the Tokyo Stock Exchange. The DX brand recognizes companies that use data and digital technologies to transform products, services and business models and fundamentally reform operations, organizations and processes to establish a competitive advantage.[9] Regarding financial performance, Daikin clocked six consecutive years of record high sales and operating income during the period FY2014-FY2020 (latest available).[10]
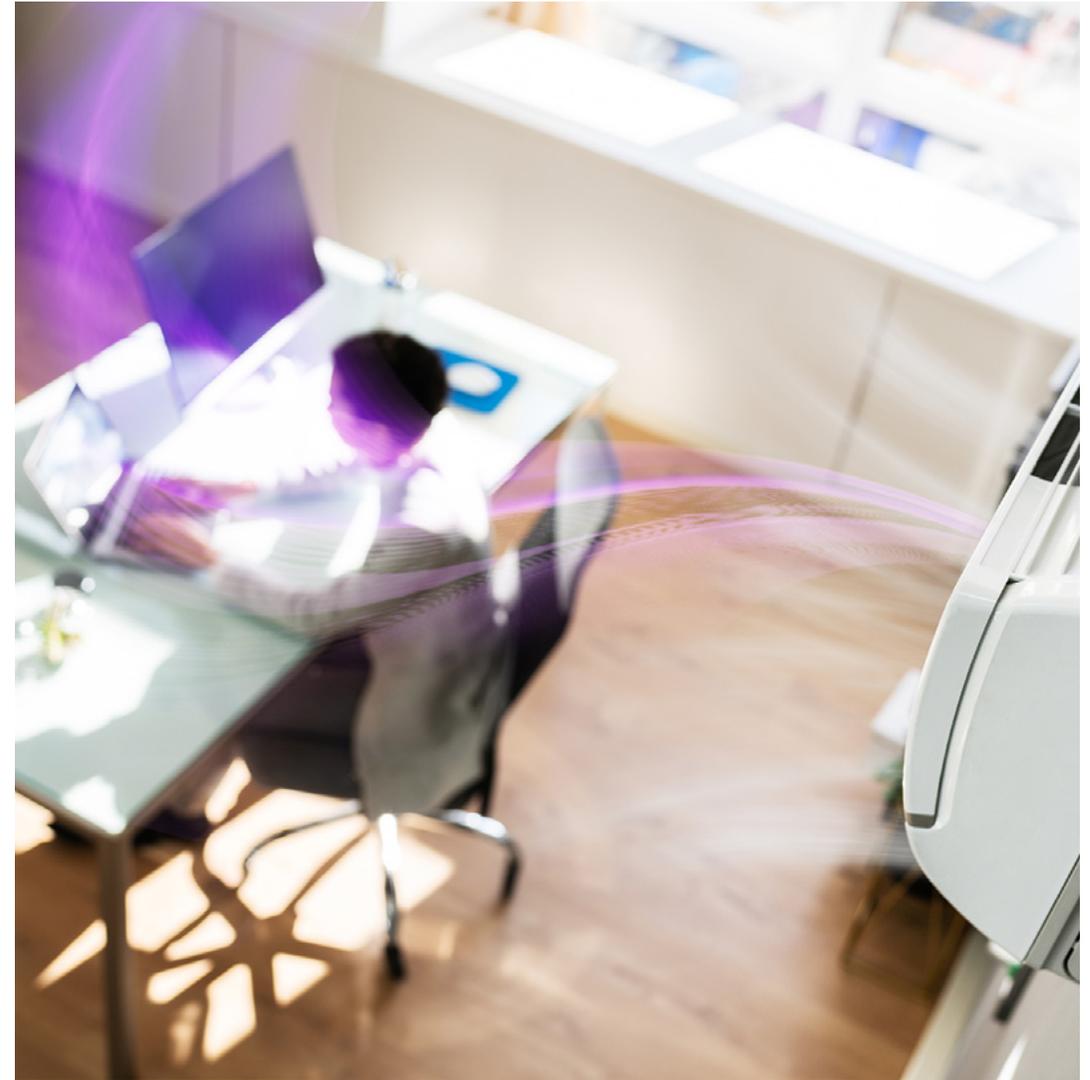
What´s next?

Our research shows that for Japanese companies to thrive in the digital era, they must evolve their thinking on product design and embrace the possibilities of digital products and services—building and selling only physical products is no longer an option. They must embark on the journey to engineering and manufacturing digital products and services at speed.

The good news? The leaders identified in our research have shown the way for other companies to accelerate their own journey.

They can start by:

- Evaluating their existing digital product vision or developing one.

- Working toward a plan to increase the digital intensity of their product portfolio.

- Building a digital engineering and manufacturing engine for the future by identifying a senior engineering and manufacturing team for mentoring by interested board members/C-suite.

- Analyzing skills and capability gaps in their manufacturing and engineering domains they can bridge through active collaborations with universities and colleges.

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Research Methodology

PHASE 1: DESIGN THINKING WORKSHOP

In December 2021, we conducted a design thinking workshop with 15 client-facing executives from Accenture's Industry X Japan practice to identify the challenges and opportunities faced by Japanese manufacturing companies. The workshop focused on three key areas: market opportunities Japanese companies should look to capture to grow their business in next 5~10 years; key initiatives Japanese companies should take to establish themselves as the market leader in the market; practices that Japanese companies should abandon and capabilities they should start building. Insights from this workshop were used to formulate, define and refine our hypothesis and develop the survey questionnaire.
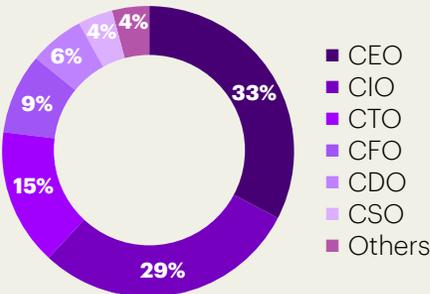
PHASE 2: PRIMARY RESEARCH

Between April and June 2022, we surveyed 150 C-suite executives from Japanese companies spanning eight industries. Each of these executives represented a company with annual sales exceeding $1 billion.
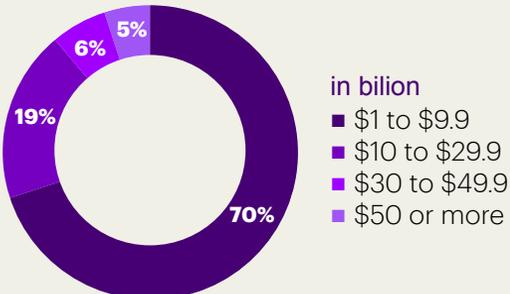
We asked executives about their companies' current portfolio of digital products as well as the readiness of Engineering and Manufacturing functions to build and deploy digital products and services. We also collected data on their current and future investments towards digital products and services as well as the impact their investments are making, or are expected to make, on selected performance metrics.

EXEC PROFILE

- CEO — 33%
- CIO — 29%
- CTO — 15%
- CFO — 9%
- CDO — 6%
- CSO — 4%
- Others — 4%

ANNUAL REVENUE

in bilion
- $1 to $9.9 — 70%
- $10 to $29.9 — 19%
- $30 to $49.9 — 6%
- $50 or more — 5%

Industry	No of companies	% of Sample
Automotive	22	15%
Chemicals	22	15%
Consumer Goods & Services	22	15%
High-Tech	25	17%
Industrial Equipment	20	13%
Life Sciences	20	13%
Medical Devices & Technologies	4	2%
Utilities	15	10%

STEP 1: We identified Japanese companies with above industry-average digital product mix

In our survey, we asked executives about the proportion of digital product (as a % of all products) innovated and introduced in the market, over the period 2018-2021. We call this the **digital product mix**. We used their inputs to calculate the industry-average digital product mix for Japan across each of the eight industries included in our survey. The 150 companies covered in our survey were then benchmarked against their industry-average digital product mix to identify groups of companies that were above and below their industry-average. This exercise helped us identify companies that had above and below industry-average digital product mix.

STEP 2: Next, we calculated the global industry-average Revenue CAGR

We used publicly available financial data to collate annual Revenue figures for manufacturing companies across the top ten industrialized countries globally (China, France, Germany, Italy, Japan, South Korea, Spain, United Kingdom, United States of America). Over 1,100 companies with annual revenue of over $1 billion were considered for this analysis. We then calculated the revenue CAGR for all the companies individually for the period 2018-2021. These were then used to calculate the global industry-average Revenue CAGR for each of the eight industries (Automotive, Chemicals, Consumer Goods & Services, High-Tech, Industrial Equipment, Life Sciences, Medical Devices & Technologies, and Utilities).

STEP 3: We then identified Japanese companies with above average-industry Revenue CAGR

We used the global industry-average Revenue CAGRs to benchmark the 150 Japanese companies in our sample to identify companies that are above and below their global industry-average Revenue CAGR.

**STEP 4: And finally, classified the Japanese companies into 4 categories**
The combination of digital product mix and three-year revenue CAGR was used to position the 150 Japanese companies in a 2x2 grid outlined in the graph on page 9.

PHASE 4: TEXT ANALYTICS STUDY
We used publicly available data sources to collate details on CEO speeches and about the board members for the Japanese companies covered in our survey. We then analyzed the professional background of each of the board members. For this analysis, we defined board members who have technology experience as those who met at least one of the following criteria:

• They have technology responsibilities (e.g., CIOs, CTOs, CDOs) at their current company or had such responsibilities in previous companies.
• They have or had senior responsibility at a technology firm.

We then ran a text analytics exercise to identify board members that have technology experience.
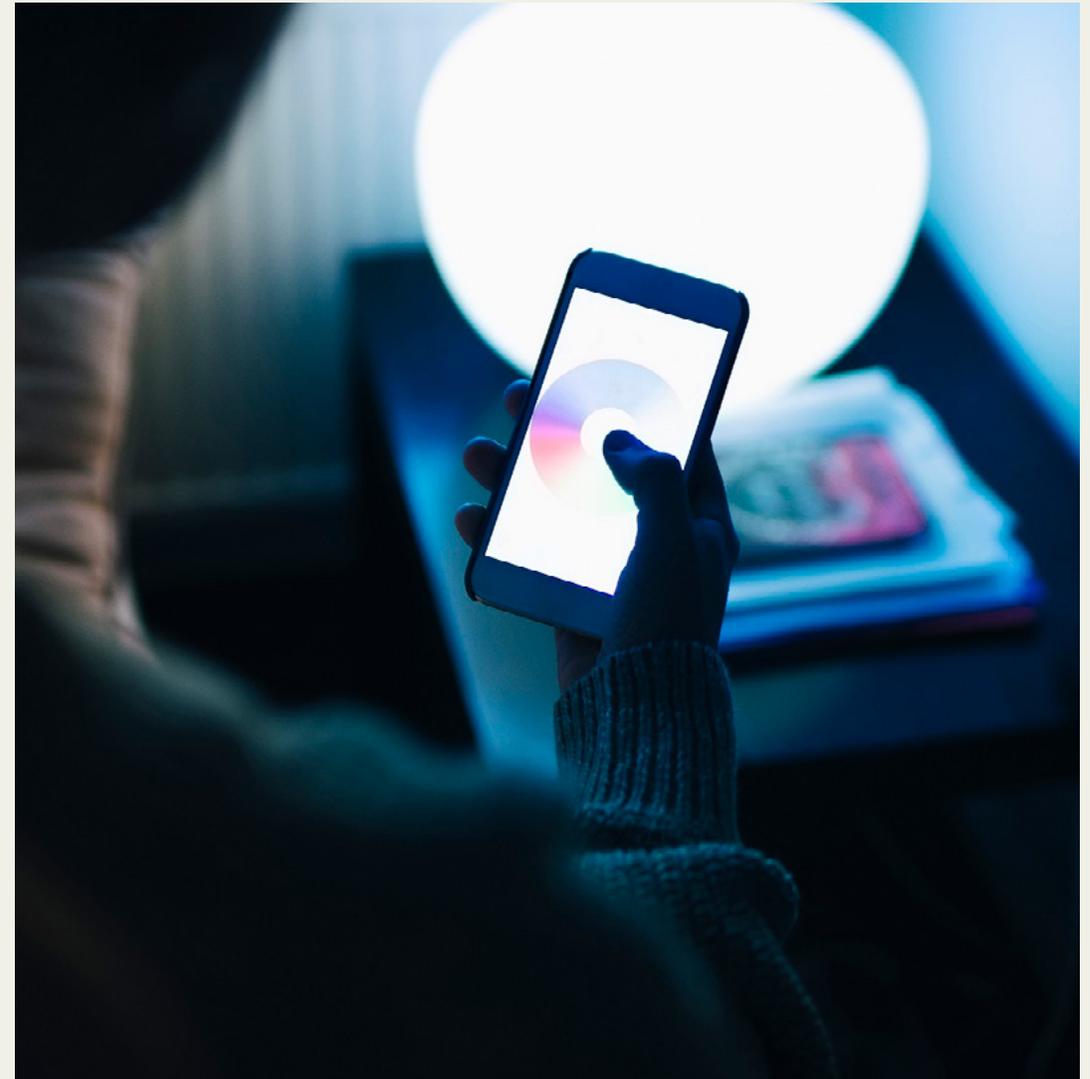
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