

Japan Digital Agenda 2030

Big moves to restore digital competitiveness and productivity

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Foreword

As the world enters a new and transformative digital era in which companies and governments rapidly embrace digital technologies and digital ways of working, Japan faces a strategic imperative: reigniting productivity and growth through digital transformation.

In 2009, the American Chamber of Commerce in Japan (ACCJ) published a White Paper on “achieving the full potential of the Internet Economy in Japan.” The White Paper detailed a range of recommendations across Japan’s still nascent Internet Economy, including changes in government ICT procurement practices, measures to protect privacy and intellectual property, steps to promote online commerce and digital government, and digitization and sharing of healthcare data under appropriate safeguards.

A decade later, many of these challenges remain, given Japan’s now declining total factor productivity. Execution and enabling regulation have lagged in Japan, and elsewhere in the world many of Japan’s competitors are moving ahead rapidly. Japanese government and industry need to fully embrace digitization across its economy from manufacturing to healthcare to finance to the retail sector and in the delivery of government services.

The ACCJ and McKinsey & Company have partnered to develop a perspective to elucidate the issues facing Japan over the next decade in digitizing its economy and society. This partnership brought together the experience of a wide range of US companies, which are at the forefront of the digital economy in Japan and globally.

The research identifies the “Big Moves” that Japan can pursue, highlighting the underlying technology use cases, and describing the digital transformation barriers and enablers to achieve them. The resulting analysis examines how Japan’s education system can support the creation of a broader base of digital talent, how Japanese industry and government can digitize their value chains, and the respective roles that startups and existing systems integrators can play in accelerating digital transformation..

The sources of insight to inform this perspective are derived from quantitative and qualitative surveys of US and Japan business and policy leaders to benchmark progress over the past decade. They also include in-depth interviews with over 100 government, business, and technology leaders in and out of Japan. Finally, over 200 data sources were consulted to gather critical inputs across a range of industries, topics, and technologies.

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Executive summary

In 2020, the great nation of Japan stood as the world's third largest economy, underpinned by an endowment that includes a top education system, leadership in sectors such as industrial and automotive manufacturing, high-quality infrastructure, as well as a professional culture infused with a strong work ethic and repeatable methods to produce high-quality goods and services.

Yet, Japan's productivity has gone from stagnant to declining, a course that needs imminent reversal to remain globally competitive. On the rise are competing nations making significant productivity gains through the development of technical talent, and the application of proven digital technologies that include cloud based infrastructure and software, mobile devices and apps, machine learning and deep learning, and many others.

Japan's relatively low digital competitiveness is in stark and unexpected contrast to the country's economic strength. In 2020 the country ranked 27th in digital competitiveness and 22nd in digital talent, and it has single-digit penetration in areas such as e-commerce, mobile banking, and digital government service usage. The country has produced just 5 out of more than 500 unicorn startups globally (startups with a private or public valuation of more than US\$1B). These metrics fall far short of Japan's full potential.

Standing in the way of digitization are some self-imposed constraints: a high-context culture with a risk-averse mindset; senior leaders focused on company longevity rather than productivity; limited exposure of some industries to global competitors; a gridlock effect between a private sector waiting for digital endorsement by government and a government waiting for the private sector to forge ahead; and most important, a deficit of more than half a million software-related engineers to build the software applications that will take the country forward.

The technologies to build a digital future can be setup in the cloud today with a few clicks, and it has never been simpler to hire talent from around the globe, or build talent up leveraging the wealth of online courses and code available. In the coming decade, Japan needs to make a definitive and far-reaching commitment to digitization. Absent such a change, current GDP growth and productivity rate trajectories suggest that economies such as India and Germany would overtake Japan beyond 2030. This loss of competitiveness would in turn undermine Japan's strengths, and be an unfortunate outcome given the country's intrinsic potential.

Incrementalism will not close the digital competitiveness gap. Japan must undertake some transformative steps which we call Big Moves – concerted efforts by major industries or stakeholders to reform their operations, capitalize on emerging trends, and embed digital technology across the value chain. These Big Moves are anchored on four themes:

- **Digital Talent:** A bold plan to more than triple the bench of digital talent, focusing disproportionately on software developers, data engineers, data scientists, machine learning engineers, product managers, agile coaches, designers and other types of new jobs. This in contrast to the continued deepening of hardware talent, which is already a strength. This requires a mindset shift that software expertise is just as valuable as traditionally Japanese prized hardware or non-software engineering disciplines. The big moves will also call for upskilling of workforces; and the digitization of the education sector itself.
- **Industry transformation:** Leapfrog moves by the four core industry sectors that contribute nearly 50% of Japanese GDP – Industrial and Automotive Manufacturing, Wholesale & Retail, Healthcare, and Financial Services. All of these sectors have single-digit digital penetration metrics; such as the number of digital manufacturing lighthouse factories, or the percentage of e-commerce penetration. Their value chains have potential to scale up more than 100 proven use cases that leverage cloud based applications, machine learning, deep learning, e-commerce technologies, IoT, 5G, cybersecurity and others to drive an increase in revenues and reduction in costs and expenses. By 2030, Japan needs an AI-enabled industrial sector, digital healthcare at scale for the elderly population, omnichannel retail experiences, and a modern, streamlined mobile banking system underpinned by a globally interoperable frictionless payment infrastructure.

- **Digital Government:** A strategic commitment from the Government to drive connectivity, cybersecurity, and the availability of cloud resources to build a new wave of applications. More importantly, the build out of digital applications in the public sector to digitize the services it provides to citizens and businesses, doing away with lengthy processes that require physical visits, paper, seals, fax, and other analog methods.
- **Economic renewal:** Japan has more than half of the world's oldest founded companies, many of those with declining revenues and profitability; it needs to inject economic renewal. This renewal mandate is best suited for the startup ecosystem, which needs to boldly address global customer problems with software, shifting from its current inward and hardware focus. Reforms are needed to encourage founders, attract talent, and enable startups to scale. Another key to economic renewal involves the transformation of Japanese systems integrators: they account for over 60% of Japanese technology related spend and 70% of IT hired talent, and it is crucial that they bring their clients along on the journey. Digital may need talent and technology back in the core operations of businesses, and systems integrators need to develop new business models to help their clients transition.

The execution of these big moves will require a formula that allows them to move from idea to impact. A survey conducted for this effort on the progress of various information, communications, and technology initiatives over the past decade revealed some important lessons. Initiatives that show progress start with dialogue between the various counterparts, are formalized in concrete action plans, have single threaded leadership accountability, show positive momentum early on, and encourage participation throughout. Conversely, initiatives that did not show progress feel victim to limited formalization, a prevalent risk mindset, and insufficient funding to see the initiative through to the end.

In 2030, the Japan story could be one of the most inspirational transformations of our time. Japan has the right endowment, with smart citizens and quality assets; the technology to build is readily available today, and the barriers to transformation are largely mindset related. But changing entrenched attitudes remains the top challenge of any transformation: strong leadership is required to meet it, along with a laser-like focus on execution and a broad-based capacity to adapt.



The current state of digital in Japan

Japan's digital scorecard

Currently holding the position of the world's third largest economy, Japan had in recent years negative total factor productivity growth, and currently ranks 27th in overall digital competitiveness (Exhibit 1). At the core of this is a void in digital talent that can apply technology and transformation expertise to industry and government. Its effects are seen in industries, where there is single digit penetration across applications such as e-commerce, telemedicine, mobile banking, and cutting edge digital manufacturing. The effects are further felt in government where only 7.5% of citizens use government portals and apps. The wide margin between Japan and best in class digital economies presents substantial opportunity for Japan to improve on the digital front.

Amidst a shrinking population, digital offers a pathway to reignite both Japan's productivity growth, as well as the national narrative around global leadership and competitiveness. However, due to the stability of the business environment and society, and the generally high quality of public infrastructure and services – including communications technology, healthcare and education – there is little sense of urgency for change. Digital can help further improve the standard of living in Japan, and it is an imperative if Japan is to maintain its standing as a top global economy with excellence across industries, the government, and the education system.

Exhibit 1:
Japan's digital scorecard in 2020

Objectives	Metric	Japan 2020	Best in Class
Digital and global competitiveness	Total factor productivity (5 year average % growth)	-0.11%	+2.81% – China
	Digital competitiveness - <i>IMD</i> ¹	#27	#1/2 – US, Singapore
Digital talent	Universities with software-related programs	29	117 – US
	Digital talent ² as % of workforce	1%	3% – US
Digital industry	Industrial Mfg.: Lighthouse 4.0 factories - <i>WEF</i>	2	5 – China
	Retail: e-commerce penetration	9%	24% – China
	Healthcare: telemedicine penetration - <i>IPSOS</i>	5%	31% – Saudi Arabia
	Finance: % mobile banking penetration	6.9%	35.2% – China
Digital government, infrastructure	Government: % citizens using digital govt. apps	7.5%	99% – Estonia
	Smart city ranking - <i>IMD</i>	#79 (Tokyo)	#1 – Singapore
Digital technology leadership	Public cloud spend (% of IT spend)	3%	10% – US
	% of global published AI conference papers	6%	29% – US
Economic renewal	Startup market cap as % of total market cap	1%	31% – US
	# of unicorn startups ³	5	320 – US

1. IMD World Digital Competitiveness Ranking measures the capacity and readiness of 63 economies to adopt and explore digital technologies as a key driver for economic transformation in business, government and wider society.

2. Engineering talent including software engineering, data engineers, and developers. Excludes consultants, project managers and process related occupations.

3. Companies with a valuation >\$1B, including public companies that received such valuation before IPO: Mercari, Preferred Networks, SmartNews, Liquid, Playco.

Source: McKinsey, McKinsey Global Institute, IMD, WEF, Gartner, Stanford HAI's Global AI Vibrancy tool, press search

Digitization is no longer a choice for Japan, but an imperative. The current momentum will not allow Japan to keep its top 3 economy spot, as Japan's digital competitiveness has been regressing. The 2020 IMD World Digital Competitiveness index ranked Japan 27th globally, four spots lower than in 2015 (Exhibit 2). Among Asian economies, Japan ranked 7th on digital competitiveness, trailing Singapore, Hong Kong, South Korea, Taiwan, China and Malaysia. Other nations have been working hard to scale the digital learning curve: Hong Kong climbed in the global ranking from 14th to 5th in five years, South Korea from 18th to 8th, and China from 33rd to 16th.

Exhibit 2:

Global IMD digital competitiveness rankings (ranked by 2020)¹

Country	2020 rank	2015 rank	Change
USA	1	2	▲ +1
Singapore	2	1	▼ -1
Denmark	3	8	▲ +5
Sweden	4	5	▲ +1
Hong Kong, SAR	5	14	▲ +9
Switzerland	6	7	▲ +1
Netherlands	7	6	▼ -1
South Korea	8	18	▲ +10
Norway	9	11	▲ +2
Finland	10	3	▼ -7
Taiwan, GC	11	15	▲ +4
Canada	12	4	▼ -8
United Kingdom	13	12	▼ -1
UAE	14	22	▲ +8
Australia	15	9	▼ -6
China	16	33	▲ +17
Austria	17	26	▲ +9
Germany	18	17	▼ -1
Israel	19	10	▼ -9
Ireland	20	25	▲ +5
Belgium	25	19	▼ -6
Malaysia	26	21	▼ -5
Japan	27	23	▼ -4

¹ Ranking can be decomposed by 3 factors: Knowledge, Technology, Future Readiness

Source: 2020 IMD World Competitiveness index

Digital competitiveness and productivity are inextricably linked. The economies ranked highly for digital competitiveness – namely Hong Kong, South Korea and China – all experienced positive labor and factor productivity growth over the past five years, with China seeing 5.25% growth in labor productivity and 2.81% in overall productivity (Exhibit 3). Japan's labor and total factor productivity were a negative -0.17% and -0.11% respectively. Even compared with other developed economies such as the US, Japan's capital productivity has dropped, with return on investment for non-financial companies in Japan 23 percentage points less than equivalent companies in the US¹.

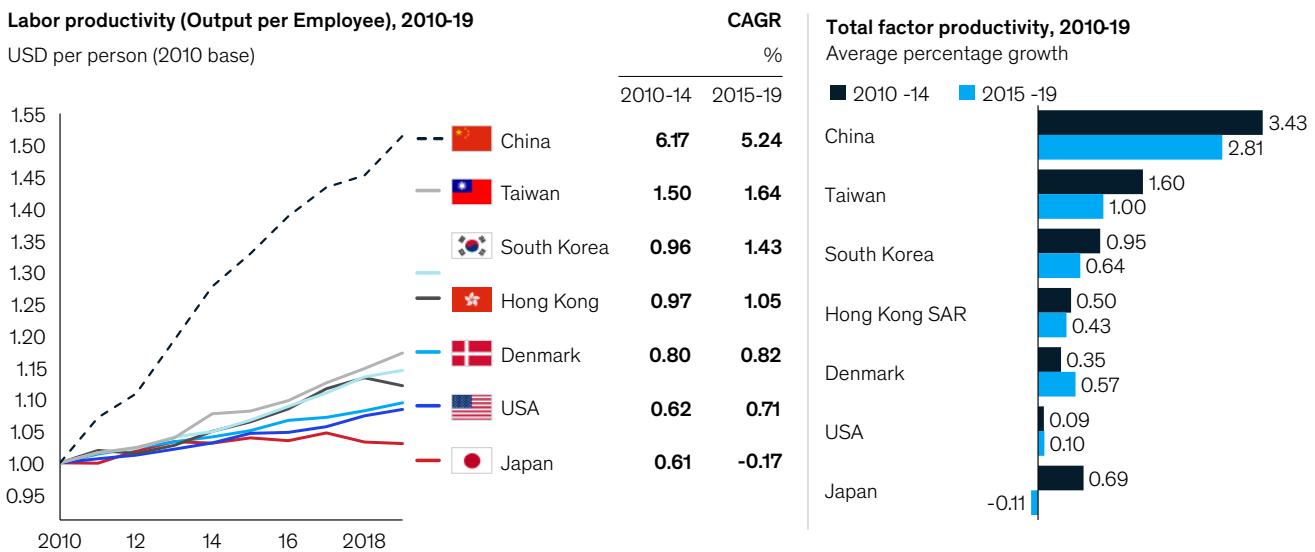
With significant headroom for digital penetration across industries, government and education, Japan has an opportunity to leverage digital in a new phase of growth in the next decade. Given the demographic challenge - a shrinking workforce expected to reach 71 million by 2025, with a rising dependency ratio estimated to pass 70% - Japan needs a boost of productivity growth, and digital is a prime lever².

¹ "How a private-sector transformation could revive Japan", McKinsey Global Institute, March 2015, McKinsey.com.

² Ibid.

Exhibit 3:

Japan's labor and total factor productivity have gone from stagnant to negative over the last ten years



Note: CAGR: Compounded Annual Growth Rate
Source: MGI Economics Platform

Digital competitiveness and productivity are just two elements of Japan's digital scorecard. An economy is only as productive as its people, and talent is a critical component where Japan has scope to cultivate a broader digital bench that possesses the requisite skillset to drive digital transformation. According to a 2020 McKinsey Global Institute analysis, artificial intelligence – namely machine learning – is expected to contribute to the automation of approximately 19 million jobs between 2018 and 2030, especially those focused on discrete repetitive tasks. However, long-term macro-trends and shifting demand for roles in areas such as cloud engineering, software development, machine learning, and new occupations are expected to gain 15.6 million new jobs³. The creation of new jobs calls for the availability of talent with the requisite digital knowledge. Cultivating that talent may be key to enabling Japan's digital transformation journey.

In addition to talent, is the importance of building trust around digital and data. Efforts from government to endorse digital to garner trust among Japanese citizens and corporations could prove crucial in creating acceptance on digital adoption. Japanese society places a great value on trust, and effective governance and leadership that highlights both benefits and risk management are likely key pillars for success. Setting governance frameworks (e.g., cybersecurity risk management including secure handling of personal data) and leadership bodies can help accelerate the digitization while maintaining a system that generates confidence, accountability, and in turn, trust.

A collective effort from multiple key stakeholders is required to drive Japan's digitization forward: the education system, the incumbent industry sectors of the economy, the government, the startup ecosystem, and the technological community that includes Japan's major systems integrators. Government and four core industry sectors of the GDP – industrial manufacturing (which includes automotive), retail, healthcare and financial services, which together made up nearly half of Japan's gross domestic product in 2018⁴ – need to lead the way actually building applications and talent.

Japan is at a unique historical inflection point. In the last decade, China was the clear example of leveraging digital to drive its economic growth and productivity goals to cement its position as the second largest economy. Other countries such as India and Germany are similarly turning to digital to bolster the bold growth and productivity agendas that could put Japan's economic position at stake in the decades ahead.

³ Maya Horii and Yasuaki Sakurai, The future of work in Japan: Accelerating automation after COVID-19, June 2020, McKinsey.com; analysis updated as of December 2020.

⁴ National Accounts of Japan, Cabinet Office, December 7, 2020, esri.cao.go.jp.

The trends pushing for digital change

There are major forces at play pushing for digital change. The rate of change in Japan may need to match these trends, so that the country can become a center for technology and innovation.

Ageing population will bring a labor shortage, requiring digital solutions: Japan has the world's highest proportion of elderly citizens, around 29% of the population—or 36 million people—are over the age of 65⁵, a number expected to reach 38% by 2050⁶. While, other developed nations are following similar trends, Japan has the opportunity to be a pioneer in addressing the effects of ageing societies, including increasing labor force participation and productivity by allowing older workers to continue working with the aid of digital technologies.

A key implication of this trend is the need to automate expert labor that is retiring from the workforce through machine learning, as well as accelerating digital application development in areas where the elderly population requires services, such as healthcare, financial services, and government.

Equally, as the workforce continues to shrink, new ways may need to be found to accelerate productivity and growth. This means either supporting the workforce by automation or augmenting it through global talent sourcing. In the former case, digital applications present a clear solution with automation technologies potentially supplementing reduced labor in Japan by 2030.

Digital companies will capture more of the global economic profit. The distribution of economic profit – profit after covering the cost of capital – in the global economy has been highly uneven: between 2014 and 2018, companies in the top quintile of the economic profit distribution captured nearly 90% of the economic profit, equivalent to \$655 billion⁷. The winners were bolstered by digital, as they are able to draw insights from huge volumes of customer and operational data and use them to identify threats and opportunities and build new businesses. McKinsey's Digital Quotient – which measures the degree of digitization of organizations - reveals that digital leaders achieve five times higher revenue growth and eight times higher EBIT than other players⁸.

As the international competition continues to digitize, Japanese players risk seeing global market share erode and ultimately losing out in winner-take-all markets. On the flip side, they also have the opportunity of becoming “digital reinventors” at a global scale - incumbents who compete in new ways through digitization. Global data show that half of firms that answer to the description of “digital reinventors” achieve over 10% annual revenue growth compared with 33% of “analog” incumbents, and they can leverage their greater market share to compete with faster-growing “digital native” newcomers⁹.

Workers and consumers have a preference for digital. Workers' expectations continue to shift towards the need for flexibility, making digital or remote interactions more commonplace. A 2020 survey of employees across Japan revealed that nearly 82% of workers would like to keep working remotely post-COVID¹⁰. Similarly, 66% of companies deemed “paperless and hanko-less” solutions as necessary, and 80% thought that digital communication tools were also key¹¹.

Globally, automation in the workplace is becoming commonplace. A global survey in 2020 showed 66% of B2B companies were piloting automation processes, up from 57% in 2018¹², and 85% said they would not require in-person support for simple or repeat purchases¹³.

On the consumer side, procurement of goods and services is increasingly moving online: in retail, the penetration of e-commerce in the US grew to 35% in the first quarter of 2020 - the equivalent of ten years of growth registered between 2009 and 2019¹⁴. Similar preference shifts are happening in healthcare, financial services and education, and the Japanese market has yet to make these gains.

⁵ “Older people account for record 28.7% of Japan’s population”, Japan Times, September 21, 2020, japantimes.co.jp.

⁶ 2019 Revision of World Population Prospects, UN Department of Economic and Social Affairs, June 2019, population.un.org.

⁷ Corporate Performance Analytics, McKinsey; S&P Global, 2020.

⁸ Jochen Böringer, Brett Grehan, Dieter Kiewell, Soenke Lehmitz, and Philipp Moser, *Four pathways to digital growth that work for B2B companies*, October 2019, McKinsey.com.

⁹ “How digital reinventors are pulling away from the pack”, October 2017, McKinsey.com.

¹⁰ テレワークに関する調査2020 [Survey on remote work], Japan Trade Union Confederation, June 30, 2020, jtuc-rengo.or.jp.

¹¹ テレワーク導入実態調査結果 [Survey on remote work introduction], Tokyo Metropolitan Government, September 14, 2020, metro.tokyo.lg.jp.

¹² “The imperatives for automation success”, August 25, 2020, McKinsey.com.

¹³ Christopher Angevine, Candace Lun Plotkin, and Jennifer Stanley, *When B2B buyers want to go digital—and when they don’t*, August 2017, McKinsey.com.

¹⁴ Five Fifty: The quickening, July 2020, McKinsey.com.

Digital technologies are no longer shiny objects, but have proven benefits. Unproven technology risk is often a concern when assessing the adoption of a new technology: companies are confronted with the risks of rapid obsolescence, disappointing performance, unrealized development, difficulty of usage, and limited interest by users. Many technologies now have demonstrated proven benefits, for example, cloud technology can deliver up to 60% reductions in IT infrastructure and licensing costs¹⁵, and AI “power users” have shown profits up to five percentage points higher than the industry average¹⁶.

Even though corporate digital transformations are still difficult, with only 16% of companies reporting complete success cases¹⁷, pitfalls and best practices are now well understood, and leadership and culture change play as crucial a role as technology. In fact, the broad availability of technologies such as cloud infrastructure and data storage, data analytics, machine learning, and cybersecurity offered “as a service”, has further reduced the complexities of adoption.

Japan's endowment

Endowments are the inherent assets and capabilities of a country, such as talent, resources, existing infrastructure, and know-how which can be leveraged in a digital transformation.

Youth with math and science aptitude

A successful digital transformation requires skilled professionals and engineers in many disciplines. In 2018, the OECD Program for International Student Assessment (PISA) index ranked Japan as 6th worldwide in mathematics performance and 5th in science - both scores above the global average - on account of its high-quality school system. The Japanese education system has proven its ability to deliver the necessary skills to match industrial policy imperatives and, if transformed to align to the digital future, it has the potential to cultivate appropriate talent. Its strengths in mathematics and science can provide a foundation for future careers in digital-related fields such as software engineering, machine learning and cybersecurity.

In terms of tertiary education, graduate degrees in fields such as software are limited. In keeping with industry priorities and employability, Japan has historically placed more importance on degrees focused on hardware or mechanical and electrical engineering¹⁸. This expertise was critical to drive the country's economic growth between the 1970s and 1990s, but the basis of competition now requires depth in design, software development, data science, and machine learning.

There are successes to scale: Rikkyo university, for example, has established a graduate school specializing in artificial intelligence leading the way for students interested in this field¹⁹. Similarly, Japan's Nara Institute of Science and Technology (NAIST) has formed a leading cybersecurity program, host to an information security engineering laboratory²⁰.

In order to fully harness and direct its student population towards gaining the skillsets needed to navigate a digital transformation, Japan's education system may need to provide more opportunities and emphasis on skills in these fields.

Robotics and hardware excellence, and deep engineering culture

According to the International Federation of Robots, Japanese manufacturers delivered just over half of the global robot supply in 2017 and have nearly 300,000 robots installed, giving them the second largest installed base after China²¹. Of the two basic components of digital technology - hardware and software - Japan has deep expertise in hardware, and has an engineering culture focused on delivering very high-quality products. Next generation hardware such as robots, and connected devices are also critical to a digital future.

¹⁵ Joe Dertouzos, Ewan Duncan, Matthias Kässer, Satya Rao, Wolf Richter, *Making the cloud pay: How industrial companies can accelerate impact from the cloud*, October 2020, McKinsey.com.

¹⁶ Jacques Bughin and Nicolas van Zeebroeck, *Artificial intelligence: Why a digital base is critical*, July 2018, McKinsey.com.

¹⁷ Hortense de la Boutetière, Alberto Montagner, Angelika Reich, *Unlocking success in digital transformations*, October 2018, McKinsey.com.

¹⁸ Robert E. Cole, *The Japanese Software Industry: What Went Wrong and What Can We Learn from It?*, California Management Review, November 2014.

¹⁹ “Rikkyo University to establish Japan's first graduate school specialized in AI in April 2020”, Rikkyo University, July 24, 2019, rikkyo.ac.jp.

²⁰ Nara Institute of Science and Technology, Information Security Engineering laboratory, Jan 2020, isw3.naist.jp.

²¹ “Why Japan leads industrial robot production”, International Federation of Robotics, December 17, 2018, ifr.org.

An unintended consequence of Japan's focus on hardware is that software and services have taken a back seat. While software is developed as ancillary to hardware, it seems to be commonly viewed as the "glue" or the "support" rather than the core component of the business. Unlike other mature markets, Japan has few stand-alone software offerings, especially in cloud based tools and software applications. The key to future success will be creating a position as a "hardware + software" leader.

Some iconic Japanese companies such as Fanuc and Keyence produce a broad range of robotic arms and high-quality sensors, all with integrated software. In addition to a mix of companies that includes equipment manufacturers and suppliers, Japan also has an inherent advantage in assembly, and the know-how required to integrate and assemble working products and devices from various components. If Japan can leverage its existing production and assembly skills to create compelling integrated hardware and software offerings, that could create a distinctive advantage.

Global leader in automotive industry

Japanese auto OEMs are commanding leaders in the global automotive industry, with the three top manufacturers - Toyota, Nissan and Honda - producing over 25% of the global total in 2019²². These world-renowned companies have access to the capital, technology partnerships, supply chains, distribution networks and customers - on a global level - necessary to make groundbreaking investments in digital pay off.

Japanese auto companies can lead the way in new digital ways of working, and set an example for Japan's industry. Moreover, in the race for autonomous driving, these companies can compete on autonomous systems which today leverage deep learning to navigate roads, and which are quickly reaching advanced levels.

Some have already started investing in the space: Honda has partnered with GM and Cruise to create a self-driving electric vehicle with no steering wheel, while Toyota is collaborating with AWS for its mobility services platform²³. Bigger bets may need to be made for Japanese companies to get the scale needed to win in automotive, and emerge as world leaders in autonomous vehicle development.

Presence of three top patent generators

According to the World Intellectual Property Organization (WIPO), Japan accounted for 9.4% of total patent applications in 2018, and was ranked 3rd globally when it came to patent filing²⁴. It is home to three of the WIPO's top 10 "innovation clusters" globally, namely Tokyo-Yokohama, Osaka-Kobe-Kyoto, and Nagoya, which ranked 1st, 5th and 9th respectively based on patents filed²⁵.

Another noticeable feature of Japan's patent performance is the wide variety of sectors issuing patents. In 2017, the electrical machinery and energy sector filed the most number of patents from the Tokyo-Yokohama cluster, accounting for 6.3% of all patents filed from within the cluster to the national patent office. For contrast, the digital communication sector accounted for 41.2% of patent filings from the Shenzhen-Hong Kong cluster in Greater China²⁶. While generating intellectual property in a variety of fields is the genesis of innovation, and can be advantageous, these innovations need to be commercialized and brought to market through new business models.

Execution excellence

Japanese companies such as Toyota have historically pioneered several ways of working, such as lean manufacturing, *gemba kaizen* (continuous improvement), and just-in-time manufacturing. With a track record of detailed project planning and thorough execution, Japanese companies are renowned for their high quality products. The "Made in Japan" label is seen as an assurance of high quality worldwide, and Japanese companies have the fewest product recalls among the top 5 global manufacturing economies²⁷. Japan can capitalize on this reputation going forward by creating high-quality digital software applications that consumers can trust, and that generate high customer satisfaction, yet adjusting for the agile needs and rapid release cycles of software development.

²² IHS Markit, 2020.

²³ "Toyota and Amazon Web Services Collaborate on Toyota's Mobility Services Platform", Toyota, August 18, 2020, global.toyota.

²⁴ *World Intellectual Property Indicators 2019*, World Intellectual Property Organization (WIPO), 2019, wipo.int.

²⁵ Kyle Bergquist et al., *Identifying and ranking the world's largest clusters of inventive activity*, WIPO, May 2017, wipo.int.

²⁶ Ibid.

²⁷ *GlobalRecalls*, OECD, accessed December 7, 2020, recalls.oecd.org; recalls adjusted by industry size.

Highly developed public infrastructure

With a comprehensive train network featuring the world's fastest bullet train, earthquake resilient buildings with hi-tech structural engineering, 5G networks, wide broadband coverage and fast internet speeds, Japan boasts some of the world's best public infrastructure. Japanese cities are in the top rank globally in terms of safety and standard of living, with indices such as Global Finance's 2020 best cities ranking placing Tokyo first in terms of quality of life worldwide, and Japanese cities such as Osaka and Fukuoka also ranking within the top 50.

The next frontier is to create smart cities by embedding digital technology into daily life. The foundations for this exist, as well as a tried and tested system for successfully rolling out infrastructure nationwide. These elements could be invaluable when digitizing Japan as a whole. Moreover, Japan can generate value by exporting some of its technology globally: smart disaster resistant buildings and connected city infrastructure are two examples of technology where it already has achieved best-in-class status.

Active global collaboration on standards and policy

Japan presented the concept of Data Free Flow with Trust (DFFT) at the G20 Osaka Summit and expressed its determination to promote international rulemaking on trade-related aspects of electronic commerce through the World Trade Organization. Japan is also actively involved in global partnerships and frameworks related to digital policy, such as the Comprehensive and Progressive Agreement for Trans-Pacific Partnership (CPTPP) and Asia-Pacific Economic Co-operation Cross Border Privacy Rules (APEC CBPR). Japan, with its Act on Protection of Personal Information (APPI) data regulations, secured the first adequacy agreement under the EU's General Data Protection Regulation (GDPR) standards, to enable data sharing²⁸. Furthermore, Japan has been an active leader in cybersecurity policy discussions globally, participating in various bilateral and multilateral dialogues on policies such as 5G and IoT security. On 5G in particular, cooperation on policy standards also brings opportunities to encourage support for Open RAN solutions, which would allow domestic and international players to collaborate and ensure the benefits of 5G are widely accessible.

Japan also signed a Digital Trade Agreement with the US, which recognizes it as a leader in global digital rulemaking²⁹. Japan's digital policies are, in many aspects, aligned with global standards, and Japan can leverage its global position to emerge as a key country in the adoption and shaping of forward-looking digital policy.

Global leadership and expertise in gaming and virtual character development

Gamified experiences, relatable characters, and games themselves are a key component of the digital economy. Japanese companies such as Nintendo and SONY, together accounted for approximately \$30 billion in revenue in 2019. Japan has proven expertise in creating unrivalled virtual experiences that combine software (games) and hardware (controllers). This expertise can be extended and capitalized upon to give Japanese digital products – whether they be robots, gamified interfaces, or wearables – a competitive edge globally.

Moreover, in a digital world where software-based AI, robots, and virtual avatars will be enabling human tasks and interaction, there is a need to humanize digital technology to improve customer engagement and experience. No country in the world excels at creating virtual characters more than Japan, which has been producing world-famous virtual characters such as Pokémon's Pikachu, pop idol Hatsune Miku whose sales topped ¥50 million during her debut year in 2007³⁰, and virtual YouTuber Kizuna Ai with over 2 million followers³¹.

²⁸ "European Commission adopts adequacy decision on Japan, creating the world's largest area of safe data flows", European Commission, January 23, 2019, ec.europa.eu.

²⁹ "U.S.-Japan Digital Trade Agreement Text", United States Trade Representative, October 7, 2019, ustr.gov.

³⁰ Yuka Okada, "「初音ミク」発売からもうすぐ1年 開発者が語る、これまでとこれから" [Almost a year since the release of "Hatsune Miku", developers talk about past and future], IT Media News, July 23, 2008, itmedia.co.jp.

³¹ Kazuaki Nagata, "Japan's latest big thing: 'virtual YouTubers'", Japan Times, July 17, 2018, japantimes.co.jp.

Contextual Japanese constraints on digitization

Now is the time to embrace digital boldly across sectors and the companies that make up those sectors, but there are some constraints that have been preventing Japan from gaining momentum

"High-context" culture with risk averse mindset

The business culture in Japan tends to be high-context; favoring nuanced communication, and prioritizing interpersonal relationships, group harmony and consensus – over making rapid decisions and changes which might disrupt the work environment and potentially alienate certain parties. Moreover, due to the high importance of trust – which is often put at the center of decision-making – there is an inherent resistance to taking risks that would potentially break trust; for example, through a failed attempt at a new technology that might break the trust of company stakeholders, or a data breach that would break the trust of customers. All these conditions contribute to a setup that intrinsically struggles to adopt the type of management system needed for digital transformation – one that calls for empowered teams, agile execution, a test and learn mindset, a fail fast approach to building new products, taking risk with the prospect of leading in a new space, and embracing any occasional setbacks or "failures" as acceptable investments in innovation towards accelerating long-term growth.

Senior leader agendas focus on extending company lifespan

In 2017, the average lifespan for companies listed on the Tokyo Stock Exchange was approximately 89 years, versus 15 for the New York Stock Exchange and nine for the London Stock Exchange³². Company longevity, often at the expense of growth, increased profitability, and global competitiveness, are priorities for many Japanese CEOs. Bold transformation agendas focused on digitization, automation, and cost savings can appear to work against the status quo, even though digital can be a way of gaining advantage in an uncertain future.

Strategic top-down commitment is needed in any transformation. A McKinsey survey revealed that 36% of Japanese managers cite insufficient commitment from senior management as the main obstacle to digital transformation. At the leadership level, if CIOs are firstly not present, and then do not gain support from other executives and their organizations, teams building digital initiatives struggle to mobilize.

The private sector is waiting for the government to endorse digitization

In 2020 Japan's public sector has showed increasing awareness of the need to digitize its processes and services, while aligning with global standard technologies for the sake of speed. Digital Government will be crucial to enable broader industry transformation in two ways.

Conversations with executives across industry reveal that companies hesitate to embrace digital until the government explicitly endorses or adopts them. In other countries, the private sector may find creative ways to foster transformation and circumvent potential inefficiencies in the public sector; in Japan, there is an expectation for government agencies to pave the way by showcasing examples of successful transformation and putting systems in place for easy adoption.

Moreover, current regulations often require companies to submit printed documents, store hard copies of records and approve processes by manual means, so that even companies that are willing to digitize need to maintain parallel, labor-intensive processes to remain compliant. On the other hand, government agencies, not seeing a strong push for digitization from the private sector, may not feel sufficient pressure to drive the process or craft sufficiently specific guidelines for companies.

Deeply rooted legacy systems under vendor-lock in core industry sectors

In Japan, 20% of mission-critical IT systems are older than 20 years; and this is expected to increase to 60% by 2025³³. Limited executive focus and a shortage of talent have been constraints on IT investment. Since 1995, annual investment in ICT by Japanese companies has remained at the same level, while for example, American and French businesses have increased their spending threefold³⁴. Lower spending

³² Tsukasa Morikuni and Mio Tomita, "Corporate Japan struggles to scale up as longevity limits dynamism", Nikkei Asia, November 18, 2018, asia.nikkei.com.

³³ ITシステム「2025年の崖」克服とDXの本格的な展開 [Overcoming the IT System "2025 Cliff" and full-scale deployment of DX], Ministry of Economy, Trade, and Industry, March 2019, meti.go.jp.

³⁴ ICT投資の状況 [Status of ICT investment], Ministry of Internal Affairs and Communications, 2019, soumu.go.jp.

often results in outdated IT infrastructure, which becomes progressively more costly and time-consuming to maintain. A Gartner survey showed that 30% of Japanese CIOs and their budgets are so focused on maintaining legacy systems that they are unable to initiate digital transformations. Without a concerted effort to modernize legacy infrastructure, a feedback cycle is created where rising development costs and longer go-to-market times act as a further deterrent to management.

Unlike modern software development, which thrives on standardized solutions, “open-source” software and libraries and shared best-practices, older infrastructure is often developed according to proprietary frameworks, heavily customized and hosted in dedicated systems. This situation is often referred to as “vendor lock”, where it is very difficult for companies to update or replace their own software without significant time, fees and contextual expertise.

Inward innovation and sub-scale startup ecosystem

Out of nearly 500 unicorns worldwide, only five (including Mercari which is now a public company) have emerged from Japan³⁵. Venture capital investment is limited in relative terms, totaling about \$15 billion in the last five years³⁶, while US startups received over \$130 billion in 2019 alone³⁷. Rather than investing in high-risk/high-return startup-style ventures, Japan’s industry culture historically has promoted “intrapreneurship”, where large established businesses encourage internal experimentation targeted at the domestic market: however, when kept within the scope of a single company, new innovations are often not scaled at the industry or global level, and miss the opportunity to unlock significant value.

The 2018 Global Entrepreneurship Index - an annual index measuring the health of entrepreneurship ecosystems across 137 countries - placed Japan as 28th globally and 5th in Asia³⁸. The top 20 startups in Japan have a combined value of \$9.2 billion³⁹; relative to China where the top two startups have a combined value of \$196 billion⁴⁰, Japan has potential for growth in entrepreneurship in order to leverage what is coming out of its high volume of intellectual property generation.

Shortfall of digital talent; existing talent concentrated within systems integrators

Digital transformation requires designers, data scientists, data engineers, machine learning engineers, software developers, product managers, cybersecurity engineers, Agile coaches and other jobs that did not exist a few decades ago. In Gartner’s Digital Business Initiative survey, 67% of Japanese respondents cited talent availability as an obstacle to transformation, compared to 38% globally. According to the Ministry of Economy, Trade and Industry, Japan faced a shortage of 170,000 digital professionals in 2015, a number expected to rise to 430,000 by 2025⁴¹.

Within digital talent, looking at software talent in particular reveals that such professionals make up just 1% of the Japanese workforce, compared to 3% in the United States. Moreover, Japan’s current technology talent is largely outsourced and therefore highly concentrated within systems integrators. While in other advanced economies such as the US or Germany, close to 70% of technology engineers are employed by companies whose main business is not provision of IT services, in Japan the majority of technology professionals work for systems integrators⁴². Given the increasing strategic relevance of digital, companies need to begin bringing digital talent and capabilities back into their core business operations.

Looking ahead, the future supply of digital talent – especially software talent – could also be constrained by current education trends: in 2019, only 1% of undergraduate students enrolled in computer science-related courses in Japan⁴³, compared to 4% in the United States⁴⁴.

³⁵ Complete List Of Unicorn Companies, CB Insights, accessed December 3, 2020, cbinsights.com.

³⁶ Japan Startup Funding 2019, Initial, June 16, 2020, initial.inc.

³⁷ US Venture Capital Investment Surpasses \$130 Billion in 2019 for Second Consecutive Year”, Pitchbook, January 14, 2020, pitchbook.com.

³⁸ *Global Entrepreneurship Index*, GEDI, 2019, thegedi.org.

³⁹ Kenjiro Suzuki, “Japan’s top 20 startups surpass 1tn yen in total value”, Nikkei Asia, November 12, 2019, asia.nikkei.com.

⁴⁰ Katharina Buchholz, “The Highest-Valued Startups in the World”, Statista, November 20, 2020, statista.com.

⁴¹ Overcoming the IT System “2025 Cliff”, 2019.

⁴² IT人材白書2015, Information Technology Promotion Agency, April 2015, ipa.go.jp.

⁴³ 学校基本調査 [Basic school survey], Ministry of Education, Culture, Sports, Science and Technology (MEXT), 2020, mext.go.jp.

⁴⁴ Integrated Postsecondary Education Data System, National Center for Education Statistics, 2019, nces.ed.gov.

Big moves for Japan

To surpass the current state of digital requires bold action. Big moves are broad actions taken by a large stakeholder group, and which seek to capitalize on a major trend, build on an endowment, or overcome a constraint. They are not meant to be incremental. In Japan's case, the education sector, industry, government, startup ecosystem, and systems integrators need to pull together do drive big moves that will enable Japan to retain its global economic position, and restore productivity.

Education, industry, and government sector to create a globally competitive and adaptive pool of digital talent

1.

Develop a deep bench of world-class talent literate in cloud tools, software development, artificial intelligence and other digital technologies and ways of working. Digitization will require cloud architects, data engineers, full-stack software developers, machine learning engineers and many other technical roles. It will also require new team roles to bring products to life such as user interface designers, product managers, Agile coaches, and cybersecurity experts. These roles are in short supply in Japan and not traditionally produced by a system that values hardware related engineering. New university curricula may be needed, as well as partnerships with online platforms that provide certifications, and broad new corporate and government programs that focus on modern digital technologies. Japan may need to significantly create new digital talent to build the future applications that underlie the impending transformation.

2.

Drive broad-scale upskilling across the workforce by shifting from traditional to adaptive learning to build digitally relevant skillsets. A dwindling workforce, the demand to build thousands of new digital applications to transform industry sectors, and an increase in automation will necessitate the upskilling of workers into new roles. Re-skilling, vocational courses, counseling, and customized learning pathways will support individuals in continuously acquiring new and digitally relevant skills throughout their working lives, so they can adapt to shifting demand and participate in digital transformation.

3.

Drive end-to-end digitization of education sector from pre-school to tertiary education with solutions for school and educator efficiency, as well as student access. Teachers and students alike can leverage digital tools for lesson creation, delivery, learning, administration, performance management, and communication.

Digital tools let teachers reduce the time spent on administrative tasks, increase flexibility and accessibility of education while reducing costs to schools, and have the potential to improve learning outcomes. Digital tools can also let students have access to educational content and attend new immersive experiences.

Major incumbent industries to pursue digital transformation to drive global competitiveness through differentiation and productivity

4.

Industrial manufacturing to build on hardware, robotics, and automotive endowments by leapfrogging with software, machine learning and deep learning. Japanese industrial companies lead across many hardware related sectors such as industrial machinery, industrial components, and automotive. In many industrial sectors, software applications and machine learning and deep learning can be applied across the value chain to develop new differentiated offerings and higher productivity. The next frontier of industrial manufacturing will involve creating global cloud platforms, software applications coupled with hardware, and applications that leverage machine and deep learning for new offerings or significant productivity increases. The stakes are highest for Japan's automotive industry, as software will be at the center of the connected car, and deep learning is at the center of the autonomous driving revolution.

5.

Retail to capitalize on shifting customer trends by delivering digital omnichannel experiences. Japanese retail stores are known for their urban accessibility, broad assortment, and high quality of customer service. With e-commerce penetration on the rise due to customer preferences, this force can be harnessed to create new omni-channel experiences that drive continued retail growth through the interplay of online and offline experiences. Mobile customer ecommerce applications, securely digitized in-store experiences, augmented and virtual reality to experience products, and machine learning for pricing optimization are some of the many applications that the retail sector can build to unlock value.

6.

Healthcare to lead globally on next-generation personalized, remote solutions targeting elderly care. Japan's unique demographic could prove an asset.

When developing digital healthcare offerings, players in the space – including pharmaceutical companies, medical device companies, pharmacies, and hospitals – can focus on creating solutions aimed at the elderly and wellness including nutrition, exercise and mental health. These can include telehealth, deep learning for disease detection, or machine learning enabled monitoring and treatment. Japan is positioned to build deep expertise in elderly care, and these solutions can then be exported globally as software platforms enabled by Japanese hardware where needed.

7.

Financial services providers to build mobile and broad accessibility solutions by leveraging cloud infrastructure and open network. In spite of low interest rates and investment incentives, the Japanese population is relatively savings-minded; new digital banking applications and “smart” robo-advisors can empower broader population segments to invest with confidence. However, while momentum is building around Open Banking, legacy banking engines and costly payment networks still pose barriers for incumbents and newcomers to develop new solutions. Japan's current digital payment landscape is rich but fragmented, which reduces incentives for adoption. There is an opportunity to create a consolidated payment infrastructure to move further towards a cashless economy.

Government to invest in digital processes and lead in secure and connected infrastructure

8.

Government to define a vision and bold goals to provide digital citizen and business services. Japan's government processes often require multiple physical visits, paper, and hanko stamps. The Japanese government has an opportunity to lay out a bold goal to aspire to 100% over the next 10 years, in line with world leading eGovernments. With a core focus of providing citizen and business services, government will also need to address underlying challenges such as the procurement of underlying technologies, data sharing, interoperability across government agencies, electronic authentication, and the build-up of digital talent within government.

9.

Government and industry collaborate to scale smart cities, building on Japan's public infrastructure endowment. Through collaboration between public and private sector industries, Japan can build world-class smart cities that combine digital applications across all areas – such as education, healthcare, transport and energy usage – to improve safety, health, mobility, environmental impact and quality of life. These applications can also create smart-city platforms in which Japan can become a global center of excellence and exporter.

Startups and systems integrators to build the next generation of digital businesses to refresh the economy

10.

Startup ecosystem to develop a concept-to-exit formula that produces globally scalable ventures. Japan can further refresh its economy by tweaking the formula to produce new global companies. This will require making adjustments to the entrepreneurship formula to attract more founders both local and international, improve the ease to setup new companies, expand the provisions to provide seamless angel financing, and foster work mobility of digital talent that is encouraged to move to new startups and bring their talents and learnings to build the next big thing.

11.

Systems integrators and technology providers to help their clients accelerate transformation, by building talent in the core and leveraging global best practices. Japanese systems integrators have a structural position in many industry sectors, as they manage and upgrade the legacy systems of major industry and government organizations. They also employ over 70% of technical talent in Japan. Japan's digital transformation will require bringing talent back into the core to build new applications. In that, SIs need to play a role building capability with their clients, and developing new approaches that deliver digital outcomes using available proven technologies rather than focusing on cross-cutting proprietary technology.

Japan's change story

Executing big moves could create a fundamentally different picture in Japan. Exhibit 4 explores the current state and how it could look different in 2030 should these moves be realized.

Exhibit 4:

A ten-year digital journey in Japan

From (2020)



To (2030)

A gap of in digital talent of 400k - 500k engineers to build digital applications, and the majority of talent outsourced - outside the core business operations

Three times the digital talent with global competitiveness across software, data, artificial intelligence; engineering talent back in the core operations

Existing talent focused on repetitive manual tasks, expert knowledge retiring, limited automation driving productivity

Productivity increase driven by automation of manual and repetitive tasks; workers upskilled into new roles via large-scale programs for individuals and employees

Low digitization from primary to tertiary education; teachers with limited tools focused on administrative activities 40% of time, <50% device connectivity across students

Teacher tools broadly available to automate administrative tasks, 100% device availability and connectivity for students, adoption of digitized learning tools underpinned by data-driven impact tracking

Industrial manufacturing in leading position on hardware, robotics, and automotive; albeit limited digital manufacturing lighthouses and automotive at risk of connected car and autonomous disruption

Industrial manufacturing cementing leadership position with differentiated hardware and software offerings, autonomous vehicles transitioned into connected future and Level 5 autonomous driving

Strong retail sector, with continued focus on physical stores, with low <10% e-commerce penetration and limited adoption of technology

World class omnichannel experiences leveraging digital stores of the future, high e-commerce penetration, and unique omni-channel digital experiences for consumers

Fragmented healthcare system with nascent telemedicine, limited digitization for diagnostics, consultations, prescriptions; limited regulation enabling digital; and <10% of population taking advantage of connected health devices

Digital healthcare with remote telemedicine at scale, deep learning powered diagnostics, digital pharmacies; 40% of population using connected health devices; and shared secure patient data across networks leveraging the cloud

Legacy banking system back-ends, with paper based long customer processes in the front-end; <7% mobile banking penetration and limited adoption of other value add services

Modernized banking and payment infrastructure and broad Open Banking participation enabling mobile front-ends for all major banking and insurance processes and products; at least 75% penetration of mobile banking

<10% of government services for citizens and businesses conducted online, with strong affinity for paper, hanko seals and underlying issues in procurement, fragmented prefecture technology, and limited interoperability

Redefined citizen and business journeys across government with 100% of processes fully digitized, with unified applications and mobile interfaces, underpinned by secured networks

Advanced infrastructure with world class buildings and transport system

Multiple scaled up smart cities with connected infrastructure and citizens

Sub-scale startup ecosystem with inward focus contributing to 1% of total market cap; bias towards hardware, robotics and gaming; limited angel and follow-on funding, and early exits in local exchanges

At-scale ecosystem where companies grown from startups contribute to at least a quarter of market cap, with global ambitions on scalable software platforms, expanded angel network with favorable regulation, deep bench of talent and large value creating exits

Systems integrators focused on providing technology products, maintaining legacy technology and harboring majority of technology talent outside of organizations; limiting transformation

Systems integrators transform to deliver digital outcomes and build talent capability for their customers; and support transition of core sectors – banking, government, telecom, retail – securely to the cloud to build modern use cases

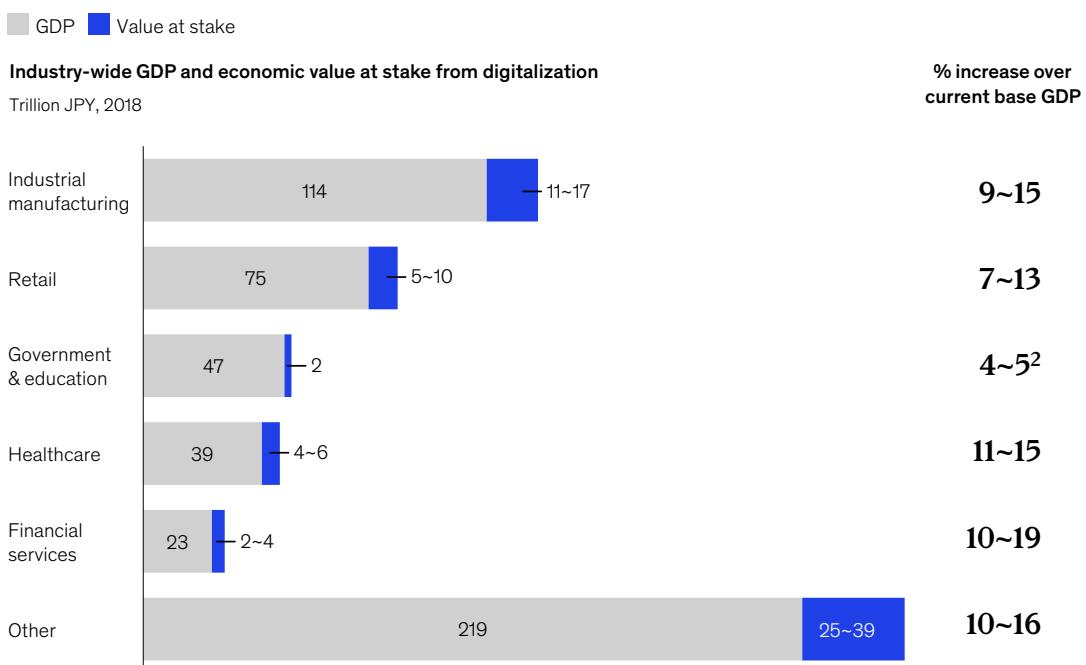
Source: McKinsey, McKinsey Global Institute, IMD, WEF, press search

Impact of the big moves on Japan's GDP

If Japan can overcome its constraints, capitalize on the trends, and build on its endowments to drive a successful digital transformation, there is significant value at stake. This value will come from productivity gains in the core sectors of the economy. (Exhibit 5).

Exhibit 5:

Estimated impact of big moves on Japan's GDP till 2030¹



1. Contingent on timeline for use case execution and resource mobilization

2. Refers to direct effect on GDP; indirect effect is not included in government and education value at stake

Source: Cabinet Office of Japan, McKinsey Global Institute

An analysis done by the McKinsey Global Institute for this effort shows that the gains from building out discrete use cases in Japan's four core industries alone could be expected to unlock an overall economic value between ¥22 and ¥37 trillion over the next decade. Including the gains from government and education boosts the value at stake to between ¥24 and ¥40 trillion. In addition to the top four industry sectors, government and education, are other sectors such as professional services, transport and agriculture, where extrapolated gains could be substantial, ranging between ¥25 and ¥39 trillion. Altogether, the Japanese economy could expect an increased value of up to ¥78 trillion⁴⁵.

This value – denoted in the exhibit in blue – could be generated through the execution of data science, machine learning, and deep learning use cases across each sector; and has been calibrated based on McKinsey experience, research and expert inputs. The timeframe for value generation could vary, based on how quickly specific companies are able to mobilize resources and execute use cases; which in turn depends on company-specific timelines, as well as availability of talent and resources that can be dedicated to use case execution.

Further ahead, we will explore each of the big moves across education, industries, government, startups and systems integrators, exploring discrete use cases that Japan can build to unlock this value.

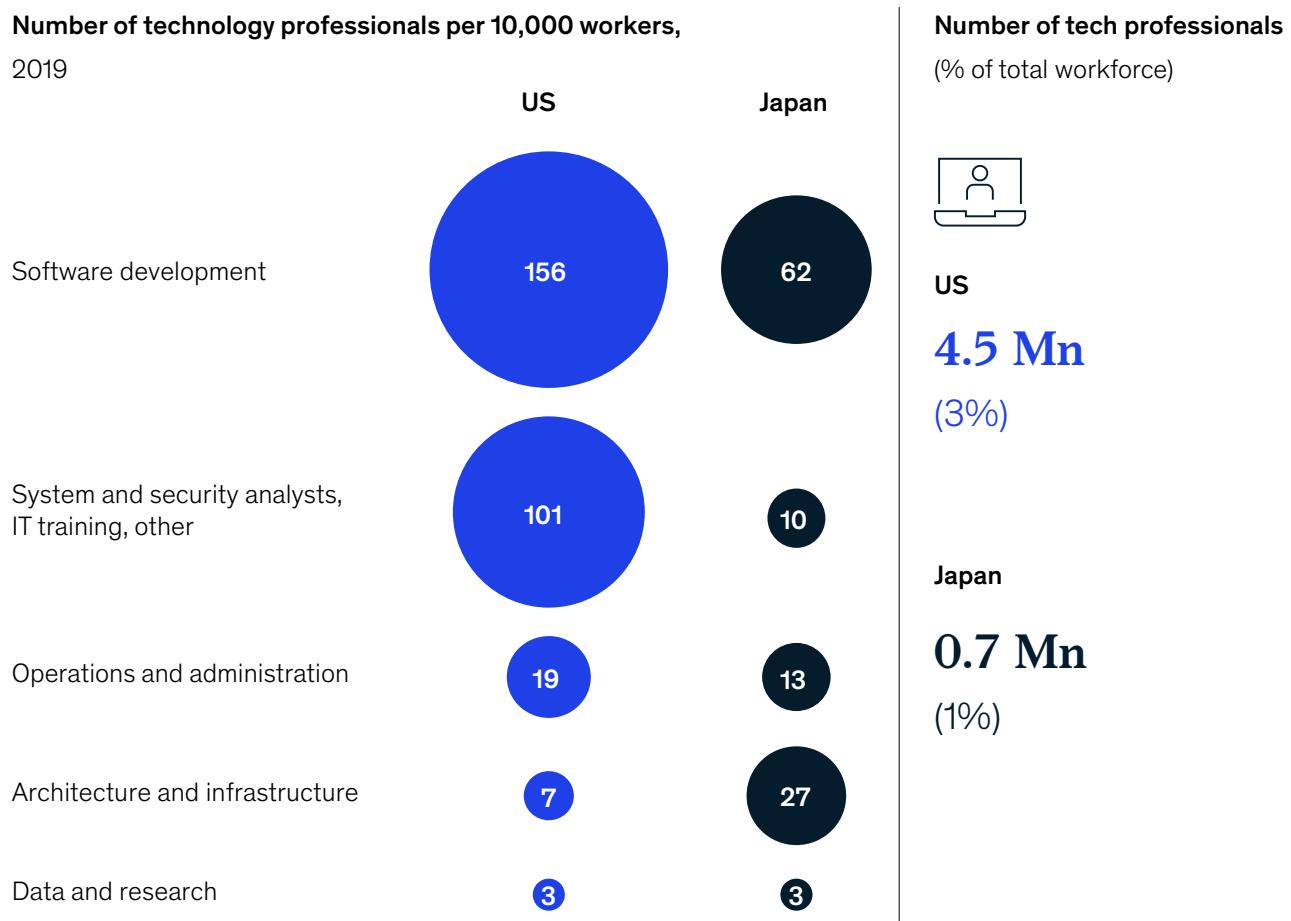
⁴⁵ Methodology from "Notes from the AI frontier: Applications and value of deep learning", McKinsey Global Institute, April 2018, McKinsey.com; analysis updated in December 2020.



Big move 1: Develop a deep bench of world-class talent literate in cloud tools, software development, artificial intelligence and other digital technologies and ways of working

Japan faces a shortage of digital talent that can be deployed in industry, government and the startup ecosystem. As of 2019, the country had a total of 787,000 digital professionals such as software developers, data scientists, and cybersecurity experts. As shown in Exhibit 6, there were 62 software developers per 10,000 workers, compared to 156 in the US⁴⁶. To reach a similar level, Japan would need to at least triple its digital workforce by 2030, and add more than 430,000 digital professionals by 2025, as estimated in the “2025 Digital Cliff” report from the Ministry of Economy, Trade and Industry (METI).

Exhibit 6:
Comparison of technology professionals in Japan and the US



Source: Information-technology Promotion Agency, IT Human Resources White Paper 2020; US Bureau of Labor Statistics

⁴⁶ Current Population Survey 2019, Bureau of Labor Statistics; IT人材白書2020, Information Technology Promotion Agency, August 2020, ipa.go.jp.

Talent is required to pursue any kind of digital transformation. Digital requires advanced critical technical roles such as cloud architects, data engineers, machine learning engineers, and full-stack developers. Beyond “hard” engineering skills, it also requires user experience designers, product managers, Agile coaches, digital marketers, and growth hackers. These jobs are core to the modern digital teams that can propel digital transformation, and they are still somewhat rare in the Japanese workforce of 2020. Executive interviews reveal that many traditional companies struggle to find and retain such skilled talent, even for a limited number of posts. The gap is further highlighted by the IMD World Talent Ranking, which in 2020 saw Japan 38th for its ability in developing, attracting and retaining talent.

While shortage of talent within industry and government can partly be addressed via re-skilling and up-skilling programs, universities remain the core engine of future talent development. In 2019, 1% of Japanese undergraduate students were enrolled in computer science courses⁴⁷, compared to 4% in the US⁴⁸. In order to ensure sufficient labor supply for the digital journey ahead, the Japanese education system needs to develop a robust set of programs to build digital talent. Building on their world-class mathematics and science capabilities, Japanese universities can create new curricula in areas such as cloud application development, data engineering, cybersecurity, data science and traditional machine learning, deep learning for computer vision and natural language processing (NLP), hardware- and software-based applications for IoT, and more. Even before university, digital education of the workforce could start as early as elementary school: in 2017 and 2018, the Ministry of Education, Culture, Sports, Science and Technology (MEXT), announced the introduction of programming education in elementary, middle, and high school curricula from 2020, 2021, and 2022 respectively⁴⁹.

One way several countries have also addressed the talent gap is attracting professionals from overseas, through favorable conditions and competitive work opportunities. Japan has been taking regulatory steps to encourage an influx of professionals: since 2017, highly skilled professionals can qualify for permanent residency in as little as one year, affording greater stability and access to loans and employment opportunities. As of June 2020 an estimated 24,000 people held the Highly Skilled Professional visa, which allows high-earning and highly educated talent to engage in a broader number of activities and benefit from preferential procedures. Hoping to nearly double this number, the government set a goal of having 40,000 visa-holders by 2022⁵⁰. Japan can be bolder in attracting talent given the size of the talent gap.

On top of technical skills, developing critical thinking and international exposure is also fundamental to being able to compete in a global scale. Programs that foster creative, personalized, and interactive learning are key to produce a workforce made of individuals who can contribute flexibly and proactively to their environment. MEXT, in its “Third Basic Plan for the Promotion of Education” from 2018, clearly emphasizes this need, and calls for educational policies to foster creative and independent thinking, as well as English proficiency and international experience. However, challenges still exist at present, as Japan ranks at the bottom of league tables for the international experience of its workforce⁵¹.

⁴⁷ 学校基本調査 [Basic school survey], Ministry of Education, Culture, Sports, Science and Technology (MEXT), 2020, mext.go.jp.

⁴⁸ Integrated Postsecondary Education Data System, *National Center for Education Statistics*, 2019, nces.ed.gov.

⁴⁹ 新学習指導要領のポイント (情報活用能力の育成・ICT活用) [Key points of the new course of study (information utilization skills, and utilization of ICT)], MEXT, May 2019, mext.go.jp.

⁵⁰ 高度人材ポイント制の認定件数 (累計) の推移 [Changes in the number of certified cases (cumulative) of the advanced human resources point system], Immigration Services Agency of Japan, July 2020, moj.go.jp.

⁵¹ IMD World Digital Competitiveness Ranking 2020, International Institute for Management Development, 2020, imd.org.

This new wave of talent may need to become proficient in the 12 major digital technologies that have significant scale-up potential in Japan, and that, when applied to industry sectors, can bring about significant productivity gains in the coming years. An understanding of these technologies is also critical at the executive level, which is why we dive into these with enough detail to provide an understanding and grasp of their potential. Readers can dive into the areas they deem most relevant. In each section, there are explanations of core concepts and key applications, as well as illustrations of current adoption and trends.

12 technologies to build new talent around

1.



AI – Traditional
Machine Learning:
Numbers and
probability prediction

2.



AI – Deep Learning:
Computer Vision

3.



AI – Deep Learning:
Language and
Speech Processing



4.



Cloud-based
software
applications

5.



E-commerce and
digital marketing

6.



5G infrastructure and
communications



7.



Next-gen mobile devices and AR/VR

8.



Internet of Things (IoT)

9.



Additive manufacturing and digital products



10.



Robotics in the factory floor, workplace, and home

11.



Cybersecurity

12.



Digital ways of working – User-centered design and Agile delivery



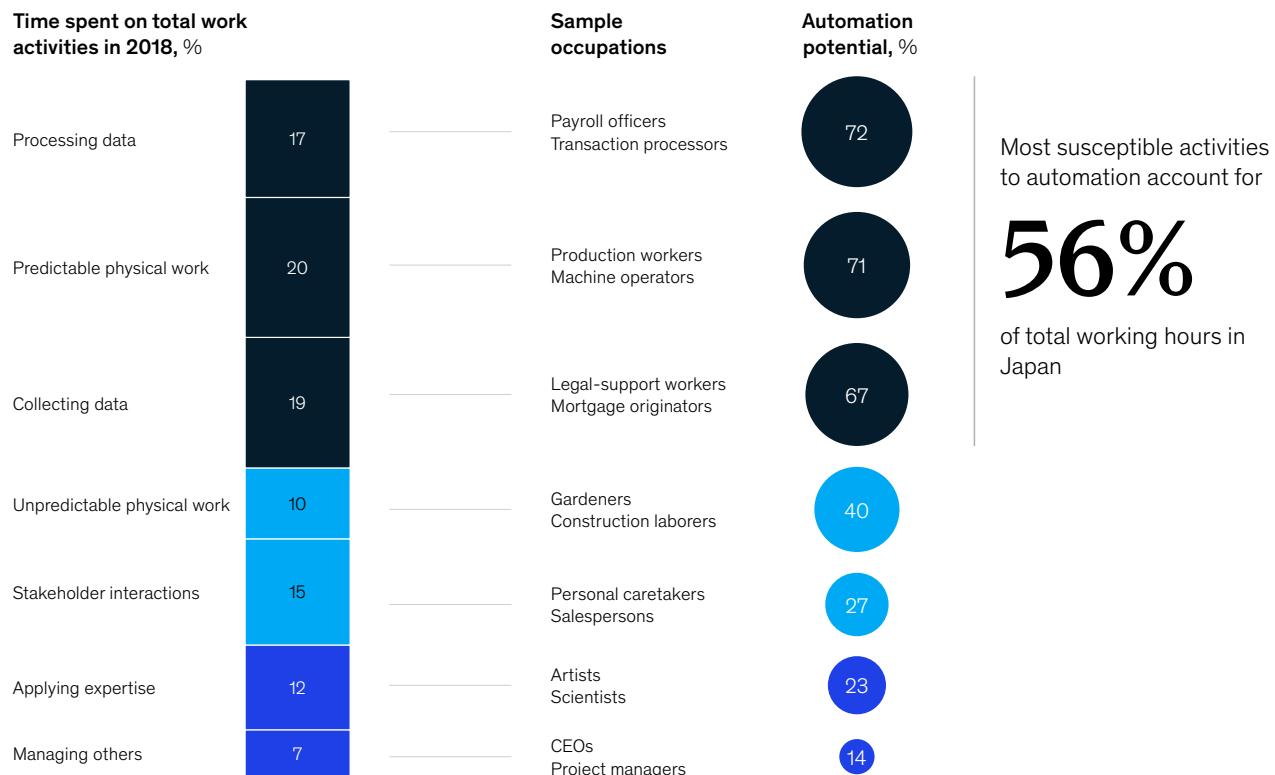


Big move 2: Drive broad-scale upskilling across the workforce by shifting from traditional to adaptive learning to build digitally relevant skillsets

Digital technologies will make it possible to automate an increasing number of tasks: repetitive cognitive tasks such as data collection and handling can be carried out by robotic process automation, while robots will be able to handle predictable physical tasks in a variety of industries. Automation – implemented through machine learning and deep learning – creates opportunities to increase efficiency, lower costs, and allow workers to focus on less monotonous tasks; however, it will displace jobs that are largely automatable. According to the McKinsey Global Institute, up to 46% of the Japanese workforce in 2030 might need to shift to other activities, amounting to an estimated 27 million workers. Compared to a global benchmark of 14%, and 33% for advanced economies⁵², the projected impact of automation is highest in Japan, driven by relatively higher wages that encourage adoption and by a shrinking labor force.

In Japan, more than half of the time spent on work activities involves highly automatable tasks, such as processing and collecting data, or predictable physical work (Exhibit 7). For nearly all occupations, automation will change the mix of activities involved in each job, with a shift towards tasks involving social, emotional, and cognitive skills. Japanese workers can learn new skills in new jobs: for example, user experience designers, product managers, digital marketers, data engineers, software developers are all relatively new roles in growing demand in Japan.

Exhibit 7:
Automation potential by activity type in Japan



Source: O*NET OnLine; Statistics Bureau of Japan; McKinsey Global Institute analysis

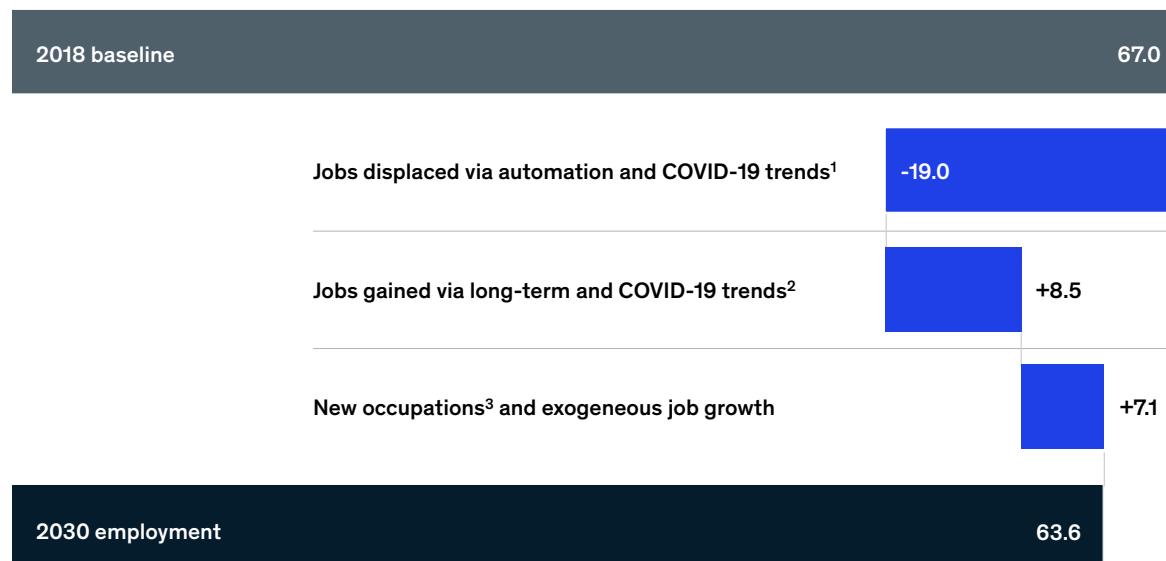
⁵² "Jobs lost, jobs gained: Workforce transitions in a time of automation", McKinsey Global Institute, November 2017, McKinsey.com.

Automation will bolster demand for roles in the technology and professional services sectors, as well as new jobs that did not exist until recently, such as digital marketing and product management. In Japan, the McKinsey Global Institute's future employment model forecasts that about 19 million jobs could be automated between 2018 and 2030. Conversely, several long-term trends could create demand for nearly 16 million jobs, either in existing roles or in new ones, reaching full employment (Exhibit 8)⁵³. In order to maximize occupation and sustain GDP growth, it will be necessary to shift workers to new roles efficiently and on a large scale, so as to fully employ the available workforce and avoid loss of productivity due to friction during the transition. Ensuring this happens will require action by various stakeholders.

Exhibit 8:

Change in employment due to automation in Japan, 2018-30 projection

Projected change in employment, millions



1. COVID-19 accelerated automation, e-commerce, increased remote working, and reduced business travel

2. Rising incomes, aging population, increased technology use, infrastructure investment, climate change, rising education levels, marketization of unpaid work, and COVID-19-accelerated e-commerce

3. Studies show that on average, 0.5% of the workforce has been working in "new jobs" every year (Lin, Jeffrey, "Technological adaptation, cities, and new work," *The Review of Economics and Statistics*, issue 93, May 2011)

Source: McKinsey Global Institute analysis; UN population projections; ILO projections on participation rates; Oxford Economics unemployment forecasts; Japan Institute for Labour Policy and Training; O*NET OnLine; Statistics Bureau of Japan;

Government agencies to expand transition support and job creation for workers

As a result of automation, the need for workers to adapt will increase, presenting new opportunities for government agencies and institutions to act.

First, labor agencies could move beyond providing financial support for unemployment and play an active role in reskilling mid-career workers. In Denmark, for example, a partnership of government, employers, and unions provides career guidance and training for unemployed individuals, as well as vocational courses open to anyone. In Sweden, employers can pay into private "job-security councils", which provide financial support and career counseling to employees who lose their job.

Governments can also encourage job creation and worker re-deployment in a number of ways. First, companies could be incentivized to invest in human capital through subsidies or tax incentives that reward the establishment of training programs. Second, the McKinsey Global Institute points to the potential job creation effect of large projects in such areas as new

⁵³ Maya Horii and Yasuaki Sakurai, *The future of work in Japan: Accelerating automation after COVID-19*, June 2020, McKinsey.com; analysis updated as of December 2020.

infrastructure, climate change abatement, and affordable housing, supported by public or private investment. Finally, new small- and medium- sized businesses can create employment: in order to encourage entrepreneurship, streamlined regulations and incentives to encourage risk-taking could be put in place⁵⁴.

Business to create new learning pathways for required talent

In addition to hiring new digital talent, retraining the existing workforce is a strategy for businesses to secure the skill mix required while retaining internal culture and know-how. Given the prevalence of lifelong employment in Japan, it is important for employers to change how they take a stake in their employees' development. Companies can achieve large-scale reskilling by exploring partnerships with universities, as well as leveraging education technology (EdTech). With the latter, employers can use Learning Management Systems (LMS) to create self-paced, on-demand courses that reduce time commitment from instructors and allow learning teams to focus on content development; moreover, enterprise LMSs allow managers to monitor the training progress of team members, reducing the related admin overhead.

To succeed, companies would first have to first identify their talent needs and necessary skills for each profile; after defining distinct learning pathways, they can build learning platforms to create trainings, or leverage third-party providers to create customized curricula from available course portfolios.

Employees to embrace global online learning platforms and certifications

It will be increasingly difficult for workers to rely solely on the skills they acquired in school or university, as technology rapidly evolves and companies become more agile in responding to changes in the market and customer demand. Individuals should plan to upgrade their skillsets continuously by considering what skills will be in demand, and proactively plan their learning. Technology can facilitate learning, by granting access to high quality supplementary education via online university degrees, MOOCs (Massive Open Online Courses), available at lower costs than formal education, and tailored adaptive learning tools, enabled by technologies such as cloud computing and machine learning. For example, some of the world's leading machine learning content is available for free on platforms such as Coursera. However, for courses that are not provided in Japanese, the language barrier to education could provide a stronger reason for more workers to learn English, perhaps by resorting to widely accessible EdTech solutions. At the same time, many learning platforms are already using machine learning to automatically generate translated captions or support community-driven contributions.

Professional training programs such as “coding bootcamps” are also becoming increasingly popular worldwide as a reskilling pathway: these programs offer intensive programming courses over a few weeks, provide micro-accreditations, and connect participants with industry sponsors for opportunities. Also important in the cybersecurity realm are technical cybersecurity challenges, such as “Security Camp,” a study program and competition for students and the largest such challenge in Japan. METI’s Information-technology Promotion Agency (IPA) reported that many graduates of the “Security Camp” are now active in a wide range of activities in Japan’s IT industry⁵⁵.

While such programs are common in the technology sector, they are still rare in other areas, where employers typically prioritize formal education and past professional experience over online programs as hiring criteria. This perception gap can discourage the adoption of such resources and reduce the incentive for employees to pursue additional training. In order to unlock the most value from alternative forms of education and stimulate the continued creation of such programs, governments, companies and universities alike could challenge the established paradigm by supporting micro-accreditation schemes and adapting their hiring criteria to incorporate a broader set of indicators.

⁵⁴ “Jobs lost, jobs gained”, 2017.

⁵⁵ “セキュリティ・キャンプ協議会について” [The Security Camp council], Security Camp, accessed December 14, 2020, security-camp.or.jp.



Big move 3: Drive end-to-end digitization of education sector from pre-school to tertiary **education with solutions for school and educator efficiency, as well as student access**

As of 2017, two million teachers were responsible for the development of almost 19 million students enrolled in the Japanese education system, of which 13 million were in elementary and high schools, and nearly four million in tertiary education⁵⁶. With nearly 40,000 public institutions serving 70% of the school population, the Japanese government spent about 3% of the country's GDP on public education in the same year⁵⁷. As for the informal education industry, in 2018 the Ministry of Economics, Trade and Industry (METI) estimated 2015 revenues of about ¥2,500 billion, with tutoring schools capturing 38% of the market, followed by corporate training services and language schools at 20% and 12% respectively⁵⁸.

Starting with primary-secondary education, the Japanese school system has been consistently ranked among the most effective in the world: in the latest Programme for International Student Assessment (PISA) conducted by the OECD in 2018, Japanese students ranked 5th in science, 6th in mathematics, and 16th in reading. In order to maintain leadership in educating top talent, the government has launched several initiatives to promote digitization and innovation in education via its "Society 5.0" vision.

One such initiative is GIGA ("Global and Innovation Gateway for All) launched by the Ministry of Education, Culture, Sports, Science and Technology (MEXT) in 2019. GIGA is a two-pronged effort aimed at enhancing technology in schools and enriching learning with digital solutions.

GIGA subsidizes and guides technology procurement, with plans for every school in Japan to have access to high-speed network connections by 2020, and one laptop per child by 2023. As an example of network implementation, in 2020, Sagamihara City partnered with Cisco Systems to deploy Meraki, a cloud-based school network solution, across all 105 local schools⁵⁹. In terms of device access, Hirakata City provided its entire elementary and junior high school population of 32,000 students with Apple iPads, in order to equip children for seamless switches to remote learning and enable new multimedia or outdoor learning activities⁶⁰. GIGA also promotes the use of high-quality digital textbooks and teaching materials, publishing guides on technology education and digitally enabled teaching of traditional subjects⁶¹.

In addition, the government is pursuing education innovation at the tertiary level. In June 2020, a MEXT initiative named Scheem-D ("Student-centered higher education ecosystem through digitization") was announced to provide a platform for university teachers and technology companies to experiment with new digital use cases and scale up and disseminate successful innovations to institutes nationwide⁶².

Digital can unlock the effectiveness of teachers and administrators. In many cases, teachers spend almost half of their working hours not directly engaging with students, but preparing lessons, assigning and grading homework, and managing student records. By one estimate, up to 40% of teacher hours are spent on activities that could be automated⁶³. In Japan, data from MEXT shows

⁵⁶ 文部科学統計要覧 (平成30年版) [MEXT Statistics Handbook, 2018 Edition], MEXT, 2018, mext.go.jp.

⁵⁷ UNESCO Institute for Statistics, December 2020, uis.unesco.org.

⁵⁸ 教育産業の現状 [Current state of the education industry], METI, January 2018, meti.go.jp.

⁵⁹ "相模原市の公立学校、「GIGAスクール構想」に基づく学校ネットワークにCisco Merakiを採用" [Sagamihara City's public schools adopt Cisco Meraki for school networks based on the GIGA school concept], September 8, 2020, news-blogs.cisco.com.

⁶⁰ Kazumi Oda, "クリエイティブなiPadは「教育委員会のお気に入り」になれるか? " [Can the creative iPad Become a favorite of boards of education?], Gizmodo, September 10, 2020, gizmodo.jp.

⁶¹ 教育の情報化に関する手引 [Guide for computerization of education], MEXT, June 2020, mext.go.jp.

⁶² 大学教育のデジタル化・イニシアチブ [Initiative for university education digitization], MEXT, June 2020, mext.go.jp.

⁶³ Jake Bryant, Christine Heitz, Saurabh Sanghvi, and Dilip Wagle, *How artificial intelligence will impact K-12 teachers*, January 2020, McKinsey.com.

that on average middle school teachers work 64-hour weeks, well past guidelines for avoiding overtime, and this excludes work done outside of school⁶⁴. Such long hours likely contribute to Japan having the second largest shortage of teaching staff among OECD countries as reported by school principals⁶⁵. By leveraging digital solutions such as Learning Management Systems (LMS) and dedicated automation tools, technology can free up teacher time, allowing them to reduce overall working hours and spend more time teaching and inspiring children.

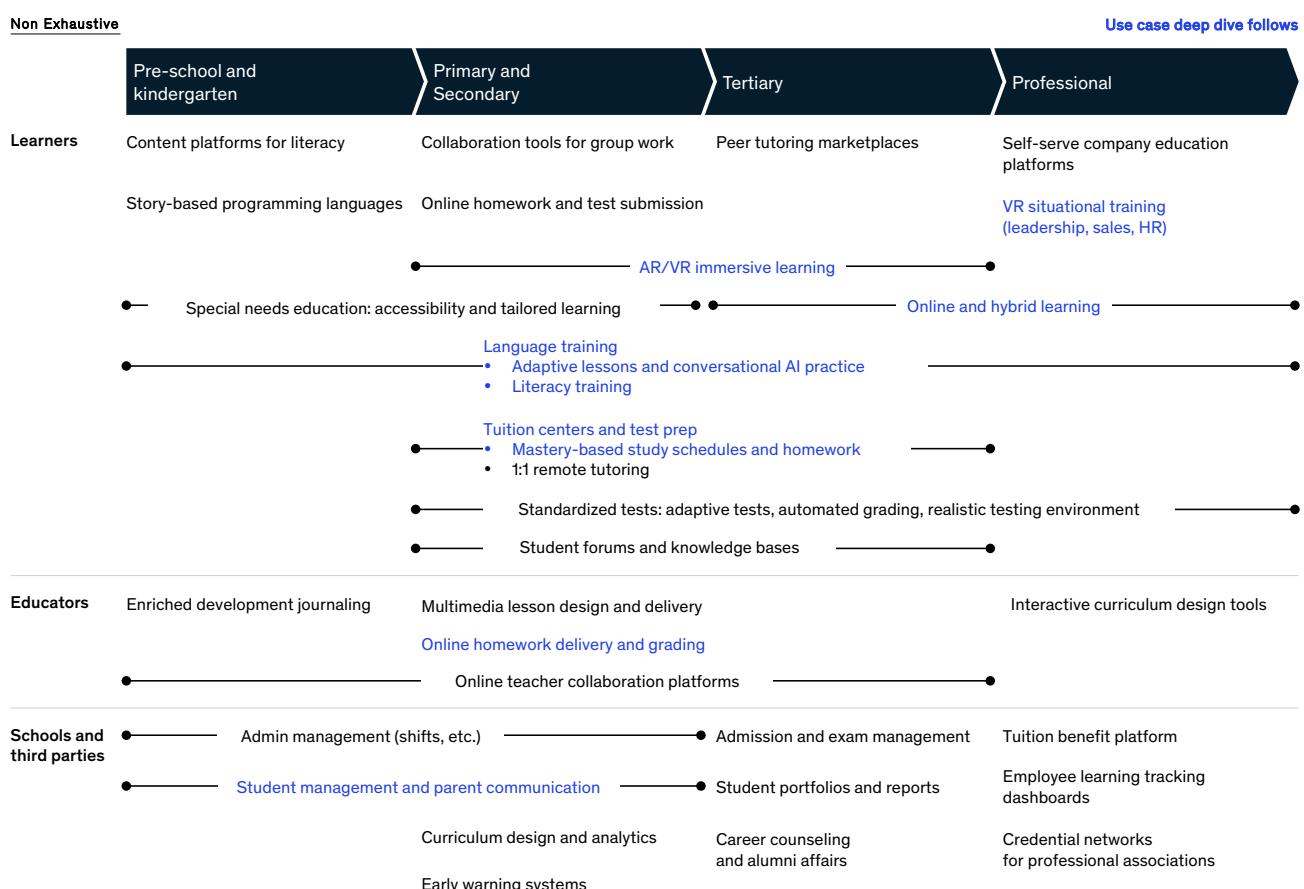
In response to these new trends and opportunities, technologies that aim to digitize education, known as “e-learning” or “EdTech”, are on the rise. The sector is attracting growing interest: the global e-learning market was estimated at \$194 billion in 2019 and is predicted to grow annually by 10.3% through to 2023, reaching an estimated \$287 billion⁶⁶. Japan is also expecting a steady growth of 5% annually in EdTech, from an estimated \$2.2 billion in 2019 to a projected \$3 billion by 2023⁶⁷.

Potential for digitization along the education journey

An individual’s lifelong learning journey can be divided into four phases, from pre-school and kindergarten, through primary and then secondary education, to tertiary and professional. The digital use case roadmap shows applications of digital technologies across all four phases (Exhibit 9).

Exhibit 9:

Digital use case roadmap across the education journey



Source: McKinsey

⁶⁴ 教員勤務実態調査 [Survey of teacher work conditions], MEXT, 2016, mext.go.jp.

⁶⁵ Education GPS, OECD, December 2020, gpseducation.oecd.org.

⁶⁶ E-Learning Trends 2019, Docebo, 2018, docebo.com.

⁶⁷ eラーニング市場に関する調査を実施 [Survey of the e-learning market], Yano Research Institute, April 2020, yano.co.jp; ITナビゲーター2020 [IT Navigator, 2020 edition], Nomura Research Institute, December 2019, nri.com.

Various digital solutions can provide benefits not only to learners but to key stakeholders in the education journey:

- Student-focused technology for personalized and enhanced learning
- Educator-focused tools for increased teacher effectiveness
- School-focused platforms for student management and broader reach

Student-focused technology

Mastery-based study schedules and homework

Impact: detailed insights on student performance for more efficient learning

In Japan, supplementary education is very common, with 50% of pupils attending after-school classes to support learning achievements and prepare for university entrance examinations⁶⁸. In order to increase the effectiveness of coaching programs, EdTech solutions can be leveraged to personalize study content and timing delivery to suit each child's needs. Japanese startup atama plus has developed a learning platform that uses machine learning to analyze students' strengths, weaknesses, growth and concentration levels. It then creates a more efficient learning program for them; blending software-based and in-person teaching, teachers can quickly assess progress, and use the service to deliver homework, optimizing time spent on these activities.

Language training with adaptive curricula

Impact: faster progression towards literacy and proficiency

Digital technologies can optimize new language learning while also reducing costs for learners. Duolingo leverages machine learning to identify a learner's proficiency level at any given time and provide them with tailored learning opportunities at the best moment. This can help novice learners gain the equivalent of four college semesters of learning with half the time commitment⁶⁹. In 2020, Google released its Readalong application worldwide, which uses speech processing to improve children's literacy by providing real-time feedback; first released in rural communities in India, it helped 64% of subjects significantly increase their reading scores⁷⁰.

Immersive learning with AR / VR

Impact: vivid learning experiences, lower costs, lower risk for situational learning

Just as school trips and laboratory classes can inspire students via experiential learning, there is growing interest in applying AR/VR (Augmented Reality and Virtual Reality) to create joyful experiences. Microsoft's Hololens, for example, is a headset that allows the user to see digital objects overlaid onto the real world and interact with them: students wearing the headset can enjoy vivid learning experiences touring historical sites, inspecting human anatomy or exploring the solar system while in

⁶⁸ *Shadow Education: Private Supplementary Tutoring and Its Implications for Policy Makers in Asia*, Asian Development Bank, May 2012, adb.org.

⁶⁹ Jiang et al., *Duolingo efficacy study: Beginning-level courses equivalent to four university semesters*, Duolingo, August 2020, duolingo.com.

⁷⁰ Kyle Wiggers, "Google's Read Along taps AI to improve kids' reading skills", VentureBeat, May 7, 2020, venturebeat.com.

the classroom. Interviews with participants attest to benefits in retention, test scores, and engagement⁷¹. In tertiary and professional education, VR shows potential as a means to simulate complex social or technical situations with lower risk and costs: for example, EdTech company Mursion provides VR-based workplace training for leadership, inclusion, customer service, and even teacher training, allowing employees to practice a wide range of situations and receive coaching.

Educator-focused technology

Online collaboration and homework delivery and grading

Impact: increased efficiency of learning activities, greater resilience for remote teaching

Spurred by the 2020 COVID-19 pandemic, remote collaboration is playing an increasing role in the school system: several EdTech players aim to simplify the provision of online teaching when in-person education is not possible, and also reduce the amount of time spent by teachers and students assigning, completing, and grading homework. Google and Microsoft, for example, have each built on their workplace productivity suites to offer education-focused products Google Classroom and Microsoft School Dashboard: teachers can use them to deliver lessons remotely, share materials, and distribute and collect assignments. Additional cloud solutions can also be integrated by schools to foster creativity and teamwork. The Adobe Creative Cloud, for instance, allows teachers to design interactive projects where students can collaborate to practice multimedia storytelling, using accessible, browser-based tools such as Adobe Spark.

School-focused technology

Online and “hybrid” university education

Impact: broader access, reduced operating costs

Online education has long been available in a variety of forms, from massive online open courses to formally accredited university courses. However, until the COVID-19 pandemic in 2020, the latter was not a mainstream option: for example, in 2018 only one third of US students attended at least one online course, but in 2020 the proportion was close to 100%⁷²; in Japan, institutions such as the University of Tokyo have made lecture recordings and courseware available online, and several have temporarily adopted online learning. For universities, hybrid or fully remote instruction presents several opportunities: it lowers operating costs from lecture halls and accommodation facilities, makes it possible for more students to attend courses, and allows for more flexible academic calendars. Moreover, the use of cloud and other technologies allows educators to leverage resources from multiple new sources, such as other universities or education programs. In order for these models to be successful, however, universities need to carefully design programs that allow for academic mentorship and feedback, social interactions, and equitable access.

⁷¹ Alice Bonasio, *Immersive Experiences in Education*, Microsoft, 2019, microsoft.com.

⁷² André Dua, Jonathan Law, Ted Rounsville, and Nadia Viswanath, *Reimagining higher education in the United States*, October 2020, McKinsey.com.

Online student management and parent communication

Impact: reduced administrative overhead for teachers

Repetitive and unwieldy administrative tasks, such as attendance recording, grade and form management and parent communication, can take up to 10% of teachers' time⁷³. School Management Systems are suites of tools that digitize and automate many of these tasks, and several EdTech companies in Japan offer them: for example, CoDMON is a tool that allows kindergartens and primary schools to automate attendance tracking with access cards, manage children's health checks, billings, and emergency alerts, and communicate with parents safely and quickly; in a similar fashion, BLEND allows teachers to manage student grades and reports in a central digital system, reducing the time spent handling and creating paperwork.

⁷³ *How artificial intelligence will impact K-12 teachers*, January 2020.

Barriers to digital transformation

For this big move to come to realization, addressing mindsets, talent constraints, legacy technology issues or regulatory changes may be needed. A few examples are:

Resource and skill gaps for schools and teachers limit advanced use-cases: As of March 2020, MEXT's GIGA effort has led to 91% of classrooms having internet access and 60% of public schools being equipped with projectors or digital whiteboards⁷⁴. However, only 8% of schools are using digital textbooks for students⁷⁵, and just 24% of principals agree that an effective online learning support platform is available, one of the lowest rates among OECD members. Moreover, and perhaps most crucially, the PISA survey highlighted gaps in teachers' tech skills, placing Japan at the bottom in terms of principals' confidence in their staff's technical and pedagogical skills for digital education⁷⁶. This skill and confidence gap could reduce the willingness of educators to experiment with new solutions.

Disparity in device access poses the risk of deepening education inequality: The OECD reports that in 2018 Japan was the only country where the rate of desktop or laptop computer usage for 15-year-old students had declined since 2009, falling from 48% to 35%⁷⁷. Access to a personal digital device is becoming increasingly necessary as digital learning (both formal and informal) spreads, a need that was sharpened by the COVID-19 crisis of 2020, which caused many schools to resort to remote learning, and parents to work remotely, in some cases on shared devices. Uneven access to technology can undo many efforts to make learning settings more equitable for children from various backgrounds. To avoid unfairness, teachers may hesitate to employ digital solutions until all children have access to technology.

Mixed learning outcomes from inappropriate use of technology create uncertainty over further adoption: Equal access to devices will be a key factor for widespread adoption of EdTech; however, simply supplying them to students does not automatically result in better learning outcomes, unless they are used as part of a well-considered educational experience. The ICT survey of the 2018 PISA assessment explored correlations between technology usage and student performance: in Asia, technology in the hands of students only (e.g., laptops and e-readers) was associated with lower student scores in reading than for peers who did not use them; conversely, usage of teacher-controlled devices (e.g., projectors) generally correlated with more positive results than with tablets or laptops⁷⁸. Such results may discourage teachers and policymakers from pursuing digital learning. Conversely, they should serve as a reminder that digital is a powerful tool for education, as long as educators and learning experts are careful in its implementation: just like evidence-based medicine is deliberate about using data to care for patients, an "evidence-based digital education" approach should use data from experiments and previous experience to identify and scale the solutions that best improve learning outcomes.

Local privacy regulations pose challenges for cloud learning solutions in schools: Although the GIGA program promotes cloud adoption to a certain extent, it has prioritized distribution of computing devices to each student and improvement of the network environment, without setting a clear mandate for cloud adoption. Since the COVID-19 crisis in 2020, the promotion of ICT systems in schools has gained greater political attention, but personal information protection ordinances of local governments have been a barrier: local regulations differ by jurisdiction, with the majority prohibiting online access from computer devices that handle personal information. While driven by the desire to protect individuals' privacy, the complexity and multiplicity of such provisions present a major impediment, particularly in implementing remote-based education at scale.

⁷⁴ 令和元年度学校における教育の情報化の実態等に関する調査結果 (令和2年3月現在) [Survey results on the situation of digitization of education in schools in FY2019 (situation as of March 2020)], MEXT, October 2020, mext.go.jp.

⁷⁵ Ibid.

⁷⁶ Education GPS, OECD.

⁷⁷ Toshihiko Maida, "世界で唯一、日本の子どものパソコン使用率が低下している" [Only in the world, the PC usage rate of Japanese children is declining], Newsweek Japan, January 8, 2020, newsweekjapan.jp.

⁷⁸ Jake Bryant, Felipe Child, Emma Dorn, and Stephen Hall, New global data reveal education technology's impact on learning, June 2020, McKinsey.com.

Enablers for digital transformation

Enablers are strategies, mindsets, talent, technology, or regulation that need to evolve to accelerate transformation. For this move, some potential areas to address include:

Focus on solutions for teacher effectiveness to reduce administrative working time and drive adoption: While EdTech tools can provide stimulating learning experiences, they cannot replace good teachers and their ability to inspire and connect students. Moreover, the PISA results on technology and performance show that implementing student technology beyond hardware is very difficult. In the classroom, EdTech should rather focus on liberating teachers from non-teaching tasks, so they can spend more time on personalizing lessons for their students. According to a global survey by McKinsey, the areas where technology could unlock most time are lesson preparation, evaluation and feedback, and administration⁷⁹: for example, existing technologies in natural language processing (NLP) and robotic process automation (RPA) can be used to automate homework assessment and equipment procurement. Schools could focus on tangible “quick wins” that can generate enthusiasm among teachers and momentum to explore more holistic solutions.

Build digital capabilities of teachers and school leaders to enable use of learning management systems: As suggested by the PISA ICT survey, schoolteachers in Japan may not yet be equipped with the technical and pedagogical skillsets necessary for e-learning. Upskilling teachers by including digital literacy and pedagogy in their training can help them harness technology effectively and build the competencies to pilot EdTech solutions and decide on their roll-out. Beyond training, dedicated teacher networks could be put in place to enable cross-school collaboration and mentoring. Moreover, teachers could be trained to educate students on simple everyday habits that can improve cybersecurity for all, such as choosing complex unique passphrases, thinking critically about which links to click, and being careful about connecting to potentially insecure public Wi-Fi networks.

Create a knowledge base of best-practice

EdTech tools to simplify procurement and implementation for schools: The range of digital solutions on offer can be overwhelming, and without guidance teachers may find it hard to identify the best tools. The Ministry of Economy, Trade and Industry (METI) lists over 140 EdTech solutions on its Learning Innovation portal: exploring synergies with MEXT, the government could support schools by impartially reviewing EdTech tools and defining “implementation recipes”, so that schools may confidently choose best-practice solutions.

Foster collaboration between EdTech, education publishers, and teachers to design solutions with proven positive learning outcomes:

Each of these players brings significant expertise in its field - technology, content creation, and teaching delivery respectively. They are all needed in the product development process. By involving all parties, businesses can ensure they develop high-quality digital solutions that are also easy to adopt, instructive for students, and do not impose significant training requirements.

Harmonize privacy regulations countrywide to enable wide solution rollout:

Privacy regulations among the nearly 2,000 local governments are colloquially known as the system of “2000 ordinances”. A harmonized regulatory framework would facilitate the deployment of cloud-based learning solutions countrywide. Given the scale of the task, a concerted effort by various agencies and commissions in partnership with EdTech players will be crucial for success. With that in place, it will be possible to provide additional educational value through technology, such as personalized learning with performance analytics and continuous collaboration.

⁷⁹ How artificial intelligence will impact K-12 teachers, January 2020.



Big move 4: Industrial manufacturing to build on hardware, robotics, and automotive endowments by leapfrogging with software, machine learning and deep learning

Valued at nearly ¥114 trillion in 2018⁸⁰, industrial manufacturing is the largest sector of Japan's economy, and covers a range of innovative industries such as automotive, industrial machinery, building technologies, electrical and power equipment. The industry is mature, and has a heritage of high quality, durability, and innovation through continuous improvement.

Shaping the overall industry and accounting for nearly a quarter of its revenues is Japan's automotive sector, the largest manufacturing segment overall in Japan. Japanese automotive companies produce approximately one third of the global total automobile supply across a broad network of sites. Leading Original Equipment Manufacturers (OEMs) include Toyota, Nissan and Honda. Industrial machinery also includes world-class organizations such as Keyence and FANUC.

Japan has many decades of manufacturing prominence in its history, and a starting point that already leverages continuous productivity improvements, the application of robotics, and hardware based technologies. The next frontier of digital for Japan's industrial sector lies in the broad adoption of software, machine learning, and deep learning across all core operations in the industrial value chain. In sub-sectors such as automotive this will mean putting applied AI in the form of autonomous driving at the heart of vehicles, and in others such as industrial machinery, leveraging AI for key supply chain, manufacturing, and aftermarket processes.

Potential for artificial intelligence across the value chain

Traditional machine learning for numbers and probability predictions, and the more powerful deep learning for computer vision and natural language processing, open up a new range of digital use cases for industrial companies (Exhibit 10). These use cases represent an evolution from human observation and data analytics methods. AI in summary involves the labeling of data by experts, to train models, and obtain high accuracy predictions to automate tasks. Japan's industrial sector can continue applying many technologies such as robotics and hardware, but it is in the application of AI where Japan can leapfrog and create a defensible globally competitive advantage.

There are four broad areas involving artificial intelligence that can be applied across the industrial value chain.

- Traditional machine learning, to predict numbers and probabilities in key tasks
- Deep learning – computer vision, used to classify images and detect objects
- Deep learning – natural language processing for text and speech
- End-to-end application of fully autonomous driving, which is specific to the automotive sector

⁸⁰ National Accounts of Japan, Cabinet Office, December 7, 2020, esri.cao.go.jp.

Exhibit 10:

Digital AI use case roadmap across the industrial manufacturing value chain

Non Exhaustive

Use case deep dive follows

		R&D	Manufacturing		Sales and distribution	Installation	Aftermarket	
Traditional machine learning	Predictive product feature selection	Procurement	Automated dynamic procurement	Manufacturing	Predictive manufacturing line stoppage	Logistics optimization through geospatial analysis	Installation cost predictive sizing	Aftermarket Parts and Services
Deep learning – computer vision	Prediction of 'designed in' quality using computer aided design	Prediction of vendor "supplied in" quality		Manufacturing defect detection -visual inspection	Automated sales lead identification using satellite imagery	Automated field installation support	Aftermarket 'snap and swipe' parts commerce	Prediction of time to replacement based on field condition
Deep learning – sound, speech & language processing	NLP for collection of early sentiment on prototypes	NLP for prediction of supplier negotiation potential		Audio-based defect prediction	NLP for prediction of B2B deal success probability	Audio-based installation quality testing	Field expertise chatbot	Vibration interpretation and control
Sector specific application of machine & deep learning								
Key technology enablers								

Fully autonomous vehicle deployment

The diagram illustrates the relationship between the AI use cases and enabling technologies. At the top, there are three columns of boxes: 'Non Exhaustive' (R&D, Manufacturing, Sales and distribution), 'Use case deep dive follows' (Installation, Aftermarket), and 'Key technology enablers'. Below these are two horizontal arrows pointing right. The top arrow is labeled 'Fully autonomous vehicle deployment' and spans from the Manufacturing row to the Aftermarket row. The bottom arrow spans from the R&D row to the Aftermarket row. Between these two arrows is a central box containing the text 'Robotic automation, cloud platforms and infrastructure, IoT and connected sensors'.

Source: McKinsey

Traditional machine learning, to predict numbers and probabilities

Machine learning for product feature selection

Impact: Reduced R&D costs, reduced manufacturing costs from efficient design, faster time to market, improved customer satisfaction with end-product

Deciding the feature specifications of a product - and on a broader level an entire product portfolio - is required to launch successfully in a market. Product teams must optimize for features that customers are willing to pay for, whilst considering product development and manufacturing costs. There are always trade-offs to determine which features should be prioritized, and which should be discarded.

The known toolset to analyze and prioritize product features is vast, and the process is often an inductive one requiring the collection and analysis from multiple data sources, such as customer reviews, conjoint analyses, actual product performance data, market share, price lists, and the bill of materials among others. Sifting through this data is time-consuming, and gaining actionable insights, given the size and format of the data, is even more challenging.

Machine learning will enable the next frontier of product development. Data sets of historical features can be labeled to specify whether those features were liked or not liked by customers; and labeled to determine their actual manufacturing time, cost, or if they faced any manufacturing issues. This can enable future predictive product development questions to be asked such as 'what may a future feature cost?' or 'what is the probability that this feature can be produced without an issue?'. Moreover, deep learning can leverage deep feed forward neural networks, that can process a wide range of data inputs, and 'one-shot' the process of picking those inputs that best predict the cost, quality or incremental value that features add to a product.

Machine learning driven predictive maintenance using IoT data and Over-the-Air updates

Impact: lesser downtime of equipment, slower wear-and-tear

Asset maintenance has been evolving rapidly, with many companies or customers having moved from ‘break-fix’ maintenance to ‘preventive maintenance’ in order to avoid products failing in the factory, on the road, or in the field. Data science and analytics has enhanced maintenance schedules, by identifying ideal times to drive preventive maintenance, thereby enabling labor and parts savings.

Today however, machine data extraction is largely done manually via hardware ports, and bespoke analyses need to be run to determine broad ‘predictive’ maintenance schedules. The next wave of digital involves more advanced IoT sensors at scale, which coupled with 5G connectivity, can relay back machine and contextual information that can aid in the prediction of potential failure. Moreover, the same connectivity can be used for over the air updates to resolve select issues as more hardware is ‘software-ized’.

Machine learning enables ongoing predictions, using streaming data to predict the probability that an asset will fail, and making it possible to deliver pre-emptive updates or truly hands-on maintenance when needed. AT&T is an example of a company enabling 5G connectivity, live video and IoT sensors to support factory automation. AT&T’s Automated Material Handling System is equipped with 4K wireless cameras and IoT sensors to enable remote monitoring and collection of data involving acceleration, position, temperature, humidity and gas flow; and 5G allows for near real-time transmission of large volumes of data collected, at a large scale across a full suite of connected devices⁸¹. The collected data is analyzed and used for proactive maintenance of factory equipment.

Similar use cases exist in the field of construction, Caterpillar Inc. has over one million connected machines that produce large amounts of data⁸². Machine learning models are used to harness this data into actionable insights that include predicting unplanned downtime for equipment or rebuilding schedules for main components, in order to save operators money and keep work on schedule.

Deep learning – computer vision, to classify images and detect objects

Deep learning for manufacturing defect detection

Impact: reduced manufacturing operational costs due to automation of visual inspection, improved quality of products, higher customer satisfaction, lower warranty costs

Defective products mean rework at the end of a production line, or warranty costs paid out to customers once the product is in the market. Many manufacturing sites today still have visual inspections done by operators. In the auto industry for example, operators are required to check the paint on the car in various checkpoints, as well as the flush gaps between stamped and assembled metal parts. Detecting small dents or defects takes operators, time, and some defects can be missed.

The next frontier for visual inspections leverages deep learning computer vision, where datasets with defects can train models that detect issues automatically. Cameras in the production line can take high resolution pictures, and edge processing can be used to predict the probability of a defect in the picture. Should there be a defect, then an operator can take over for further investigation. Deep learning models can be updated and retrained for new types of defects, making this scalable at low cost.

⁸¹ “AT&T and Samsung Bring 5G to Life for the Manufacturing Industry”, AT&T, June 21, 2019, about.att.com.

⁸² “Machine learning: Caterpillar Inc.’s Metamorphosis into Big Data”, Harvard Business School Digital Initiative, November 12, 2018, digital.hbs.edu.

This technology is available today. Startups such as Landing AI have visual inspection platforms, and there are various options that leverage robotics, software, and sensors. For example, Japanese robotics manufacturer Keyence provides an array of machine vision and image processing technologies that can detect even the minutest of flaws - as small as 0.03 mm - and support 100% in-line inspection⁸³.

Deep learning enabled aftermarket parts commerce

Impact: improved customer experience due to streamlined ordering process, increased after-market sales, reduced operational costs in after-market due to automation of customer support functionality

Aftermarket parts are often a high double digit margin business for industrial companies. In some industries, the gross margins of aftermarket parts oscillate between 40-80%. Most aftermarket parts end-customers often fall into a Do It Yourself (DIY) segment that wants to buy a part quickly and perform the fix, or a DIFM (Do It For Me) customer that wants to buy a part, but get expert help to install and perform the repair.

Many industrial players have already setup e-commerce portals with a part number search, that allow customers or dealers to search for a part and purchase online. AI will further transform this experience by enabling DIY and DIFM customers to ‘search’ for a part by simply taking a picture of it with their phone, and instantly purchasing without going through a funnel process that involves searching part numbers, assessing fit, and providing other inputs such as location.

Computer vision enabled “snap and swipe” parts purchasing – involving snapping a photo of the part needing replacement, and then simply swiping to order for delivery – can improve the customer journey and expedite the buying process for aftermarket parts. Japanese companies have the technology available to get started today. Car and machine OEMs often have datasets of parts photos. These need only be labeled, and models trained on available tools such as AWS Rekognition or Google’s AutoML to detect what type of part the picture should detect. In inventories with thousands of SKUs (stock keeping units), starting with high turnover SKUs is a sensible choice. Once this functionality is integrated into a mobile app, all the customer has to do is snap a photo, and then swipe to purchase.

Deep learning – natural language processing for text and speech

Field expertise chatbots

Impact: reduced service cycle time, improved repair quality, lower labor costs

With industry experts in the field reaching retirement age, expert knowledge on how to install, run, maintain, and repair products is gradually being lost. Conversational AI (also known as chatbots) is an elegant solution to automate the otherwise retired and lost knowledge of expert field workers, and codify it in an efficient question-answer form, versus lengthy physical documents or hard to search knowledge bases.

Companies with distinguished field engineers that are knowledgeable on how to troubleshoot issues, can train and deploy models that answer key questions. Once again, the technology to do this is available today. Using cloud tools such as AWS’s Polly or Google’s Dialogflow, companies can build chatbots to troubleshoot common maintenance issues in the field, with which junior engineers and technicians can converse to get their questions answered.

⁸³ “Appearance inspection (foreign particles, flaws, defects)”, Keyence, accessed December 4, 2020, keyence.com.

Fully autonomous vehicle deployment

As a global leader in automotive production today, Japan may need to successfully transition its future fleets into the world of autonomous driving and connected cars. A consumer survey by the McKinsey Center for Future Mobility done in 2019 found that 40% of Japanese respondents were interested in trading in their manual vehicle for an autonomous one – 7 percentage points higher than the global average of 33%. In the same survey, 36% of survey respondents globally said they were willing to change car brands to achieve better connectivity. These trends will only accelerate. Over the next decade, much of the race to enable autonomous will involve software. Key areas of software development involve deep learning for training, decision making, and actuation. The basis of competition will increasingly shift from traditional areas such as engine development, to software related areas. In particular, progressing from L1/2 autonomous driving to L5 is likely to be the challenge for Japanese and global automotive players over the next decade.

Exhibit 11:

Definition of autonomous vehicles based on levels of automation

Level 0

No automation

Human driver performs all aspects of driving task (steering, acceleration, braking, etc.)

Level 1

Driver assistance

Driving assistance for certain aspects (e.g. adaptive cruise control) with human driver performing all remaining aspects of driving task

Level 2

Partial automation

Vehicle performs steering and acceleration, while human driver monitors all driving tasks and can take control at any time



Human driver monitors the driving environment



Automated driving system monitors the driving environment

Level 5

Full automation

Automated driving system performs all aspects of driving task, under all roadway and environment conditions that could have been managed by a human driver

Level 4

High automation

Automated driving system performs all aspects of driving task, under most roadway and environment conditions, even if a human driver does not respond appropriately at request to intervene

Level 3

Conditional automation

Automated driving system performs all aspects of driving task, under certain ideal conditions and limitations (e.g. limited-access divided highway with speed limit), with expectation that human driver will respond appropriately at request to intervene

Source: Society of Automotive Engineering, McKinsey analysis

The automotive industry is progressing from level 0 to level 5 of autonomous driving. In the final quarter of 2020, an evaluation of active driving assistance systems (level 2) rated Comma Two's Open Pilot, Cadillac's Super Cruise, and Tesla's AutoPilot as the top driving assistance systems⁸⁴. Japanese OEMs did not rank within the Top 10. To remain globally competitive, Japanese players need to boldly commit to moving up the autonomous scale, overcoming barriers and enabling autonomous fleets.

Deep learning models for autonomous driving

Impact: more accurate autonomous driving capabilities, improved autonomous safety

The technology for autonomous driving is widely available today: camera sensors that are placed in the car and take hundreds of pictures per second; deep learning algorithms and models such as YOLO (You only look once, freely available on GitHub) that do object recognition, location, localization, and edge processing that happens in the car, to predict what an object is (e.g. a stop sign) and take avoiding action (e.g. stopping the car). These models require labeled datasets which train them to identify images so they can distinguish between common objects such as traffic signals, road signs, other vehicles and pedestrians; as well as continued training that comes from driving millions of miles on a given road with an operator behind the wheel to train the model on what to do in a specific situation. Companies with datasets and driven miles have a head start. Tesla for example has nearly 50 deep learning models, trained from millions of images, running at once on the car's onboard computer to predict what the auto-pilot should do in reaction to traffic signals, pedestrians, or other objects. In addition to such deep learning models are high-performance, low-power consumption system on a chip that offer high reliability and scalability to allow for over-the-air updates. Such Application-specific integrated circuit (ASIC) or Graphical Processing Unit (GPU) chips are embedded into autonomous vehicles to allow for on-board edge processing, reducing the volume of data that needs to be transmitted outside the vehicle.

Autonomous vehicle safety

Impact: improved autonomous safety, fewer accidents, injuries and deaths

There are various technologies that can be deployed in conjunction to ensure the safety of autonomous vehicles: cybersecurity to protect connected car software from attacks; geofencing to improve road safety, efficiency, and reduce climate impact; and finally, the safety of the autonomous driving model itself in how accurately it mimics safe human driver behavior in responding to road conditions, traffic signals and other external elements. This last point, the testing and proving the safety of autonomous driving, is critical for automotive developers to receive regulatory approval, and to garner consumer confidence in the product.

Companies such as Intel's subsidiary Mobileye are contributing to space of autonomous car safety standards. Mobileye has developed a Responsibility-Sensitive Safety (RSS) model, that can measure and prove the safety of autonomous vehicles, using a tested mathematical formula to mimic human driver behavior. RSS provides autonomous vehicle companies with a transparent safety model to test and prove safety of their vehicles, and defines a 'safe state' for human responsibility and caution needed to prevent accidents.

⁸⁴ "Active Driving Assistance Systems: Test Results and Design Recommendations", November 2020, consumerreports.org.

Connected cars and services at scale

Impact: subscription models, increased volume of collected car data for monetization

Embedded connectivity for end-to-end software platforms, that links together all the major systems in a car, becomes crucial as an enabling functionality. Moreover, with the advent of autonomous eliminating the need for a human operator constantly in control of the steering wheel, car passengers are freed up to focus on other tasks, such as working remotely while travelling. Affordable, secure and reliable connectivity is becoming an increasingly important feature that consumers look for in their vehicles.

Companies such as AT&T, in partnership with KDDI, already provide connected car hardware, through connected car Wi-Fi hotspots which are embedded in vehicles, enabling travelers to stream entertainment or work on-the-go for Mazda vehicles. Activating one hotspot can get multiple connections, eliminating the need for individual data plans or routing devices. The car Wi-Fi can also be connected to from outside vehicles, making it a viable connectivity solution when working from home. Beyond in-vehicle infotainment, automotive players are starting to offer other connected services such as, predictive maintenance, real-time emergency response, concierge services, and even in-vehicle e-commerce services.

Barriers to digital transformation

For this big move to come to realization, addressing mindsets, talent constraints, legacy technology issues or regulatory changes may be needed. A few examples are:

Software talent and artificial intelligence expertise are scarce and not in the core: Many staff in traditional manufacturing companies come from mechanical or industrial engineering backgrounds, with fewer from software or computer science related backgrounds. For example, R&D employees are today disproportionately focused on improving the various steel or electronic components of a car, versus creating new software or deep learning models. These teams may need to build an understanding of data labeling, model development and training, and deployment. Similarly, those on the manufacturing floor may need to learn how to use and deploy tools that leverage deep learning computer vision, while those in aftermarket may need a firm grasp on e-commerce, digital marketing, and AI. Talent is scarce internally today, and most digital initiatives rely on IT vendors. Talent may need to come back into the core given the strategic importance of digital now and going forward.

Limited availability of labeled datasets hinders development of machine learning models: The predictive accuracy of machine learning starts with the quality and availability of labeled data that is used to train machine learning models. Currently, most traditional manufacturers shun unstructured image data banks in favor of traditional transaction tabular data. Practices to collect and label images - e.g. image data from car camera sensors - is often not being collected and stored in a format that is usable in the future. Multiple issues need to be addressed early to enable an AI future: either data is not being collected at all; or collected data exists in siloes and is not being integrated in any interoperable format; and finally, data is not being labeled.

Legacy IT policies and fragmented infrastructure impede data-driven use cases: One common but significant barrier for industrial players is the continued use of legacy systems or outdated software. For example, some automobile companies still engage in legacy 2D product design, which requires process rework to move to 3D. Similarly, fragmented legacy systems for data collection - spread across bills of materials in different divisions, with different data standards, formats and naming conventions - have led to a data disconnect, where there is no single source of truth or integrated database that can be leveraged for digital use case implementation.

Autonomous vehicle regulations are at L3 and have yet to evolve to encourage L5: In April 2020, the Ministry of Land, Infrastructure and Transport (MLIT) amended the Road Vehicle Act, to include equipment for level 3 automated driving in the list of motor vehicle equipment subject to safety standards; and in November 2020, the MLIT approved Honda's new L3 self-driving vehicle, allowing for it to be driven by the automated driving system rather than the driver in certain conditions⁸⁵. And while these steps are a sign of progress, they come at a time when companies such as Tesla, Waymo, and European OEMs such as Mercedes are working towards level 4. Given the importance of Japan's auto sector, bolder action is needed to encourage levels 4 and 5 development. Moreover, beyond the L5 regulations, the legal liability – for example, in the case of an accident caused in part by a machine learning algorithm – remain ambiguous in the autonomous space, and the potential for unlimited liability attributed to autonomous vehicle manufacturers is a deterrent for development.

⁸⁵ "Honda to launch world's first level 3 autonomous vehicle by March", 2020.

Top management reluctant to invest in bold digital transformations: Many executive offices at traditional industrial manufacturing companies have agendas that focus on extending company longevity, capturing low-hanging fruit operational gains, or protecting market share. Sometimes these objectives are counter to launching digital at scale. Small pilot digital investments are common, but large investments in hardware or tooling tend to get higher priority. While there may be an understanding around the high-level value proposition of digital, it is more challenging to set a bold agenda to drive digital throughout.

Perception that automation threatens workforce stability: Software and automation are often portrayed as a means to rationalize the workforce. Yet, for the development of new technologies, new roles are needed, and humans are capable of learning new things in ways that computers aren't. Japanese companies are often hesitant to lay off workers compared to their global counterparts, and hence there may be a reluctance to drive new technology development if it puts existing workers' jobs at risk. Given the need for software and the demographic trends, the re-skilling and repurposing of parts of the existing workforce will be crucial for digital transformation.

Enablers for digital transformation

Enablers are strategies, mindsets, talent, technology, or regulation that need to evolve to accelerate transformation. For this move, some potential areas to address include:

C-level to drive resource reallocation into software, analytics, AI to achieve future digital state: Japanese companies are leaders in manufacturing, and Japan does have seedlings of machine and deep learning startups – a combination that is capable of boosting Japan to the premier league of digital industrial globally. Japan could benefit from a shared industry aspiration to reclaim its global leadership in digital manufacturing over the next decade. In concrete terms, the vision for reclaiming leadership could focus on heavy machinery and deep learning implementation to drive innovation, whilst relying on traditional technologies (IoT, robotics) to maintain and improve productivity. But in order to make this vision a reality, top private and public sector decision-makers need to develop digital strategies and drive company efforts – in terms of hiring talent and allocating budget and resources – along the path of digital transformation.

Upskill industrial workforce in areas of software development and machine learning: There are two requirements here; the first is improving digital literacy of current employees, equipping them to handle new digital technologies and understand machine learning builds, which can be done through training and capability building. The second is re-skilling employees who perform narrow tasks that can be automated. These employees have valuable expertise which can be used in labeling data to train machine learning models, or identifying and analyzing outliers in datasets. Similarly, employees with deep sector knowledge could play a role as domain experts working in conjunction with machine learning teams.

Create practices to gather and label unstructured data for machine learning purposes: Companies may need to revamp their internal policies, processes and systems related to data, to create an environment more conducive

to digital transformation. This includes creating processes and cultures focused on managing data. This goes hand-in-hand with re-skilling the workforce, since one of the key tasks here could be manually labeling images for deep learning model training, or helping integrate siloed data into data warehouses.

Launch agile digital divisions to operate unencumbered in a ‘test and learn’ environment with latitude from legacy organization: Setting up new entities that can develop their own processes, structures, incentives, and culture is a way to encourage new entity development in a way that is not encumbered by previous processes, mindsets and legacy systems. While there will be a challenge with respect to integration, there is more freedom to create a new culture and new ways of working in a different organization, as opposed to the subsidiary of a larger organization that has been around for decades, or even centuries in the case of Japan.

Accelerate development of L5 autonomous vehicles to maintain global leadership, and enable with regulatory change: This is a ‘chicken and egg’ case with the private sector awaiting government regulations, and the government not feeling any pressure from the private sector to move. A dual approach is needed, where the government progressively allows higher levels of autonomous driving, thus incentivizing the private sector; and the private sector simultaneously invests in and works with L4 and L5 technologies to push the government. With companies such as Tesla working towards L4 and L5, movement by both public and private sectors is vital. If Japanese players are to not only match other players, but potentially lead on autonomous driving, it would be best to start now.

Develop legal and insurance frameworks for autonomous driving to reduce development reluctance:

This holds true for several applications of artificial intelligence, but especially for autonomous driving where there is a higher risk associated with AI-based decision-making. In order for Japanese OEMs to sell to the domestic market, it is important to clarify legal responsibility and, in order to incentivize autonomous vehicle development, create a mechanism for sharing the risk between users, government and the industry. Insurance policies need to cover the related risks, while accounting for the intrinsic moral hazard that comes with reduced user attention to the road in front of them.

Foster partnerships between automotive players and leading tech companies:

Japan's automotive players are starting to make progress on autonomous vehicle development through partnerships with tech and other companies. For example, in 2020, Toyota announced a partnership with AWS, to collaborate on Toyota's Mobility Services Platform; a collaboration that would enable Toyota to develop and deploy the next generation of data-driven mobility services across their cloud-connected fleet⁸⁶. Mobileye, a subsidiary of Intel Corporation, announced in 2020 a partnership with Japanese bus company Willer, to develop robo-taxi solutions leveraging Mobileye's autonomous driving technology to bring new transportation services to Japan and improve mobility⁸⁷. Such partnerships, that combine

the automotive expertise of Japanese OEMs with the AI expertise of leading tech companies, will be key to putting Japanese OEMs back in the race when it comes to autonomous driving.

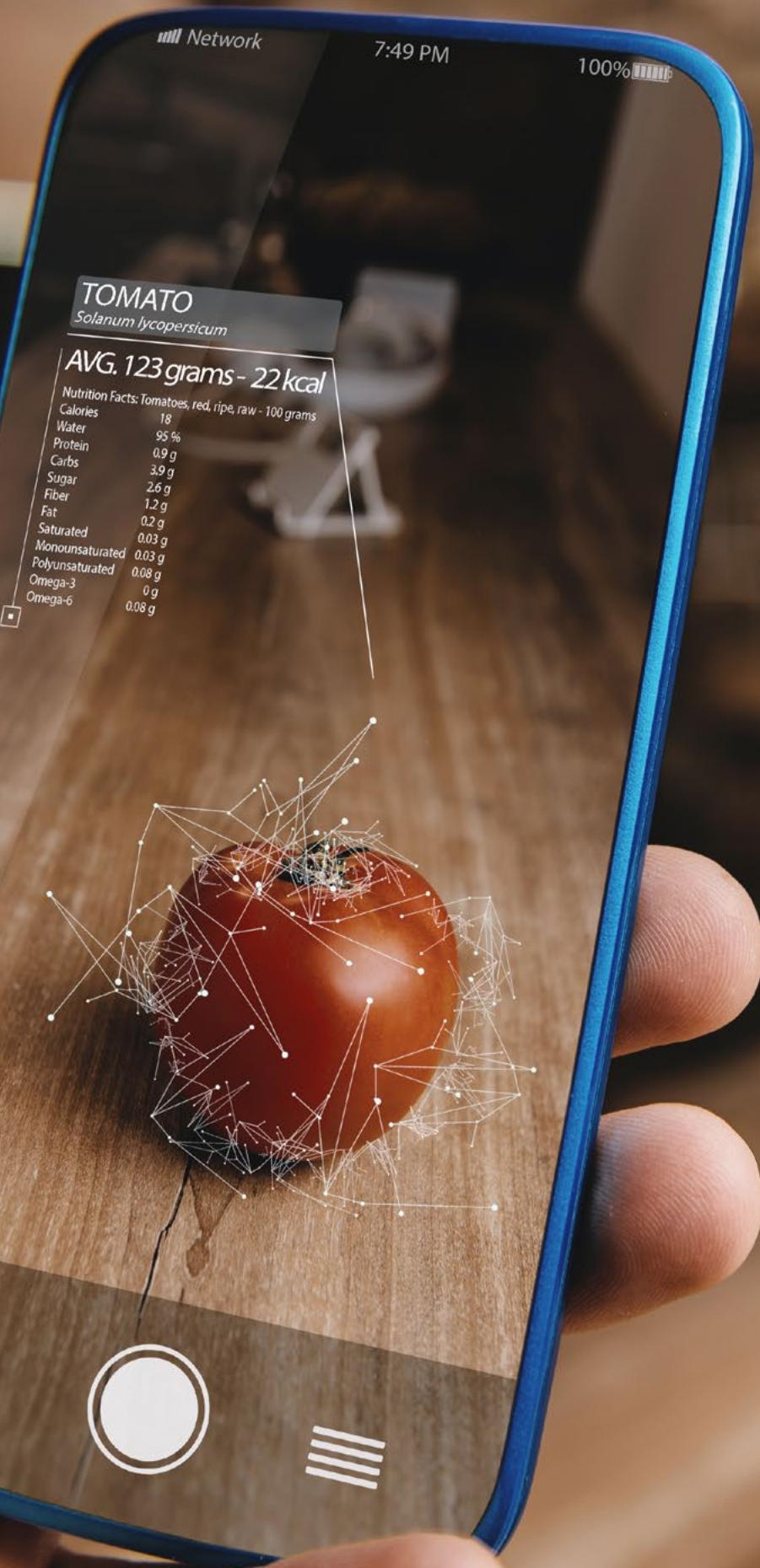
Create initiatives to incentivize industrial manufacturing companies to adopt digital through public-private collaboration:

A successful case of a government initiative that enabled digital transformation was the MLIT i-construction policy aimed at improving manufacturing productivity and supporting small- and mid-sized companies in digitization efforts⁸⁸. MLIT worked together with companies and industry associations to help shape the initiative, which provides subsidies, tax deductions and low-interest loans to companies that implement digital hardware and software, and develop human resources able to work with the new technology. There are two aspects that make the MLIT's i-construction initiative a success: the collaborative model; and the support provided for longer term initiatives such as talent development to build sustainability.

⁸⁶ "Toyota and Amazon Web Services collaborate on Toyota's Mobility Services Platform", August 17, 2020, global.toyota.

⁸⁷ "WILLERとモービルアイが日本・台湾・ASEANにおける自動運転ソリューションの提供に向け協業" [WILLER and Mobileye collaborate to provide autonomous driving solutions in Japan, Taiwan and ASEAN], Intel, July 8, 2020, newsroom.intel.co.jp.

⁸⁸ "i-Construction ICT施工) の導入に関する補助金", [Subsidy for the introduction of i-Construction (ICT construction)], MLIT, October 2020, ktr.mlit.go.jp.



Big move 5: Retail to capitalize on shifting customer trends by delivering digital omnichannel experiences

In 2018, Japan's retail sector – encompassing sub-sectors such as general merchandise, apparel, food and beverages, and other consumer goods – had collective revenues of ¥75 trillion. E-commerce represented ¥19.4 trillion of retail revenues⁸⁹, with a robust 7.65% year-over-year growth⁹⁰, and the sub-segment mobile e-commerce - dubbed m-commerce - accounted for over half of e-commerce traffic, with a compound annual growth rate (CAGR) of 34% between 2011 and 2018⁹¹.

Even with the high growth of e-commerce, Japan's e-commerce penetration - the proportion of total retail sales driven by e-commerce - is an estimated 9%, lower than neighboring economies such as China and South Korea, where e-commerce penetration stands at 24% for both countries⁹². However, the COVID-19 pandemic has led to an acceleration in e-commerce adoption, the effects of which are likely to continue even after the pandemic: according to a McKinsey Japanese Consumer Pulse Survey carried out in November 2020, Japanese consumers expressed an intent to purchase up to 20% more online even after the pandemic ended⁹³. Going forward, it will be critical to improve the consumer experience both online and in traditional retail stores.

Traditional retail stores in Japan have a compelling value proposition: they are in easily accessible urban locations; and they offer good service, customer experience, product assortment, and long opening hours. Stores also have headroom to grow in creating the 'store of the future' where customer experiences go digital introducing tactile and sensory elements of taste, smell and touch, which cannot be delivered through a digital medium. However, with the advantages of e-commerce in convenience, assortment, and price, consumers are increasingly turning to this option as well. The goal of digitization in retail is not about solely driving e-commerce penetration at the expense of traditional retail, but rather about enabling the coexistence of the two through digital omnichannel, while improving overall retail performance and customer experience.

Omnichannel is the seamless coordination of channels so that customers can discover, evaluate, purchase, and experience products using a combination of offline and online channels. It may require coordinating various combinations such as online discovery but offline purchase, or offline evaluation, but online purchase and experience. Companies that can coordinate their digital and physical assets through the purchase decision journey stand to gain customer loyalty.

More than 90% of omnichannel journeys start online. With the availability of information online regarding various competitor products and prices, customers have greater knowledge and decision-making power in the purchasing process. Customers often walk into shops with an idea of what it is they want to buy, and in many cases have various delivery channels available to them. To accommodate for this, the role of the retailer is shifting from trying to sell products to customers then and there, to one that showcases products online in order to inform the upfront part of the customer journey. Digital solutions that improve the customer journey - such as reducing wait times for trials and checkouts – while protecting customer data, will thus be key to deliver unique customer experiences and improve both customer satisfaction and loyalty.

Retail in Japan can be fragmented for some sectors, such as supermarkets, where, as of 2018, the top player Aeon had a market share of 16% but other top players had only amassed 3-4% each⁹⁴; or consolidated in other sub-sectors, such as convenience stores, where the top three players – 7-Eleven, FamilyMart and Lawson – each have 42%, 25% and 23% market share respectively in

⁸⁹ National Accounts of Japan, Cabinet Office, December 7, 2020, esri.cao.go.jp.

⁹⁰ "電子商取引に関する市場調査の結果を取りまとめました" [Summary of market research on e-commerce], METI, July 22, 2020, meti.go.jp.

⁹¹ Euromonitor, December 12, 2019, euromonitor.com.

⁹² Ibid.

⁹³ "Survey: Japanese consumer sentiment during the coronavirus crisis", December 10, 2020, mckinsey.com.

⁹⁴ Chain Store Age, December 12, 2019, chainstoreage.com; Euromonitor, December 12, 2019, euromonitor.com; SPEEDA, December 12, 2019, ub-speeda.com.

2018⁹⁵. There is relatively little cross-sector overlap, with different market leaders across sub-sectors, such as drugstores (Welcia, Tsuruha), electronics stores (Yamada Denki, Bic Camera), department stores (Isetan, Mitsukoshi) and discount stores (Don Quijote). However, chains such as Bic Camera, although primarily known for electronics, do sell other product categories such as apparel and cosmetics.

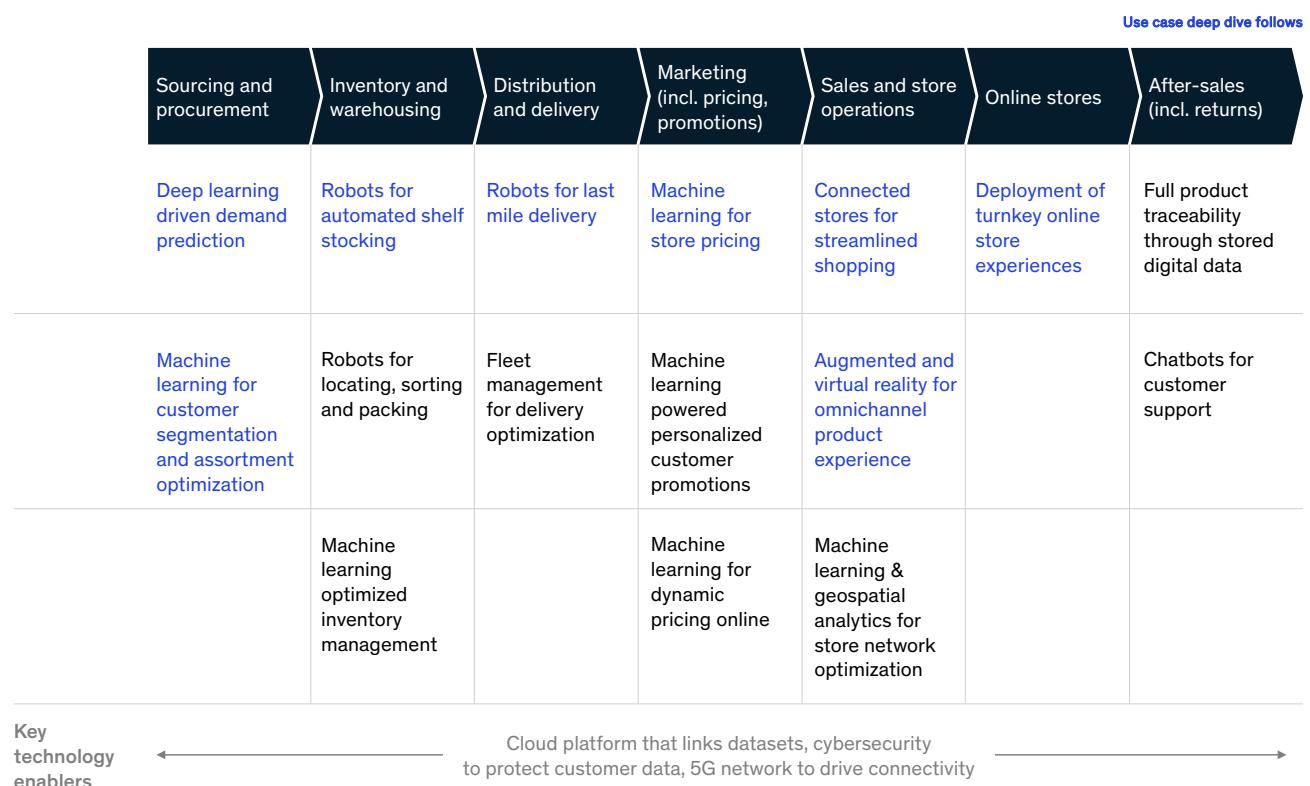
Overall, as of 2018, the top five retailers by sales in Japan are Aeon, Seven & i (7-Eleven), Fast Retailing (Uniqlo), Yamada Denki and Pan Pacific International Holdings (Don Quijote). The top players in e-commerce are Amazon, Rakuten and Yahoo Shopping. Due to the differing levels of fragmentation across retail sub-sectors in Japan, it is expected that digital adoption could evolve quite differently across retailers, starting with giants such as Aeon and Don Quijote, who have the necessary resources and access to vast networks of data to act as first adopters, followed later by smaller grocery chains and drugstores.

Potential for digitization across the value chain

The digital use case transformation roadmap below illustrates digital use cases across the retail value chain, from product conceptualization and ordering to final customer delivery and after-service (Exhibit 12).

Exhibit 12:

Digital use case roadmap across the retail value chain



Source: McKinsey

There are two key areas where Japanese retailers can begin scaling up digital use cases to deliver world class omnichannel experiences, leveraging digital stores of the future in combination with e-commerce:

- Improving in-store and online customer experience
- Improving operations

⁹⁵ Ibid.

Improving in-store and online customer experience

Connected stores for streamlined shopping experience

Impact: streamlined shopping journey with no waiting times, reduced labor costs, data collection on customer behavior and preferences

While digital check-out kiosks reduce waiting times, Amazon Go Grocery's offering of Just Walk Out Shopping takes this a step further by eliminating the need for check-out altogether. This is done through spatial analytics using cameras and on-shelf sensors, to automatically detect which customer takes (or replaces) what product; combined with a mobile app for customer interfacing and updates the customer's virtual shopping cart accordingly. Customers who finish shopping and leave the store are charged for what remains on their virtual shopping cart. By eliminating time spent waiting in line and paying, Amazon Go has streamlined the customer journey and enhanced the customer experience, while reducing human error at checkout. Another hidden benefit of Amazon Go Grocery is the ability to collect valuable data on customer behavior and preferences. Physical grocery stores have no way of tracking anything beyond final purchases. Amazon Go Grocery, by contrast, uses customer scrolls, views and clicks to obtain additional insights, e.g. the number of times a product was picked up but replaced on shelves without a final purchase. This trove of data can inform assortment decisions and store layout.

Augmented reality (AR) and virtual reality (VR) for omnichannel product experience

Impact: reduced waiting times for trial, increased customer satisfaction with final product, translating to reduced returns and increased customer loyalty

Gone are the days of long lines for trial cubicles or the discovery that a certain shade of lipstick doesn't quite match one's skin tone as expected. AR is being combined with technologies such as 3D scanning and mobile apps to offer customers a virtual trial experience before they buy products. Companies such as Zurich-based Fision – acquired in 2020 by European e-commerce player Zalando – is expanding on the concept of virtual fitting rooms with 3D body scanning cameras so customers can see how clothing would fit on their body frames without actually having to go through the hassle of changing⁹⁶. Ikea's VR app allows customers to place furniture in a space - be it their actual room, or the storefront - to see how it would look⁹⁷. Japanese multinational Shiseido also offers products in this space, with its Makeup Simulator app that eliminates the need to test makeup physically. Used by beauty consultants across Shiseido stores, and also available on mobile, the app allows users to look into the screen as if it were a mirror, replicates the user's face without makeup, and allows users to test out various Shiseido products on their 'makeup free' face⁹⁸.

Deployment of turnkey online store experiences

Impact: improved customer experience, increased sales through omnichannel approach, availability of data for customer insights

Adobe Magento is an example of an e-commerce platform that can be used to build a homepage for online sales channels. The platform features a 'drag and drop' interface for page design, as well as specific functionalities such as fulfillment options for buying online and store pick-up, live chat for customer support, and a built-in business intelligence tool for data analysis and insights. The platform makes it possible for companies, including Japanese eyewear company, Jins, to set up fully functioning online stores even without advanced coding knowledge.

⁹⁶ "Zalando invests in customer experience with acquisition of Swiss mobile body scanning developer Fision", October 16, 2020, corporate.zalando.com.

⁹⁷ Ayda Ayoubi, "IKEA Launches Augmented Reality Application", Architect, September 21, 2017, architectmagazine.com.

⁹⁸ Yukari Mitsuhashi, "Reaching out to women: Shiseido does it well", Bridge, July 29, 2013, thebridge.jp.

Another example is that of Japanese multinational footwear and apparel company ASICS. As a part of its new digital strategy to accelerate e-commerce, ASICS needed to build and migrate to a new universal e-commerce platform that could manage its entire portfolio of brands across geographies; this effort also involved developing application programming interfaces (APIs) to integrate with various order and product management systems, payment providers, and legacy systems to access backend data. ASICS leveraged Salesforce Integration Cloud's MuleSoft Anypoint Platform – a unified platform for enterprise iPaaS (integrated platform as a service) and full lifecycle API management – to connect between the disparate systems, and integrate previously siloed data including customer information, order status, real-time inventory and pricing. By eliminating the need for point-to-point connections, MuleSoft allowed ASICS more agility and flexibility with their e-commerce platform, enabling them to build a better customer experience.

Improving operations

Deep learning driven demand prediction

Impact: improved sales prediction accuracy, shortened times between design and production

Traditionally, demand prediction involved old-school statistics to analyze datasets such as historical sales reports and competitor product catalogues. There is, however, a wealth of information available that traditional techniques cannot easily capture, such as, for apparel: comments on fashion blogs; popular styles and colors as seen on social media posts; customer style and color searches on online stores. Machine learning, and deep learning – including image and text recognition – can unlock new realms of customer data that can provide insight into what is popular and selling now, and in the future. Such insights can be valuable for retailers during the process of designing and predicting demand for products.

An example of a company playing in this space is Fast Retailing, the owner of Uniqlo. Fast Retailing launched a partnership with Google as a part of Project Ariake in 2018, to use machine learning, and deep learning for image recognition, to evaluate product trends and predict demand. By analyzing images and other data, the partnership will enable Uniqlo to predict colors, shapes and styles likely to be in vogue and design products accordingly⁹⁹.

Machine learning for customer segmentation and assortment optimization

Impact: increased customer satisfaction and loyalty, translating to higher sales and fewer unsold products

For grocery stores selling similar types and brands of products with similar, relatively elastic price ranges, optimizing the exact product assortment based on customer preferences can be a key factor in improving both revenues and customer satisfaction and loyalty. This is traditionally done at a macro-level, looking at product sales aggregated across all customers; any sort of customer segmentation exercise relies on historically observed segments. However, with rapidly evolving customer behaviors, and customers' desire for a more personalized shopping experience, there is a need for more micro-level, customer data-driven and sophisticated analysis. Here, machine learning can be leveraged to provide deeper and quicker insights than human analysis.

Two large Japanese retailers (which requested anonymity) have already begun the process of embedding machine-learning in their assortment decision-making. The process involves using feature engineering to identify variables shown to strongly influence purchase decisions by different customer segments (e.g., purchase amount, more popular categories) and to develop new customer segments using data clustering (e.g., heavy cookers, bargain hunters). This enables an understanding of customer

⁹⁹ Barbara Santamaria, "Fast Retailing teams up with Google to power Ariake project", Fashion Network, September 19, 2018, fashionnetwork.com.

profiles and creation of a tool that continuously segments new customers in real time. Mapping products and buying preferences to customer segments, calibrated by size and behaviors, allows companies to tailor their product offering to the specific composition of their customer base.

Robots for automated shelf stocking

Impact: reduction in lost sales opportunities due to stock-outs, reduction in inventory levels, more employee time focused on customer experience rather than repetitive tasks (e.g. stock checking and shelving)

Stocking merchandise on shelves where the customers can see and buy it is crucial to driving both customer experience and sales. On average, retailers lose 4% of revenue annually due to stock-outs of merchandise. The situation is especially complex in grocery inventory tracking where a portion of groceries are not stocked on shelves but in store-rooms, and product expiration dates create a much shorter sales window. Time spent by store employees on manual shelf checks and stocking diverts them from helping customers. An attractive alternative is to use robots to carry out the stocking tasks instead. For example, Bossa Nova's robots can scan shelves for out-of-stocks as well as misplaced items¹⁰⁰, and are said to have an accuracy of 90% when it comes to identifying on-shelf availability as opposed to the 40- 60% accuracy with human agency. Integrating data gathered by a robot with inventory information can give a holistic view of available stock and enable the building of models to analyze product sales patterns based on time of day, seasonality and other factors.

Robots for last mile delivery

Impact: 10- 40% reduction in delivery costs, quicker delivery times

Droids, drones, robotic dogs, autonomous delivery vehicles and other forms of driverless delivery technology are expected to transform last-mile delivery, doing away with old-fashioned human delivery. A San Francisco startup called Starship Technologies is trialling an autonomously driven six-wheeled delivery robot to bring meals and groceries to customers' doorsteps¹⁰¹. It drives at walking speed on pavements and can cross streets and navigate obstacles, work at night and in various weather conditions. The robot comes with an app that can be used by customers to track its location and unlock it to receive their delivery. Starship has also partnered with Mercedes-Benz to create a 'mothership' for its robots - that is, a van that will ferry and drop them off to make deliveries, embedded with algorithms to determine efficient routing and drop-off points¹⁰².

Machine learning for in-store pricing

Impact: increased customer traffic by competitively pricing price-elastic products, higher margins on products with lower price-elasticities

Large Japanese retailers (who asked to keep their names confidential) are embarking on machine-learning-driven pricing optimization. This is done for both known value items (KVs) and non-KVs: in the case of the former, price optimization disproportionately drives value perceptions as the price of these products (e.g., eggs, milk) is well known.

The first step is analyzing product, sales and competitor data, to identify pricing improvement areas in both KVs and non-KVs. KVI scores are calculated and assigned to these products, based on their importance to price sensitive customers. Price setting rules are defined based on KVI scores so that products with high price-elasticities and high importance for overall pricing perceptions are priced competitively to drive higher demand, and those with lower price-elasticities and lesser importance to overall pricing perception are priced to drive higher margins. In addition, a revenue and gross profit financial estimation model can be developed to test the proposed price setting rules and predict its impact on key financials.

¹⁰⁰ Glynn Davis, "Taking stock of the inventory management battleground", Essential Retail, January 29, 2020, essentialretail.com.

¹⁰¹ James Vincent, "Mercedes-Benz has made a 'mothership' van for six-wheeled delivery robots", Verge, September 7, 2016, theverge.com.

¹⁰² Ibid.

Cybersecurity to enable operations across multiple public clouds

Impact: more robust cybersecurity protection and operational efficiencies

As more businesses move to the cloud, security concerns such as integration issues, misconfigurations, advanced threats, and access control become more critical to address through deployment of appropriate cybersecurity.

For example, a Japanese company operating stores for CD, DVD, game and book purchase and rental nationwide, needed to move its existing IT systems to the cloud to achieve business agility and competitiveness. The company wanted to leverage different public clouds depending on the application. However, doing this would add an additional layer of complexity to its operations and would challenge its existing IT team to fully understand security risks and respond to incidents. The company thus leveraged Palo Alto Networks Prisma Cloud, a cybersecurity platform designed to automatically monitor public clouds, providing visibility of security risks, and automating monitoring and compliance checks with global security guidelines and compliance standards. By deploying Prisma Cloud's workload-based licensing – dependent on the number of public cloud objects to monitor and protect – the corporation was able to optimize operations for cybersecurity coverage and cost.

Barriers to digital transformation

For this big move to come to realization, addressing mindsets, talent constraints, legacy technology issues or regulatory changes may be need. A few examples are:

Prevalence of legacy systems increases modernization costs: Of all industries in Japan, retail and distribution have the greatest reliance on legacy systems. One third of companies in the space rely almost entirely on legacy systems - as opposed to 29% in finance and 20% in manufacturing; and 44% of companies have at least half their data architecture tied to legacy systems - as opposed to 29% in finance and 26% in manufacturing¹⁰³. This poses a challenge to digitization, and potentially limits the scope of data-driven use cases that can be implemented, since these legacy systems are often incompatible with newer technologies such as cloud-based data visualization tools. Moreover, many retailers stumble when they contract systems integrators to implement end-to-end transformations through enterprise resource management (ERP) systems that take several years and require significant capital expenditure.

Capability gaps and limited data availability hinder rollout of turnkey e-commerce solutions for small stores: Digitizing services and offering online options and delivery requires certain aptitudes (e.g. website design and testing) and manpower (e.g. for delivery, if delivery partners are not utilized) that are not available to all stores equally. Additionally, smaller stores wanting to grow their e-commerce sales do not have sufficient customer data to form strategies and sales projections.

Size of workforce poses challenges for staff retraining and change management: As of 2019, approximately 1.65 million people were employed as sales workers in food and beverage retail alone. The number of employees means that any sort of digital rollout - whether stocking robots or virtual product trials - requires large-scale training and change management to ensure adoption. Even in non-storefront functions such as warehousing and inbound / outbound supply, distributors, merchants and vendors may have to buy into the digital use case and, in some cases, receive the same training and change management as retail staff. The automation will not cover 100% of all processes, and an element of human decision-making will persist alongside the digital component, which is why human understanding and acceptance is crucial for success.

Store-based incentive structure discourages shifting to e-commerce and omnichannel: A barrier specific to e-commerce is the limited incentive for retail employees to pursue omnichannel retail. Retail employees often receive bonuses based on in-store sales, and because of this, they are less motivated to shift their customers to an online platform.

Non-standardized product and customer IDs hinder supply / demand, and customer analytics: Even within one retail company, product and customer IDs can differ from one sales branch to another. This makes supply-demand analysis and personalized customer service difficult.

¹⁰³ DXレポート～ITシステム「2025年の崖」克服とDXの本格的な展開 [DX Report-Overcoming the IT System “Cliff in 2025” and Full-scale Deployment of DX], METI, March 5, 2019, meti.go.jp.

Enablers for digital transformation

Enablers are strategies, mindsets, talent, technology, or regulation that need to evolve to accelerate transformation. For this move, some potential areas to address include:

Leverage secure cloud data platforms to process high frequency and volume of retail customer data to enhance operations and customer centricity: Retail is one major industry that frequently connects with the large population groups. The availability of rich, granular and high-frequency customer datasets, with oftentimes fewer sensitivities around data collection and usage, than, say, patient health records in the healthcare sector, allows players to perform fully functional advanced analytics. However, in order to fully leverage this data, enterprises need to move away from legacy systems to cloud-based digital platforms that support data integration and building of scalable digital applications. In order to do this, enterprises can leverage a range of readily available cloud products – available from cloud-native providers such as Amazon Web Services and Microsoft Azure. As enterprises move to the cloud, they realize that cloud security is a shared responsibility; while cloud providers are responsible for security ‘of the cloud’ – protecting the infrastructure that runs the services offered in the cloud – enterprises are responsible for the security of their data and information ‘in the cloud’. Companies such as Palo Alto Networks provide cybersecurity solutions for Japanese and other companies to secure their data seamlessly, whether on premises or in the cloud, and as data moves among multiple cloud infrastructures. For example, a Japanese department store in 2017 wanted to change its systems to be 100% cloud, and move its core business applications such as e-commerce, point-of-sales and merchandising systems to the cloud. To enable and protect this effort, it selected Palo Alto Networks VM-Series Virtualized Next-Generation Firewall as the security platform to detect, analyze and deal with unknown malware and targeted attacks.

Leverage turnkey online marketplaces, and two- and three- sided platforms, and other technologies to drive e-commerce penetration:

Online marketplaces such as Amazon, two-, and three-sided marketplaces such as Uber Eats, provide the online interface and infrastructure, as well as the connection to auxiliary services such as delivery, enabling companies that might not otherwise do so to transition to digital and e-commerce. Moreover, some online marketplaces provide sales data as well as integrated business intelligence tools to support sellers with strategies and sales projections.

Create in-house digital teams with technology and retail domain expertise to build capabilities and deploy digital products: Many retailers do not have enough in-house data engineers and data scientists; nor talent in business-side roles that possesses the digital understanding to work with them. Retailers often outsource work related to digital to systems integrators, instead of building capability in-house. An in-house team combining both the depth of industry knowledge that comes from working within retail, with the capability needed to implement digital solutions, would enable retailers to make more independent and informed decisions regarding digital strategy and implementation. The approach here could involve targeted hiring for digitally-native roles (e.g., data scientists, designers); as well as training to build capabilities among existing employees (e.g., basics of machine and deep learning).

Leverage user-friendly analytics and machine learning tools to enable retail employees to develop ongoing customer insights: With user-friendly visualization tools, interfaces and no-coding platforms connected to machine learning models, it is becoming possible for even those without data science or engineering

backgrounds to run simple models and simulations when given basic training. With automated models taking care of the core analysis, there is a lower barrier on the skills needed to adopt and implement these technologies, and it becomes possible for store employees - if given the requisite training - to use them.

Standardize product codes, customer IDs and other data to enable smoother operations and supply / demand analytics: Every single product and customer should have a unique identifier – consistent across sales locations and channels – that can be used to track sales.

Enhance incentive systems to reward employees for driving omnichannel (physical and online) purchases: Structural changes to the employee incentive system could help shift attitudes of in-store employees; for example, performance indicators based on number of in-store customers that signed up to an e-mail distribution list, could motivate employees into having their customers sign to online channels rather than focusing on trying to drive only in-store sales.



Big move 6: Healthcare to lead globally on next-generation personalized, remote solutions targeting elderly care

In 2018, Japan's healthcare related GDP amounted to ¥39 trillion, accounting for approximately 8% of the nation's GDP¹⁰⁴. Digital transformation is a focus point, thanks in part to prioritization from the government: digital in healthcare was mentioned as a key principle in the 2020 report entitled *Honebutō Houshin* (Basic Policies for Economic and Fiscal Management and Reform). In addition, the 2020 COVID-19 pandemic has accelerated the shift to remote patient care. As a result, the industry is on the brink of an impending digital transformation that could yield significant socioeconomic benefits.

However, the existing healthcare system faces pressure from Japan's aging population. In effect it is a victim of its own success in delivering excellent universal healthcare and improving life expectancy. In 2018, Japan had the top life expectancy globally¹⁰⁵ and the elderly population is estimated to reach 38% of the total population by 2050¹⁰⁶. The World Economic Forum ranked Japan as the world's fourth healthiest nation¹⁰⁷; however, the aging population places increasing demands on the hospital system and intensive care. When it comes to using digital technology in managing health, only 5% of the Japanese population used telemedicine services in 2018¹⁰⁸. If disease management for certain therapeutic areas (e.g. diabetes) could further leverage digital methods, it could help reduce the burden on Japan's healthcare system and potentially improve health outcomes.

To help create a more resilient system to handle these needs, Japan's government is focused on digitization and data. The Ministry of Health, Labor and Welfare (MHLW) is creating a holistic database of claims and long-term care data; and the Cabinet Office is advancing the use of medical data backed by the Next Generation Medical Infrastructure Act, which grants access to aggregated, anonymized electronic medical record (EMR) data¹⁰⁹. The government is also aiming to make personal health records accessible through the MYNA Portal, using My Number¹¹⁰; while opening the national database to private enterprise.

Indeed, if there were a time for Japan to radically transform its healthcare industry, it is now, and digital is the key to unlocking Japan's full potential. Both industry players and the government can work in tandem to push digital initiatives across the healthcare value chain.

Potential for digitization across the value chain

The healthcare industry consists of three sub-sectors:

- Biotechnology and Pharmaceuticals: including active ingredients, OTC drugs, generic drugs;
- Medical devices: including medical instruments, medical electronic devices, wearables, and related software;
- Healthcare services and treatments: including medical labs, hospitals and clinics.

It can be broken down into two distinct value chains:

- Creating products: the value chain for the biotechnology, pharmaceuticals and medical devices sub-sectors;
- Providing services: the value chain for the healthcare services and treatments sub-sector.

¹⁰⁴ Statistical data - Social Security, Statistics Bureau, accessed November 2020, stat.go.jp.

¹⁰⁵ Sean Fleming, "Spain will soon overtake Japan in life expectancy rankings. Here's why", World Economic Forum, October 23, 2018, weforum.org.

¹⁰⁶ 2019 Revision of World Population Prospects, UN Department of Economic and Social Affairs, June 2019, population.un.org.

¹⁰⁷ Alex Thornton, "These are the world's healthiest nations", World Economic Forum, February 25, 2019, weforum.org.

¹⁰⁸ Global Views On Healthcare – 2018, IPSOS Global Advisor, 2018, ipsos.com.

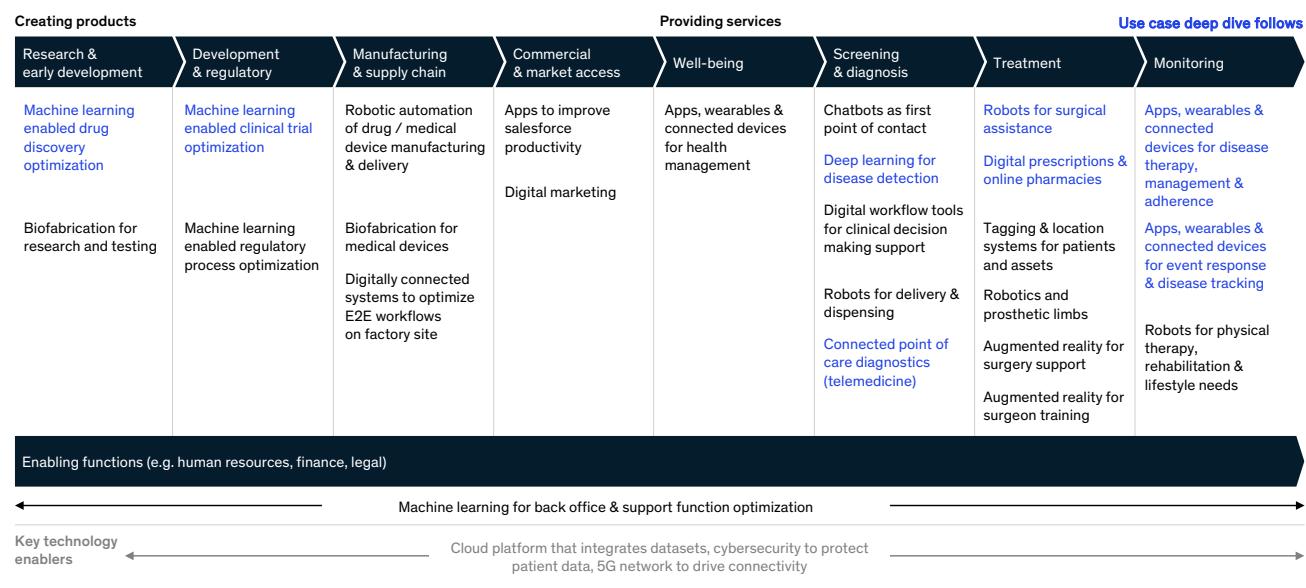
¹⁰⁹ Raymond Chan, Yusuke Nishikawa, Jan van Overbeeke, and Michele Raviscioni, *The digital imperative for pharma companies in Japan*, March 2018, McKinsey.com.

¹¹⁰ My Number is the ID number issued to all citizens and residents of Japan, and is used for social security and tax purposes.

The digital use case transformation roadmap below takes various digital technologies and identifies how to apply them to the different steps in the healthcare value chain (Exhibit 13). The exhibit represents an end-state; but getting started is key and this can be done by scaling up successes or looking to specific up-and-coming applications relevant to Japanese healthcare.

Exhibit 13:

Digital use case roadmap across the healthcare value chain



Source: McKinsey

There are four key areas where Japan can begin scaling up digital use cases in healthcare and build competitive advantages in delivering high quality, personalized outcomes catering to the needs of an aging population:

- Machine and deep learning to facilitate drug development
- Robotics and deep learning to support doctors in diagnosis and surgery
- Telehealth and online pharmacy
- Connected devices for disease management and tracking

Machine and deep learning to facilitate drug development

Machine learning enabled drug discovery optimization

Impact: reduced timeline of exploratory research phase, increased pipeline probability of success

Traditional approaches to drug discovery are costly and time-consuming, with the pre-clinical phase accounting for approximately a third of total R&D costs and taking 3-4 years to reach Phase I trials¹¹¹. Leveraging machine learning on multiple data sources can help more quickly and accurately predict biomarkers of therapeutic response and inform target selection.

In 2020, artificial intelligence raised a hypothesis that baricitinib, Eli Lilly's existing medicine to treat rheumatoid arthritis, could be used to treat COVID-19. Eli Lilly mobilized teams to research the possibility of using baricitinib for this purpose, and commenced phase three clinical trials in June 2020. The US Food and Drug Administration issued an Emergency Use Authorization to allow use of baricitinib as a part of combination therapy to treat hospitalized COVID-19 patients, marking an example of where artificial intelligence supported identification of an alternative indication for an existing drug¹¹².

¹¹¹ Arnaub Chatterjee, Sastry Chilukuri, Edd Fleming, Adam Knepp, Saif Rathore, and Joe Zabinski, Real-world evidence: Driving a new drug-development paradigm in oncology, July 2018, McKinsey.com.

¹¹² "Lilly's COVID-19 Science Leads to a Second FDA Emergency Use Authorization", Eli Lilly, November 19, 2020, lilly.com.

An example of recent success in Japan in this area is the collaboration between Sumitomo Dainippon and Exscientia to create the drug DSP-1181, for treatment of obsessive compulsive disorder. The discovery process leveraged machine learning, which expedited the exploratory research phase to under one year¹¹³.

Machine learning enabled clinical trial optimization

Impact: faster patient enrollment, reduced trial costs, increased trial probability of success

The clinical trial cycle is critical in bringing drugs to market, but is fraught with complications at each step of the way - from protocol design, to site selection, to patient recruitment - which cause delays running up to months and wasted costs running into billions of yen. Machine learning can streamline the end-to-end clinical trial cycle¹¹⁴. By integrating a wide range of both internal and external data sources - including medical claims data and past trial data from databases such as jRCT - onto a scalable cloud infrastructure, predictive and optimization algorithms can be leveraged to capture opportunities at every step: from protocol design, including endpoint and inclusion / exclusion criteria selection, to site optimization, patient recruitment and predictive quality management. Automated dashboards can provide simple visualization to allow transparent monitoring throughout the process, and enable early intervention where required. Applying machine learning to even a single step of the cycle, such as protocol optimization, can drastically reduce protocol amendments and cut time-to-market by five weeks. It should be noted that a prerequisite for applying machine learning is simple automation of the clinical trial process; the current process is paper-based and involves physical signatures on documents, and basic automation is the first step to cost savings and creating a digital foundation on which machine learning can be applied to yield further benefits.

Robotics and deep learning to support doctors in diagnosis and surgery

Deep learning for disease detection

Impact: quicker and more accurate disease identification leading to quicker intervention and higher patient survival rate

Cancer is one of the leading causes of death in Japan, and early identification is crucial to improving patient survival rate. However, interpretation of medical scans such as X-rays to find indicators of cancer requires time, expertise and extensive training of doctors, and is a space where technology can provide support. For example, during cancer research identification at the University of Tokyo in 2016, IBM's AI Watson was able to diagnose leukemia in ten minutes - a process which would have taken radiologists weeks¹¹⁵.

Deep learning can support doctors in disease diagnosis across therapeutic areas. In 2016, Google developed deep learning algorithms capable of detecting diabetic retinopathy based on retinal photographs, to support doctors in screening patients¹¹⁶. In 2018, Google further developed deep learning algorithms which could predict cardiovascular risk factors from retinal photographs, along with the risk of a cardiovascular event occurring¹¹⁷.

Robots for surgical assistance

Impact: better patient outcomes, more precise and less invasive procedures, reduced doctor burden

Japanese doctors face some of the longest working hours amongst developed countries. With the heightened risk of infection during the 2020 COVID-19 pandemic coupled with a dwindling

¹¹³ "Sumitomo Dainippon Pharma and Exscientia Joint Development: New Drug Candidate Created Using Artificial Intelligence (AI) Begins Clinical Study", Sumitomo Dainippon Pharma, January 30, 2020, ds-pharma.com.

¹¹⁴ Real-world evidence, 2018.

¹¹⁵ "IBM's Watson Detected Rare Leukemia In Just 10 Minutes", Asian Scientist, August 15, 2016, asianscientist.com.

¹¹⁶ Google AI Blog, "Deep Learning for Detection of Diabetic Eye Disease", blog entry by Lily Peng and Varun Gulshan, November 29, 2016, ai.googleblog.com.

¹¹⁷ Ibid, "Assessing Cardiovascular Risk Factors with Computer Vision", blog entry by Lily Peng, February 19, 2018.

workforce, there is a growing need to augment hospital staff. By facilitating precise outcomes that reduce complications and the need for additional care, technology can improve patient quality of life while helping to reduce hospital visits and infection risk, and freeing hospital staff and other healthcare resources. Surgical robots present a potential solution - they can assist and enhance human power for certain treatments and tasks, without risk of carrying infectious diseases. Robots have successfully completed operations such as coronary artery bypass and gastrectomy. Their potential in orthopedics is an important development in Japan, where demand for hip and knee surgery is expected to grow as the next generation of seniors will seek increased mobility and independence, as lifestyles and workstyle adjust to the aging of society.

In August 2020, Japanese company Medicaroid, a joint investment between Kawasaki Heavy Industries and Sysmex, received regulatory approval for Hinotori - the first made-in-Japan robotic assisted surgery system¹¹⁸. Participation in the growing robotic-assisted surgery market by both Japanese and global players will drive increased innovation that could position Japan as leader in this critical digitally-driven technology.

Telehealth and online pharmacy

Connected point of care diagnostics

Impact: more frequent monitoring of data, reduction of medical costs, reduction in both patient and doctor time spent gathering data due to real-time transmission

Telemedicine involves remote medical care provided when patients and doctors are not in physical contact with one another. In 2016, a successful test for telemedicine was undertaken in Nagasaki, where Kripton Co. Ltd. developed a real-time high resolution image and diagnostic data transmission system. This system involved high quality imaging devices in the remote island of Kamigoto, which were connected to Nagasaki University Hospital, and used for real-time transmission of imaging and diagnostic data¹¹⁹. Tests were carried out across therapeutic areas including gastroscopy, bronchoscopy, echography and endoscopy. The application received approval from the PMDA (Pharmaceutical and Medical Devices Agency) for registration as a medical instrument and represents a successful case of digitally-enabled home care.

Successful telemedicine requires connectivity, and technologies such as Verizon's 5G Ultra Wideband which enable smooth interactions and rapid data sharing between patients and doctors¹²⁰. Verizon 5G's low latency¹²¹ allows for near real-time data transfer and syncing, making it possible for treatments such as physical therapy to be carried out remotely through AR and VR technology.

Digital prescriptions and online pharmacies

Impact: increased prescription sales, increased adherence of customers to prescription regime, reduced adverse effects due to polypharmacy

Many retailers such as the drugstore chain Tomod's have opened up online portals where nonprescription drugs (e.g. antidiarrheal, migraine pain relief) and low-risk medical devices (e.g. hygiene products) are available for delivery. However, as of late 2020, the type of products they can provide is limited, since many drugs, including those for birth control, require paper prescriptions to purchase in Japan. Moving to electronic prescriptions would greatly augment the scope of this use case, and also enable collection of data that can be used for functionality such as automated refills.

Digital prescriptions and online pharmacy are especially crucial to Japan due to the high elderly population using polypharmacy, i.e. multiple drugs - on average 4-6 for patients above 80 years of age¹²². Adverse effects due to drug interactions can be reduced through technologies that cross-check and prevent

¹¹⁸ "Collaboration of Medicaroid, Kawasaki Heavy Industries and Sysmex for the business of the 'hinotori Surgical Robot System', a robotic assisted surgery system", Sysmex, August 11, 2020, sysmex.co.jp.

¹¹⁹ Development of the system for Telemedicine and Home health care, Japan Agency for Medical Research and Development, May 31, 2017, amed.go.jp.

¹²⁰ Chris Ashraf, "5G, five impacts: Healthcare", Verizon, February 28, 2020, verizon.com.

¹²¹ Amount of time taken for a packet of data to reach its destination across a network.

¹²² Mabuchi et al., Polypharmacy in elderly patients in Japan: Analysis of Japanese real-world databases, Journal of Clinical Pharmacy and Therapeutics, January 27, 2020, pubmed.ncbi.nlm.nih.gov.

inappropriate prescription combinations. Japan has recently made developments in the digital prescription space with companies such as Qol providing delivery service upon remote medical instruction, leveraging online consulting systems such as Pharms by Medley¹²³.

Connected devices for disease management and tracking

Apps, wearables and connected devices for disease therapy, management and adherence

Impact: increased patient adherence, lower morbidity, increased patient satisfaction, lower cost of care

With a growing elderly population, a large percentage of whom live alone, there is an increasing mental burden of having to monitor and manage treatment by oneself. Limited adherence - often caused by simple forgetfulness - can be deadly; for example, in the case of an elderly diabetic patient who forgets their insulin dosage and suffers from hypoglycemia. Wearables and other connected devices work in tandem with mobile apps to provide reminders, tracking and additional support, improving patient adherence and wellbeing.

Smart pillboxes – equipped with sensors and connected through the IoMT (Internet of Medical Things) – are another digital solution targeting medication adherence, with devices such as DEFI (Don't Ever Forget it) and Popit Sense being made available in Japan. Solutions such as tad, a secure pill dispenser developed by US-based Intent Solutions that integrates AT&T's low-power wide-area secure network, are able to provide near real-time prescription adherence data to caregivers, without needing to be paired with a smartphone or tablet. Additionally, tad can be locked and programmed to dispense only through fingerprint recognition of the intended patient at the prescribed time, minimizing accidental overdosing.

Similarly, CureApp Smoking Cessation - a joint effort between CureApp and Keio University aimed at reducing nicotine dependence - received approval in August 2020, as the first digital therapeutic in Japan, and the first to get reimbursement from the MHLW¹²⁴, based on the effectiveness of their clinical trial. The app uses algorithms to provide users with advice on how to deal with withdrawal symptoms, in response to reported cravings and physical condition.

Apps, wearables and connected devices for event response and disease tracking

Impact: reduced spread of disease through more targeted contact tracing and quarantining

The 2020 COVID-19 pandemic has seen the deployment of contact tracking apps for infectious diseases at scale to enable nationally coordinated measures, such as quarantining of individuals who have come in contact with a disease¹²⁴. These apps provide governments and healthcare providers with the data needed to mitigate and limit escalation of potentially serious contagions in a targeted manner. As a response to COVID-19 specifically, Japan rolled out a contact tracing app, COCOA, in June 2020¹²⁵. The app uses Bluetooth, and relies on Apple and Google's co-developed platform to collect data on users who have been in close contact with one another through encrypted data flagging. If a user tests positive for COVID-19, the app will notify others who have been in close contact, and this is done without storing personal information such as location data and phone numbers. Health event management and pandemic tracing apps and devices are likely to continue in use even after COVID-19 has subsided, to track and control the spread of infectious diseases.

¹²³ クオール / 全店舗でオンライン服薬指導を開始” [Qol started online medication instruction in all stores], Ryutsuu, September 3, 2020, ryutsuu.biz.

¹²⁴ Molly Bode, Matt Craven, Markus Leopoldseder, Paul Rutten, and Matt Wilson, Contact tracing for COVID-19: New considerations for its practical application, May 2020, McKinsey.com.

¹²⁵ Sam Byford, “Japan rolls out Microsoft-developed COVID-19 contact tracing app”, Verge, June 19, 2020, theverge.com.

Barriers to digital transformation

For this big move to come to realization, addressing mindsets, talent constraints, legacy technology issues or regulatory changes may be needed. A few examples are:

Regulations limit patient data sharing: Data regulations such as the APPI (Act on the Protection of Personal Information) have made patient privacy a priority. In addition to the APPI, there are two sets of guidelines from three different ministries pertaining to safety management of medical data - the MHLW's guidelines aimed at healthcare providers; and the Ministry of Economy, Trade and Industry (METI) / Ministry of Internal Affairs and Communication (MIC) guidelines for IT system providers. These guidelines require patient data to be securely handled, anonymized and aggregated, and there are specific regulations on how certified vendors may extract and use this data. However, the number of ministries involved adds an additional layer of complexity for healthcare players wishing to aggregate and leverage this patient data insightfully.

Regulations limit online pharmacy by requiring face to face visits and paper prescriptions: Article 20 of the Medical Practitioner's Act calls for providing medical care and prescriptions in person as a general rule, with limited exceptions made for online channels; while Article 9-3 of the Pharmaceuticals and Medical Devices Act requires medication instruction by pharmacists to be done face-to-face. And while the COVID-19 pandemic made it possible for pharmacists to provide online medical guidance, as of late 2020, it is still necessary for medical institutions to print prescriptions on paper, stamp them, and then fax and mail the original stamped document to the pharmacy. It should be noted there has been progress in this space, with the 2020 Honebuto Houshin noting the start of electronic prescriptions, slated for the summer of 2022¹²⁶.

Low competition and monetization opportunities limit incentive to introduce new technologies: While a single payor universal healthcare system has the benefits of enabling standardization and at-scale adoption, the absence of a competitor dynamic reduces the incentive for early adoption of new technology. Japan could actively introduce technologies for monetization, such as utilizing the innovation technologies of private medical insurance companies. Without further incentives, the monetization opportunity may be limited within the current system.

Limited opportunities for funding during clinical trial period serve as bottlenecks for medical startups: Digital solutions such as wearable medical devices must comply with the Pharmaceutical and Medical Devices Act for approval, which contains basic rules for reimbursement of devices with proven benefits in diagnosing, treating and preventing a disease. While attaining approval is a challenge in itself, it also involves long clinical trial periods, during which funding is necessary but not always easily available – a key bottleneck for many medical startups in Japan.

Paper-based processing slows down clinical core and support functions: Various processes – such as clinical trial contracts, common technical documents (CTDs), doctor records of patient data – are currently not yet fully digitized, and can still operate with paper, often requiring copying, physical hand-off, seals or signatures.

¹²⁶ Muneaki Hashimoto, "2年後に運用目指す電子処方箋も、課題は「はんこ」" [The issue for electronic prescriptions, which we aim to operate in two years, is hanko], Nikkei Business, August 19, 2020, business.nikkei.com.

Digital literacy is low among doctors and patients: Although there are services that allow doctors to manage their patient data electronically, certain doctors are resistant to and have limited familiarity with such technology. Japan's electric medical record (EMR) penetration rate in 2017 was just over 40%, compared to other developed economies such as the United Kingdom, where the EMR penetration rate was 99%¹²⁷. Indeed, certain clinics still rely on binders to store hard copies of patient information, and only take payment in cash. On the patient front as well, a certain level of digital proficiency is required to operate connected devices and apps. In 2018, a survey by Ipsos Group found that only 9% of Japanese respondents had ever used a connected health device before; 31% of respondents stated that the barrier preventing their usage was that they 'didn't know enough about them'¹²⁸. Limited knowledge on the benefits of, and how to use digital technology remains a key barrier that needs to be overcome to drive adoption.

Risk averse mindset amongst doctors and patients hinders adoption of digital tools: Hospitals and doctors are sometimes reluctant to trust digital solutions, given their sense of responsibility or fear of a mishap – such as a data breach, or incorrect classification by a machine learning model – that could result in negative consequences for their patients, and cause a loss in patient trust. Although medical device manufacturers are partnering with pharmaceutical companies and hospitals, and getting regulatory approval to mitigate some fears around using technology, changing mindsets remains a challenge; currently, there is a disproportionate focus on risk, as opposed to benefits. On occasion, even patients have displayed discomfort in having their personal data made available to government agencies. In a high-context culture that revolves around trust-based relationships, this presents a key hurdle to overcome.

Hospital infrastructure is insufficient to implement digital use cases: Many hospitals do not have high-speed, secure networks, such as 5G, to connect to digital technology; nor the appropriate cybersecurity investments in place to secure patient and other critical healthcare data, such as medical devices that are increasingly connected online, or remote diagnostics data. Such data can be sensitive and therefore needs to be set up to function in a secure digital environment.

¹²⁷ 電子カルテシステム等の普及状況の推移 [Changes in the diffusion of electronic medical record systems, etc.], MHLW, 2017, mhlw.go.jp; Health at a Glance: Europe 2020, OECD, 2020, oecd.org.

¹²⁸ Global Views On Healthcare – 2018.

Enablers for digital transformation

Enablers are strategies, mindsets, talent, technology, or regulation that need to evolve to accelerate transformation. For this move, some potential areas to address include:

Create cloud-based interoperable data platform to support safe sharing of patient data, backed by regulations and adequate cybersecurity: Development of a common healthcare data platform that leverages cloud computing could improve interoperability of different systems and give patients access to their health records irrespective of whichever clinic or hospital they use. Progress is being made, with the Cabinet Office's Law of Next Generation Medical Infrastructure, that allows certified vendors access to anonymized Electronic Health Records (EHR), and permits medical institutions to provide this data with an opt-out system in place. Additionally, there is a push from the MHLW through the Centralized Data Health Reform Plan, to make non-anonymized public health records (e.g. from Japan's statutory health checkups) available to patients, who will be granted easier access to their own data. Despite progress on data access, data standardization and interoperability still needs further action in order to maximize the value from sharing the data. The first step involves agreeing on a unified platform protected by strong cybersecurity, with defined data standards including minimum encryption and data sensitivity levels. When examining and updating regulations on cybersecurity for the healthcare sector, one example of a country that Japan can look to is the UK, which over the past few years has focused on updating rules and requirements regarding the security of its National Health Service (NHS) to help NHS organizations manage and improve their cybersecurity.

Create regulations to scale up frictionless ordering and reimbursement of online health services: Boosting remote diagnosis and treatment in a market that is almost exclusively driven by face to face interactions will be critical for scale. COVID-19 has catalyzed the change, with a near 5 times increase in the number of hospitals reporting online medical consultations between March to June 2020¹²⁹. While the MHLW has not

made these regulatory changes permanent at the time of this paper in 2020, the Prime Minister has emphasized deregulating telemedicine in his new policy so that the situation does not revert to the status quo after the COVID pandemic.

Create financial incentives for digital solution development to support pre-clinical and clinical trial period: Financial support – through subsidies, tax incentives, low-interest loans, and mechanisms for sharing and monetizing clinical trial data – to companies, especially startups, through the lengthy pre-clinical and clinical trial periods, could help offset bottlenecks to new drug and product development.

Use digital forms and signatures to eliminate the need for paper and seals across healthcare processes: Switching paper-based and hanko processes to digital submissions is necessary both to cut costs and establish a framework for further digitization efforts.

Roll out digital training for doctors, patients, and government to drive adoption of digital applications and overcome risk averse mindset: A part of the challenge related to adoption lies in the mistrust and uncertainty that stems from a limited knowledge of how to use such technologies, and their benefits. This block can be overcome through training and capability building, particularly aimed at the aging population of patients, healthcare providers and government officials. While the younger generation is likely to adopt new solutions and innovations more willingly, the older generation may require additional support to drive adoption.

¹²⁹ Haruna Futaba, “オンライン診療料の届け出、3カ月で3.4倍に” [Online notification of medical fees up 3.4x in 3 months], Nikkei Medical, August 21, 2020, medical.nikkeibp.co.jp.

Roll out pervasive, secure connectivity in hospitals nationwide to ensure seamless data transfer across the network:

A relatively straightforward opportunity is to ensure hospitals have access to secure, high-speed networks. One company that has already taken this step is AT&T, collaborating with Chicago-based Rush University Medical Center to create a 5G-enabled hospital that leverages AT&T's 5G network to support various digital use cases that are being deployed across the hospital system¹³⁰. North York General Hospital redesigned its analytics architecture around IBM's PureData System for Analytics data warehouse, integrating IBM analytics solutions to enable high quality care through daily performance tracking, trend identification and process improvement¹³¹.

Create partnerships between healthcare players and cloud / AI companies to leverage combined expertise: Innovation will require partnerships between incumbents, disruptors, academia and others. For example, Japanese pharmaceutical company Otsuka has joined forces with IBM Japan to create

digital health solutions targeting the CNS therapeutic area¹³². Through a joint venture partnership, Otsuka Digital Health (ODH) was established as an independent startup subsidiary to Otsuka Holdings and a peer of Otsuka Pharmaceuticals. Other notable partnerships include an industry-academia collaboration between Eisai and Keio University to create an innovation lab using the latest technologies for drug discovery and development related to dementia¹³³.

Convene new generation of digitally native doctors to drive digital adoption: There are doctors who have displayed more progressive and digital-friendly mindsets when it comes to adopting new technologies. However, there is no group or coalition amongst such doctors as of late 2020. Establishing such a group that provides pro-digital pressure might inspire more reluctant doctors to go digital as well. By setting an example and proving the benefits of digital technology, these doctors can help build trust in digital among their peers.

¹³⁰ "AT&T and Rush System for Health Ink Agreement to Use 5G in Hospital Setting", AT&T, January 8, 2019, att.com.

¹³¹ "North York General Hospital", IBM, accessed December 4, 2020, ibm.com.

¹³² "Otsuka Pharmaceutical and IBM Japan to set up joint venture for digital health solutions in central nervous system field", Otsuka, June 13, 2016, otsuka.co.jp.

¹³³ "Eisai and Keio university to establish a new industry-academia collaboration site", Eisai, December 22, 2016, eisai.com.



Big move 7: Financial services providers to build mobile and broad accessibility solutions by leveraging cloud infrastructure and open network

In 2018, Japan's financial and insurance service industry revenues totaled an estimated ¥23 trillion, or ~4% of national GDP. While the financial industries in other developed Asian countries grew between 4 to 9% annually from 2014 until then, Japan's financial sector growth stagnated in the same period, given near zero GDP growth combined with the low, or even negative, interest rate environment. Coupled with high costs, Japanese banks' profitability also decreased by 4.4% annually between 2014 and 2018¹³⁴.

Digital technologies can be applied in various efforts of cost reduction: for example, Natural Language Processing (NLP) and Optical Character Recognition (OCR) to reduce or digitize paperwork, Robotic Process Automation (RPA) to lower the human effort involved in various processes, and even Machine Learning for trade surveillance to ensure regulatory compliance. However, digital presents opportunities for Japanese financial players to go beyond reducing costs, and develop new revenue streams to establish global competitiveness. From a regulatory perspective, Japan is favorably positioned to digitize its financial services: with the Financial Services Agency (FSA) as the sole regulator with full regulatory control since government approval is not needed in order to authorize cloud and other technology usage, compared to other major jurisdictions where authority can be distributed across multiple agencies.

Globally, major shifts are taking place in the financial sector. For instance, in 2010 traditional banks made up 96% of the global banking and payment market, but their share has eroded to 72% in 2020 as financial and insurance tech companies (respectively, "fintech" and "insurtech") and non-bank payment firms enter the market with more innovative offerings¹³⁵. Fintech companies are transforming services across the value chain, from payments to retail banking to insurance, as new and more convenient value propositions attract the attention of investors and customers alike. As of May 2020, there were 66 fintech and insurtech "unicorns" (startups valued at over \$1 billion) worldwide, with a total valuation of more than \$300 billion. The ecosystem is thriving in most major financial markets such as the United States, the United Kingdom, and China, with 37, 8, and 5 unicorns respectively, while Japan is home to one, Liquid, a cryptocurrency trading platform¹³⁶.

Across the financial services sector, there are four key forces that incumbents can pursue to modernize the financial infrastructure for both mobile front-end services as well as digitized back-end processes:

Disaggregation. As banking and insurance products become unbundled, consumers can freely choose the best single service provider, posing challenges to incumbents' traditional revenue streams. Targeted value propositions with demonstrated opportunity for monetization creates incentives for new fintech and tech giant players to enter the financial services space.

Disintermediation. Customers can increasingly access financial services via non-banking channels. As fintech and insurtech players look to build digital "ecosystems" based on social media or e-commerce, traditional banks and insurers risk being displaced from many customer interactions.

¹³⁴ Global Banking Pools, from Panorama by McKinsey.

¹³⁵ "How the digital surge will reshape finance", Economist, October 8, 2020, economist.com.

¹³⁶ PitchBook, May 2020, pitchbook.com.

Commoditization. Increased transparency through online or mobile channels allows for easy product comparisons, making it necessary for incumbents to differentiate themselves from lower-cost offerings.

Shifting customer expectations. Catalyzed by the COVID-19 pandemic in 2020, customers are increasingly expecting more personalization, immediacy, and local delivery of key services. Financial and insurance services are no exception. Delivering on these changing expectations will likely require scalable technology, digital skills, and readily available, secured data.

Potential for digitization across the value chain

The services provided by the financial industry can be classified into six domains, from payments to banking, to insurance. The functions that enable each service take place either in the “front office”, i.e. as a customer interface, or in the “back office”, where transactions are carried out and recorded. The digital use case transformation roadmap shows applications of digital technologies across these six domains (Exhibit 14).

Exhibit 14:

Digital use case roadmap across the financial services value chain

		Use case deep dive follows					
		Customer acquisition and engagement		BI services (accounting, payroll, etc.)		Digital attacker banks	
Bank-wide solutions	Products & services	Payments	Retail banking	Wealth management	SME & corporate banking	Investment banking & capital markets	Insurance
Front office	Retail payments & digital wallets	Retail lending	Robo-advisors and personal finance management	Digital business lending	Funding/issuance platforms	Digital brokers & aggregators	
	B2B and C2B payments	Account management and personal finance	Savings-focused solutions	Digital cash management		Micro-insurance	
	Decentralized global payments with blockchain	Online marketplace lenders	Investment and brokerage platforms	FX & hedging solutions	Trade execution and algorithmic trading	New risk coverage (cyber, sharing economy etc.)	
	POS & merchant services	Product comparison solutions		B2B2C financial services		Usage-based policies with IoT	
Back office	Card products	Infomediaries and aggregators		Trade & supply chain finance	Market data & information services	Digital claims and servicing	
	Payment gateways / PSPs				Post-trade services (incl. compliance)	Digital underwriting and analytics	
						Broker/agent services	
Key technology enablers		Open Banking (APIs, etc.)	Robotic Process Automation	Cybersecurity	Core banking platforms		
		RegTech (AML & KYC)	Advanced analytics	Data processing and storage	Project mgmt. and product dev.		

Source: McKinsey

There are four key areas where Japanese banking and insurance players can begin scaling up digital use cases to shift away from legacy back-end systems and enable customer-centric services:

- Cashless and transparent payments
- Data-driven consumer products
- Automation of back-office processes
- Modernized financial infrastructure

Cashless and transparent payments

Digital wallets for cashless payments

Impact: greater ease of payment, lower operating costs, greater availability of data for customer insights

Payments have outperformed all other financial services sub-sectors for the past-decade, given several developments that have changed the payments value chain. The geographic payments center has shifted to Asia, which now captures almost half of global payments revenues, and has been growing at an annual rate of 8% between 2013-2018¹³⁷. In China, digital wallets such as Alipay and WeChat have been particularly successful in creating services for a society where use of credit card point of sales and online payments were historically limited. Alipay, originally a payment method for Alibaba's e-commerce platform, is now the largest mobile payment service, and the second largest payment service globally. In several other Asian countries, innovation in real-time domestic payments has been driven by proactive regulators. Initiatives such as Immediate Payment Service (IMPS) and Unified Payments Interface (UPI) in India, Real-time Retail Payments Platform (RPP) in Malaysia, PromptPay in Thailand, Fast And Secure Transfers (FAST) in Singapore and Faster Payment System (FPS) in Hong Kong are some examples of payment systems that were developed under the supervision of the respective central banks.

In Japan, METI estimates that the cost to maintain the current cash-based infrastructure amounts to ¥1.6 trillion annually, and is mostly borne by banks for ATM operations and cash transport¹³⁸. Digital wallets such as PayPay and LINE Pay, as well as card-less online payment systems such as Paidy, have been increasing in popularity, thanks to their value proposition of zero-fee peer-to-peer and consumer-to-business payments, easy setup for merchants, and seamless payments that do not require PIN codes or shipping addresses. A McKinsey consumer sentiment survey from June 2020 shows that the COVID-19 pandemic prompted a further shift in preferences, with nearly one in three respondents reporting decreased usage of cash¹³⁹. However, with no clear winner, the service landscape remains fragmented: for both business and consumers, this entails the need to configure and operate multiple payment methods, thus creating overheads which may outweigh the benefits of convenience and cost saving.

Decentralized global payments with cryptocurrencies and fiat currencies using blockchain technology

Impact: lower transaction cost, automated approval processing, secure transactions

Cryptocurrencies are a type of virtual currency in which transactions are verified by a decentralized system ("blockchain") using cryptography, rather than a central authority. Currencies such as Bitcoin and Ethereum allow for international payments that are fast, secure, confidential, and remove the need to manage multiple currency accounts. Not requiring institutional intermediaries, their use can result in relatively lower costs than traditional networks, and frees users from approval processes and business cut-off times. Japan is one of the largest crypto asset markets, with the FSA reporting 3.5 million users as of 2018¹⁴⁰. On the consumer side, coins can be exchanged for payment to peers and stores using Japan-based services such as Coincheck, bitFlyer, and Liquid. On the business side, some leading banks are establishing blockchain-based digital payment clearing and settlement infrastructure based on fiat currencies. JP Morgan, for example, has been working on Project Ubin with the support of the Monetary Authority of Singapore, to provide capabilities for multi-currency clearing, foreign exchange settlement, and delivery versus payment (DVP). The project aims to create a new wholesale payment rail on blockchain, leveraging JPMorgan Chase's JPM Coin offering.

Japan pioneered the crypto space by becoming the first country to legally define "virtual currency" in 2016, and local regulations on crypto assets have been praised as enabling innovation while

¹³⁷ Global Payments Map, from Panorama by McKinsey.

¹³⁸ 我が国におけるFinTech普及に向けた環境整備に関する調査検討 [Survey and examination on environmental improvements for the spread of FinTech in Japan], Nomura Research Institute, March 2018, meti.go.jp.

¹³⁹ Eunjo Chon, John Euart, David Hutchinson, and Sameer Kumar, Financial decision-maker sentiment: Japan, July 2020, McKinsey.com.

¹⁴⁰ Status report on cryptocurrency trading, Japan Virtual and Crypto assets Exchange Association, April 2018, fsa.go.jp.

protecting users. New regulations were introduced after 2014, when the Mt. Gox exchange, which handled 70% of all Bitcoin transactions, announced the theft of about 850,000 bitcoins (equivalent to approximately \$1 billion at the time). As a result, the government approved an amendment Payment Services Act, introducing a registration system for cryptocurrency exchange businesses, and subjecting cryptocurrency transactions to money laundering regulations¹⁴¹.

In October 2020, the Bank of Japan announced its plan to trial a Central Bank-issued Digital Currency (CBDC), following the launch of China's "digital yuan"¹⁴²: a CBDC has the potential to provide an official alternative to fiat currency that can help reduce the cost of cash, provide a means to enforce monetary policy, and create a standardized digital payment solution based on domestic currency.

Data-driven consumer products

Data-driven investing for broader audiences

Impact: increased investment volume, broader access to investment products, lower fees on investment services, lower operating cost through automation

With 17% of global fintechs developing easy-to-use, data-driven investment products, retail banks are facing increased competition in both the mass customers and niche segments.

Previously, wealth management and investment used to be reserved for individuals with substantial capital, financial knowledge, or the ability to hire advisors. Robo-advisory services make algorithmic trading available to a wider set of customers with different experience levels, who can invest in data-driven plans at low fees, aided by intuitive dashboards. In Japan, startups such as WealthNavi and Theo use machine learning to manage customers' finances, and most major banks have begun introducing similar services, such as Mizuho's Smart Folio or MUFG's PortStar.

Usage-based insurance policies with IoT

Impact: improved accuracy in risk assessment and consumer pricing

Insurers are starting to leverage connected IoT devices, including smartphones, to develop "usage-based insurance", where premiums are set and discounted according to the customer's behavior, from auto to health insurance. In the latter area, examples include Beam Dental, which uses its IoT toothbrush to determine brushing habits and award discounts, and the Japanese startup JustInCase, which determines health insurance premiums based on clients' lifestyle, as determined by step counts and other health factors.

Automation of back-office processes

Paperless insurance application and claim processing

Impact: shorter process time for consumers and agents, greater flexibility for consumers, greater data availability, lower chance of errors

For insurance companies, going paperless means shorter filing times and greater convenience for customers, but also faster processing times in the back-office, since the transferring and handling of digital documents can be more readily automated.

An example of paperless processes for insurance application in Japan comes from Aflac, the leading provider of medical and cancer insurance in Japan. In October 2020, it launched a new service that allows customers to complete contracts for customized life insurance products, from policy proposals to

¹⁴¹ "Regulation of Cryptocurrency: Japan", Library of Congress, July 24, 2020, loc.gov.

¹⁴² Koji Okuda, "BOJ to start trials on digital yen next year as China moves ahead", Nikkei Asia, October 10, 2020, asia.nikkei.com.

applications, fully online, helping to ensure that customers can safely meet their insurance needs from wherever they might be.

When filing claims, paperless processing reduces filing time for customers and processing time for agents, thus allowing customers to receive payments in a shorter time. Ping An, the largest insurance company in China, developed the “Ping An Auto Owner App”, which recently exceeded 100 million users. Through this service, customers report accident claims in under two minutes. A known example of a financial service player countering disintermediation by creating an ecosystem centered around broader customer needs, Ping An’s app also enables customers to request car maintenance, refueling, and other services¹⁴³.

A concerted effort from both government and firms will be necessary to create fully digital operations. One such initiative could be allowing the digitization of commonly used forms, such as reinstatement-related forms, questionnaires for data exchanges from trust banks to insurers, or payment slips used by companies to pay local taxes via financial institutions.

Instant loans with data-driven underwriting

Impact: quicker loan approval process

Retail lending has been undergoing significant changes, with new models aimed at making loans transparent and readily available. In the US, companies such as Roostify are reinventing the mortgage process with an online platform for lenders that streamlines document submission and automates underwriting, decreasing approval times and reducing operating costs. In e-commerce, micro-lending is gaining momentum: at nearly \$11 billion, Klarna is Europe’s most highly valued fintech¹⁴⁴, with a lending platform that allows shoppers to pay in installments at any online store.

Modernized financial infrastructure

From plug-n-play Core Banking to Banking-as-a-Service

Impact: faster go-to-market times and lower operating costs

“Core banking” encompasses the essential activities that banks perform, such as the processing of transactions, deposits and loans. This sub-sector is both heavily regulated and capital intensive and, while generating \$3 trillion in global revenues, typically provides a lower 5-6% return on equity. Building on top of these Core Banking Systems (CBS), banks can offer more diversified lines of business with returns as high as 20%, such as payment services and product distribution¹⁴⁵. “Banking as a Service” (BaaS) is a business model where a banking license, a CBS, and banking products are decoupled from each other, and can be offered as services by different players. BaaS can be leveraged by companies wishing to provide financial services without a banking license, such as online lenders, P2P platforms and micro-finance institutions. Moreover, it can also help banking incumbents and newcomers deploy the latest core technologies or launch fully digital banks in months, powered by RPA (Robotic Process Automation), CRM (Customer Relationship Management), and analytics. The reduced infrastructure and asset costs can give digital banks a cost advantage of up to 70% over traditional banks¹⁴⁶.

Several strong BaaS players are expanding in Asia, such as startup ThoughtMachine and more established Avaloq, with its core banking platform geared towards wealth management. The latter, after being named the best CBS provider in Asia¹⁴⁷, was acquired by NEC in October 2020, in a move to integrate digital financial services in its vision for smart cities¹⁴⁸.

¹⁴³ Ping An’s Auto Service App Ranked Top in China with Over 100 Million Users, COVID-19 Spurs Demand for Online Auto Service”, PR Newswire, April 9, 2020, prnewswire.com.

¹⁴⁴ “Klarna announces \$650M funding round to further accelerate global growth”, Klarna, September 15, 2020, klarna.com.

¹⁴⁵ “How the digital surge will reshape finance”, Economist, October 8, 2020, economist.com.

¹⁴⁶ Panorama FinTech, from Panorama by McKinsey.

¹⁴⁷ “Avaloq named Best Core Banking Platform in Asia”, February 28, 2020, avaloq.com.

¹⁴⁸ “Avaloq joins NEC for next phase of growth and accelerated innovation”, October 5, 2020, avaloq.com.

Open Banking as the foundation of new services and business models

Impact: faster and simpler integration between financial service providers

Open Banking is the use of Application Programming Interfaces (APIs) to enable integration among financial and other entities, and is a critical step to enable new use customer-centric services. Many countries are taking similar steps, including Hong Kong, Singapore, and Australia. In Japan, a recent positive signal was the Japanese government amendment to the Japan Banking Act in 2018 to promote the growth of Open Banking: the amendment called for 80 of the 140 largest banks to open APIs by mid-2020, a goal that was surpassed more than a year ahead of time. However, legislation in Japan is yet to regulate data standardization or usage fees, potentially complicating negotiations between banks and service providers: in other markets, such as the EU, the law mandates basic information be accessible for free, effectively treating APIs as essential infrastructure in order to promote cooperation¹⁴⁹. Recent examples of GMO Aozora Net Bank and MUFG launching free APIs have set a positive trend in Japan, but significant headroom continues to exist.

Cybersecurity to enable compliant operations across borders

Impact: adherence to regulatory compliance, lower total cost of ownership, increased trust in how the business operates

Financial institutions are mandated to respect stringent security regulations in order to guarantee the safekeeping of valuable assets and information. Firms that operate across multiple jurisdictions must ensure compliance with security guidelines established by the financial supervision authorities in each country of operation. For one such company operating across the Asia Pacific and Japan region, an audit firm conducted an examination of the company's network security and determined that, to comply with the guidelines, it had to make improvements to its endpoint security. Palo Alto Networks' advanced endpoint protection allowed the company to leverage Palo Alto Networks WildFire cloud-based threat analysis service to immediately reflect global threat information on all devices, securing endpoints from vulnerabilities and known and unknown malware. In addition to replacing disparate "point products" that are designed to only counter one type of threat, this type of unified solution can enable companies to meet strict security regulations and more confidently conduct business across borders. The company also successfully built trust among investors from different countries and regions with the cybersecurity solution.

¹⁴⁹ Open APIs are essential to Japanese banking innovation, Nomura Research Institute, January 24, 2020, nri.com.

Barriers to digital transformation

For this big move to come to realization, addressing mindsets, talent constraints, legacy technology issues or regulatory changes may be need. A few examples are:

Digital is underrepresented in strategic decision-making: In traditional financial companies, top management can often view long-term digital transformations as a lower strategic priority. Consequently, technology and cybersecurity experts might be tangential to strategic planning, and are rather instructed to focus on cutting costs and decreasing risk. In order to comply with such directives, software projects are usually carried out in a “waterfall” style, which focuses on delivering software according to strict specifications, with less room to test, learn, and adjust course. Such methods can regularly lead to delays, cost overruns, or inconsistent results due to time and budget constraints. When this happens, management can be quick to pause investment, creating new legacy software in the process. The final product will likely not be a cutting-edge solution, and players can miss the chance for competitive differentiation.

Legacy core banking engines under vendor lock inhibit innovation: The criticality of banking infrastructure and strict regulations have led to the creation of systems that are built for stability, rather than flexibility. Legacy software is often more expensive and time-consuming to maintain than software based on modern practices and tools: making innovation difficult as resources are diverted away from new development initiatives. A heavy reliance on systems integrators and a prevalence of highly customized, on-premise infrastructure make provisioning IT infrastructure and developing applications a lengthy and expensive process, which may create delays and complexities when integrating with external services.

Internal compliance regulations constrain scope of innovation: In order to guarantee compliance, financial institutions have established rigorous procedures and manuals which, while providing assurance on critical operations, often limit new applications, or involve longer development and approval processes for updating systems and creating new features. To facilitate innovation, other countries such as Singapore have introduced “regulatory sandboxes”, which grant relaxed legal requirements to financial institutions and fintech startups for well-defined use cases and durations¹⁵⁰: in such a system, it is possible for players to experiment with new services and models with less concern and burden of compliance in the initial phases of innovation.

Transaction networks present high costs and outdated infrastructure: Banking networks enable transactions between consumers, commercial banks, and central banks. In Japan, the major networks are BOJ-Net for central bank settlements, Zengin for inter-bank payments, and CAFIS for credit card transactions, developed and operated by a single company. Access to such infrastructure is vital, but fees and integration costs with legacy architectures can be prohibitively high for prospective newcomers, including remote access by non-residents. Moreover, the IT infrastructure supporting these networks is optimized for stability and security, but does not capture the possibilities offered by the cloud in terms of cost efficiency, operational continuity, and scalability: Zengin, for example, was only equipped for 24/7 processing in 2018, and still operates as a centralized on-premise infrastructure¹⁵¹. In 2018, a Japan Bank Consortium initiative led by SBI Ripple Asia saw the launch of MoneyTap, a new payment service based on Ripple’s blockchain technology. While still relatively small as of 2020, the application is an example of innovation in banking networks, and it allows users of domestic banks to transact instantly, at any time, and with no customer fees.

¹⁵⁰ “Overview of Regulatory Sandbox”, Monetary Authority of Singapore, August 2020, mas.gov.sg.
¹⁵¹ “The Zengin Data Telecommunication System”, Zengin, December 2019, zengin-net.jp.

Customer and product data silos hinder new development: In traditional financial and insurance companies, data can frequently be “siloed”, that is, kept separate across business units and often in incompatible formats. This separation can be the result of legacy system design but, in many instances, is actually imposed by internal company regulations. As a result, many players struggle to establish a comprehensive picture of their customers, which hinders their ability to deliver higher value services such as customized offerings and risk assessments. While cloud technology in 2020 makes it possible to create integration layers across siloed data sources to facilitate communication, it is also important that companies review their internal rules to secure sensitive customer data. For example, digital teams may need to ensure that, for every step they take to integrate data sources, they also implement security controls that limit access to that data only to certain users or devices based on sensitivity and criticality; and also continue to segregate data and networks based on level of risk or function, to minimize potential for data breaches.

Structural unprofitability and complacent competition reduce pressure to develop new digital services: With sovereign interest rates below 0% at the time of writing, and average returns on equity (ROE) for financial players under 6% in 2017, a wave of consolidation has resulted in the three mega-bank groups accounting for 90% of the industry’s revenues¹⁵². With similar revenue streams and cost structures, and fewer competitors in the market, the current strategy has been more focused on cost reduction than innovation. However, as company profits and ROEs continue to fall, and investment in local fintech startups trends upwards, incumbents are increasingly realizing the need to innovate, with early-movers well-positioned to capture a larger customer base and market share before new digital players reach critical mass.

¹⁵² Global Banking Pools, from Panorama by McKinsey.

Enablers for digital transformation

Enablers are strategies, mindsets, talent, technology, or regulation that need to evolve to accelerate transformation. For this move, some potential areas to address include:

Accelerate legacy banking and finance systems migration to the cloud in order to increase resilience, operational efficiency, and flexibility of product development:

By adopting cloud solutions, banks can not only reduce their operating costs, but also create a foundation for future development, by leveraging shorter delivery times and greater data availability. For example, Sony Bank has migrated part of its IT systems to the Amazon Web Services (AWS) cloud, achieving 50% shorter deployment times and 40–60% lower operating costs compared to on-premise solutions, and intend to migrate even the core banking systems¹⁵³. Along with efficiency gains, cloud offers the possibility to easily implement significantly more robust fault tolerance, disaster recovery options and cutting-edge cybersecurity technology, which financial players need in order to guarantee the continuity of operations and safety of critical data. Beyond banks, banking networks could also benefit from the scalability and cost savings of modern cloud infrastructure and protocols, in order to deliver even higher performance and enable parties to integrate easily.

Reorganize divisions around products to achieve greater agility and data sharing to benefit customers:

Starting from data sharing, business units can aim to coordinate their policies and technology infrastructure to create product-oriented organizations, so that cross-functional teams with shared goals can minimize external dependencies and maximize internal agility. Doing so can make it easier to automate each decision process end-to-end, rather than just portions of it: the result is optimized customer journeys with fewer development bottlenecks. As disaggregation and commoditization cause an explosion of options, customers' expectations of service quality increase. Human-centered design, supported by data analytics, could be key for players to understand their customers and create solutions that meets their specific individual needs: for example, more senior users might prefer simpler guided digital experiences, while other customers might prefer solutions that integrate in "ecosystems" familiar to them, such as wallets embedded in e-commerce platforms, or social media-based payments.

Attract domestic and international digital talent to raise the strategic importance of digital initiatives:

Cultivating in-house technology talent at all levels will likely provide players with a significant advantage in being able to migrate from legacy software, develop cutting edge solutions, and create a culture of digital-driven innovation. Having internal technology experts can also improve the software procurement process, enabling business units to define appropriate architecture requirements and control development with greater confidence. Even top management can benefit from digital education through showcases or training programs, helping them experience the real impact of digital transformations and gaining their commitment to ambitious initiatives. Given the increasing demand for highly skilled professionals, attracting international talent could be key, not only through tax and visa incentives, but also by lowering language barriers and fostering multi-cultural environments.

Foster extensive Open Banking and data flows to facilitate the implementation of broader use cases:

While the reform to the Japan Banking Act was a decisive stimulus in fostering Open Banking, issues with API standardization and usage fees still remain. Building on the progress made, Open Banking can become a novel common ground on which companies can build new and richer products, rather than a series of revenue lines for individual players. Such progress could be achieved either through further regulatory impetus that allows seamless non-resident access, or organically by incumbents adopting new business models, for example by establishing consortia for standardization and cooperation.

Explore partnerships with fintechs as well as non-financial industry players to launch innovative services and revenue streams:

While startups are natural disruptors of existing value chains, their new technology or business models often bring solutions to and freedom from cumbersome legacy systems. An example in Japan, startup Moneytree has built partnerships with numerous financial institutions to provide customers with a consolidated platform to monitor their finances, which partly helped incumbents from having to build similarly advanced features in-house. Moreover, collaborations with non-financial players could represent interesting avenues to create a larger ecosystem, such as in e-commerce, healthcare, etc.

¹⁵³ "ソニー銀行、勘定系を含む全てのシステムに AWS の利用可能範囲を拡大" [Sony Bank extending the availability of AWS to all systems, including core banking], Amazon Web Services, January 20, 2020, aws.amazon.com.

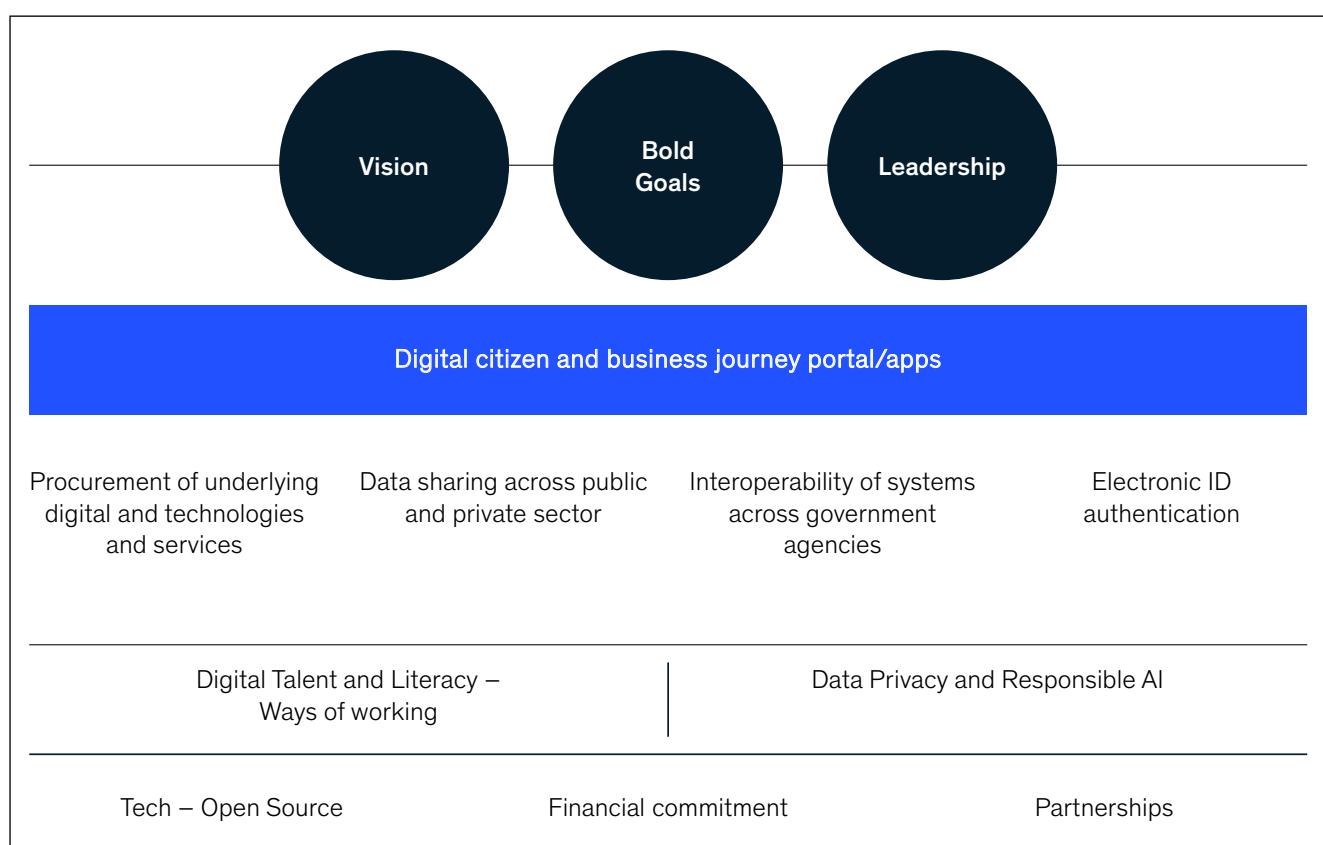


Big move 8: **Government** to define a vision and bold goals to provide digital citizen and business services

The government of Japan provides services to both citizens and businesses, and as of 2020, only 7.5% of Japan's administrative procedures could be performed online¹⁵⁴. The overwhelming majority of procedures require manual processes, physical visits to government offices, paperwork, fax machines, and hanko stamps. Some of these analog practices are pervasive. For example, according to the Information Technology Cooperative, over 95% of businesses still relied on fax machines in 2020¹⁵⁵, some of that activity related to submitting government related paperwork. At the end of 2020, Japan announced the formation of a new digital agency to take on the challenge of digital transformation.

A number of governments around the world have been succeeding at digital transformation. In both the IMD digital competitiveness index and the United Nations e-government development index several countries rise to the top¹⁵⁶. Singapore, Denmark, Estonia, and Sweden are marquee examples of smaller population countries that have pervasively driven digital. South Korea, the UK, Germany, and the US are examples of countries in the Top 10 e-government ranking that have also made significant strides in digital government. McKinsey performed a bottom-up analysis of the digital agendas of these governments, revealing some commonality in the building blocks of their success. (Exhibit 15).

Exhibit 15:
Best Practice Digital Government Agenda



¹⁵⁴ Jonathan Soble, "It's time to reset Japan's digital infrastructure", Japan Times, August 2, 2020, japantimes.co.jp

¹⁵⁵ Tomohiro Osaki, "As the new administrative reform minister, Taro Kono declares war on fax machines", Japan Times, September 27, 2020, japantimes.co.jp.

¹⁵⁶ United Nations E-Government Development Index - <https://publicadministration.un.org/egovkb/en-us/About/Overview/-E-Government-Development-Index>

Vision and Bold Goals

Across leading countries, the digital transformation journey began with a vision and some bold [numerical] goals. Having a clear vision generates buy-in and helps resolve difficult trade-offs. This vision can be oriented around either customer experience or cost efficiencies: achieving one delivers benefits for the other. The goals lay out an aspirational targets. Singapore for example, set goals to provide 100% of services offering e-payment and forms pre-filled with government verified data, and to achieve 75% of customers and businesses declaring themselves ‘very satisfied’ with e-services. Germany has gone as far as legislating the goal of moving all 575 public services online by 2022, to ensure easy access for all customers.¹⁵⁷

Leadership

Structural and visible leadership is required for success. The structural component refers to the type of organization – such as an agency – and where it sits in government. In Singapore for example, GovTech, the agency responsible for the delivery of the government’s digital services to the public, sits within the Prime Minister’s Office and is part of the Prime Minister’s personal KPIs. Leadership visibility and communication of the end-state is equally important; Sweden’s minister leading the effort spent over 250 days on the road building grassroots support.

Digital citizen and business journey portal/apps

The core thrust of government digital transformation is building applications to serve citizens and businesses. This usually comes in the form of central .GOV portals or purpose-specific apps for customers and businesses. No matter the underlying initiatives, the ultimate goal should be to digitize the citizen and business journeys, saving time and improving quality for the key stakeholders. There are notable examples of this. The UK’s Government Digital Service (GDS) developed ‘Gov.UK’ in 2012, a one-stop-shop to access e-services, which replaced ~1,700 different government websites and provides access to ~300 agencies. This has been estimated to save taxpayers £70m per year in service delivery costs.

In terms of purpose-specific apps, the Singapore government created an app called ‘Moments of Life (Families)’, to proactively support families of children aged 6 and below: it provides necessary information to parents and caregivers (including birth registration, preschools, immunization records) and is designed to improve with feedback.

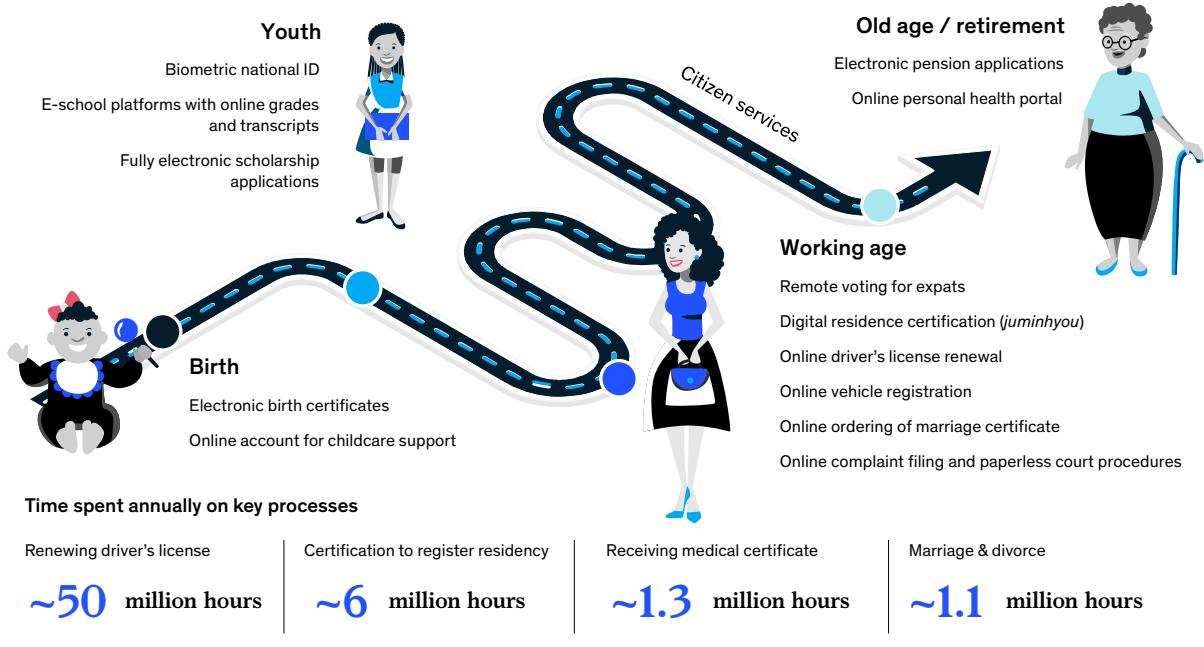
The build out of these services is often done in waves. Denmark carefully prioritized initiatives that would have very visible customer impact, and services were digitized in 4 sequential waves to eventually cover some 85 services in total. These waves progress over time, launching new services in a way designed to erode skepticism and publicize quick wins. Estonia, often touted as the top eGovernment, is a good example of executing a plan to consistently roll out new digital products. In 2000 it rolled out e-Taxes, in 2002 ID-card to access e-services, in 2005 i-voting, in 2007 Mobile-ID; a mobile version of the original ID card. Later in 2011 it launched Reporting 3.0 to help entrepreneurs accelerate the submission of data, and in 2014 it launched e-Residency. Estonia has further identified 10 focus areas to keep pace with digital revolutions and emerging technologies by moving basic services to a full digital model, with the goal of having at least 7 new services functioning in 2020.

The Japanese government has already posted some quick wins but has potential to scale further. For example, in 2017, the Cabinet Secretariat of Japan adopted Salesforce Community Cloud, Salesforce Service Cloud and Salesforce Platform to build a secure and flexible data architecture for the Myna Portal.¹⁵⁸ The Myna Portal is the government’s platform to apply for administrative services using the My Number card. This platform made it possible to improve productivity of online services while securely managing and standardizing operations across over 1,700 municipal governments nationally.

¹⁵⁷ Shaping Digitization, Federal Government of Germany, July 2018, bundesregierung.de.

¹⁵⁸ Naoki Kiyoshima, “マイナポータル「ぴったりサービス」をSalesforceで構築、アジャイル開発手法で” [Building the Myna Portal service with Salesforce], Nikkei XTech, September 21, 2017, xtech.nikkei.com.

Exhibit 16:
Digital citizen journey and time spent annually on key citizen processes



Source: McKinsey

Below we explore some examples of use cases that Japan's Government can build-out and scale for citizens (Exhibit 16) and for businesses (Exhibit 17). These include high-frequency time-consuming processes that if digitized can simplify, streamline and expedite operations for those involved.

Online account for childcare support payments

Impact: reduced administrative burden on new parents wishing to obtain childcare support

The Japanese government provides various forms of financial support for families with children, including lump-sum payments at childbirth for those enrolled under national health insurance, medical subsidies for children, and monthly child allowance payments. However, receiving each of these forms of support requires families to submit applications at municipal offices, sometimes requiring physical copies of their child's medical certificates; as well as, in the case of medical subsidies, original receipts for costs incurred for treatments. The UK, as a part of its consolidated government e-services website, allows citizens to create online childcare accounts which can then be used to obtain childcare support programs, such as yearly free childcare with approved childcare providers.

Digital residence certification (*juminhyou*)

Impact: reduced waiting and travel time for citizens, reduced processing hours for government workers, reduced paperwork

Obtaining residence certification (known as *juminhyou*) is an essential prerequisite for various other activities such as opening a bank account or starting a new job; and it often needs to be issued 30 days before a given errand, making it necessary for citizens to repeat the process several times. The process used to involve physically visiting municipal offices to fill out various paper forms, or applying for and receiving a *juminhyou* via post – typically taking between seven to ten days – but the Japanese government recently rolled a far more convenient and expedited method. It is now possible to use one's My Number card to issue and print a *juminhyou* at any of approximately 55,000 convenience stores spread across the country – and serving 740 municipalities that represent over 80% of the national population – in a process that takes just a few minutes at a self-operated kiosk.¹⁵⁹ Moreover,

¹⁵⁹ "6 advantages of the Individual Number Card", Japan Agency for Local Authority Information Systems, accessed December 3, 2020, kojinbango-card.go.jp.

certain municipalities such as Shibuya in Tokyo have rolled out chatbots, that can be used to apply for and electronically pay for *juminhyou* copies and other documents such as tax certificates through one's smartphone, via the popular LINE messaging app. After requesting and paying via LINE, citizens have to wait to receive physical copies of the documents which are mailed to their registered residential addresses. Although the kiosks and chatbots mark considerable improvements from a process based on physical visits, they still involve receiving paper copies of the *juminhyou*. A step further would involve digitizing not only the process, but the *juminhyou* itself, by making it available – and acceptable for submission – in a digital format, such as PDF, that can be instantly downloaded from an online portal.

Electronic pension applications

Impact: reduced waiting and travel time for citizens, reduced processing hours for government workers, reduced paperwork

In order to obtain pension payments, eligible citizens under the National Pension system in Japan who count as "Category I insured persons" – including the self-employed, or business operators in industries such as agriculture – need to first register themselves in person at a municipal office and submit paper forms. While the current generation of Japanese citizens receiving pensions may be accustomed to, and possibly prefer, the manual process, the next generation will be more digitally savvy, which is why it is critical for the government to begin digitizing the pension process now. Moreover, citizens currently contributing towards the National Pension are given pension handbooks and receive monthly slips in the mail informing them of their contributions, resulting in multiple pension-related documents that could be entirely digitized. An example is Norway, where pension applications can be made entirely online using the Norwegian Labor and Welfare Administration's portal, and citizens can apply electronically and receive a response within minutes. Citizens may also use the portal to get an overview of their pension earnings, calculate future pension amounts, and compare options to see how withdrawal dates and rates can affect the size of one's pension – all without having to deal with multiple slips of paper¹⁶⁰.

Online portal to enable one-day company setup

Impact: quicker setup of company, reduction in processing time for government workers

Starting a company usually requires deciding on a business structure, obtaining approval for a company name, securing the necessary capital, appointing key staff, and establishing a legal address. Streamlining this process, New Zealand reached the top of the World Bank's global DB (Doing Business) ranking for ease of starting a business.¹⁶¹ On the Companies Office website, registering a business is a one-step procedure completed in under a day.

Japan ranks 106th out of 190 countries for ease of starting a business. Registration is an eight-step process taking over 11 days, requiring interaction with seven government agencies, only three of which accept online submissions.¹⁶² Furthermore, any digitized processes have limited availability. For example, the website to initiate the registration process only operates during business hours on weekdays, combines several distinct workflows for registration, and remains incompatible with more recent computer operating systems and browsers, reducing accessibility. End-to-end digitization can help reduce the time and complexity of the process, by favoring data sharing among the agencies involved, and providing a single government interface for prospective business owners.

Online filing for corporate taxes

Impact: shorter processing time, lower volumes of physical documents, lower margin of error, reduced financial burden for small businesses

Digitizing and streamlining taxation can significantly shorten the time spent by companies on filing taxes and lower costs involved with accounting, while also enabling tax authorities to reduce processing times, costs, errors, and fraud.

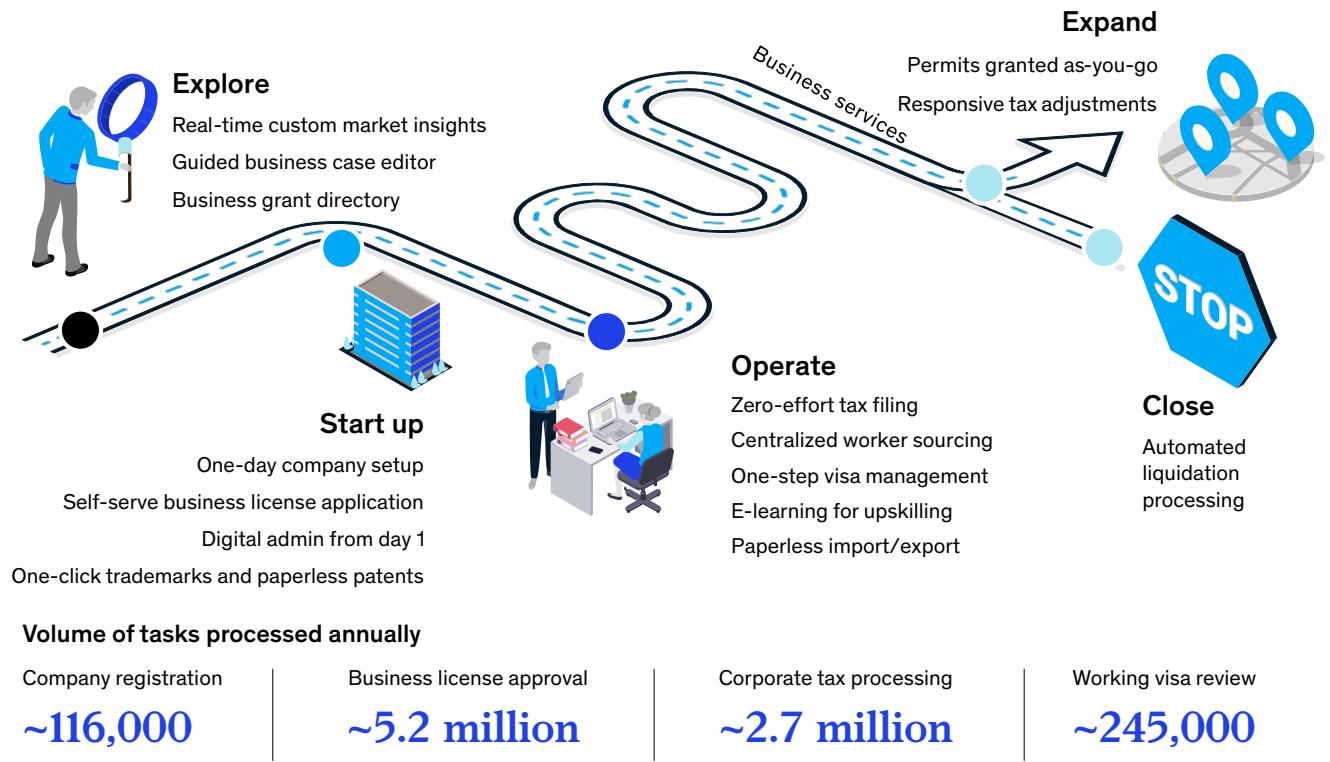
¹⁶⁰ Norwegian Labor and Welfare Administration homepage, accessed December 10, 2020, nav.no.

¹⁶¹ Doing Business – New Zealand, World Bank Group, 2020, doingbusiness.com.

¹⁶² Doing Business – Japan, World Bank Group, 2020, doingbusiness.com.

Exhibit 17:

Digital business journey and key business services processed annually



Source: McKinsey

Since 2016, companies in Japan are able to electronically file (or “e-file”) both national and local taxes, through the e-Tax and eLTAX systems respectively. The only requirements to join are a user account and an “e-certificate” consisting of an IC card and card reader. The system allows companies to submit documents at any time, provides auto-calculation for certain procedures, and removes the need to use hanko stamps and visit government offices. In the 2019 fiscal year, 87% of tax applications were filed via e-Tax, with 74% of surveyed users reporting satisfaction with the system.¹⁶³ As of fiscal year 2020, large companies (i.e., with capital above ¥100 million) are required to use online filing, in a strong push towards digitization.¹⁶⁴ However, as of 2018 only half of large companies used e-filing, possibly due to incompatibility of internal accounting systems, and difficulties with switching over to the e-Tax format.

In order to further increase its impact, fully featured e-filing systems could be made available on the web rather than via dedicated software, and access could be expanded to foreign companies, which at the moment are only allowed to file taxes on paper, since a legal residence in Japan is required for an e-certificate.

Online paperless platform for import and export of goods and services

Impact: increased volume and expedited process of trade, reduced disruptions to production schedules due to a streamlined and diversified supply chain

A truly interesting innovation is Singapore’s online platform for trade, the NTP (Networked Trade Platform), which has won several international awards. More than an online marketplace, it allows any Singaporean business to log in with a single business ID, connect with domestic and international players across the value chain, set up paperless contracts and customs declarations, organize freight shipments, monitor trade activity and integrate with third-party systems.

¹⁶³ 令和元年度におけるe-Taxの利用状況等について [Usage status of e-Tax in 2019], National Tax Agency, August 2020, nta.go.jp.

¹⁶⁴ 法人についてe-Taxが義務化されます [e-Tax becomes compulsory for corporations], National Tax Agency, June 2018, nta.go.jp.

In 2020, Japan's Ministry of Economy, Trade, and Industry (METI) announced its support of an ASEAN-wide trade digitization platform¹⁶⁵. Like the NTP, this platform, under development by NTT Data, is expected to eliminate paperwork between trading counterparties, and reduce costs associated with customs documentation, credit letter issuance, and trade insurance contracts. Businesses will also be able to avoid supply chain disruptions by searching for alternative suppliers on the platform.

Procurement of digital technologies and services

Building out citizen and business journey use cases will require procuring technology throughout the software stack, including cloud infrastructure, data warehouses, analytics or rules engines, containers, and others. There are hundreds of cloud tools available today to build applications quickly. More importantly, many of these technologies can be procured 'on demand' and throttled up or down to match the required computing power, storage capacity, or amount of users. Procurement processes that used to be about large multi-year CapEx buys have had to change to on-going OpEx buys that are flexible and adaptive. In this regard, Government may need to change, by enabling procurement through common platforms, pre-selecting cloud technology vendors to limit the broad range of technologies, and creating different structures that accommodate the new OpEx buys.

Some countries have succeeded at solving the centralized procurement challenge. Korea ON-line Eo-Procurement System (KONEPS) was created as a central portal for public procurement. The launch of KONEPS reduced bid processing time from 30 hours to <2 hours, and is one of the largest e-commerce marketplaces in the world with a total transaction volume of around U\$60B. Sweden is another example, with a common eProcurement platform that was launched as long ago as 2007.

Japan has key challenges to overcome in this domain. There are over 700+ disparate information systems across government agencies, each with different procurement and contracting processes. The current procurement process is often lengthy and complex due to selection of multiple vendors to handle different aspects of systems (e.g. design, connectivity, migration). Finally, because procurement requires technical knowledge of what is being bought, some technical know-how gaps need to be addressed to streamline and evaluate the various digital solutions.

Yet there are several initiatives to build on. For example, Japan could accelerate migration towards the Seifu Kyotsu Platform to reduce the number of disparate information systems and drive consolidation among vendors. Adopting a common platform has not yet been driven as a top-down mandate. The deployment of a one-stop procurement portal for all government needs could serve as a 'single source of truth' to access procurement data and conduct procurement processes. Digital training for procurement officials on topics such as cloud technologies, pre-selecting vendors, and involving "digital natives" as part of the procurement process can help in the transition.

Data sharing across public and private sector

In a digital world, making data accessible is critical to development. The digital world is less about data integration – which requires moving data from one location to another – and more about sharing data sets or making data accessible through Application Program Interfaces (APIs). Businesses have solved this problem by creating data-lakes with data sets that can be accessed across an organization, or by developing layers with APIs to enable builder teams to access select data.

Building a data exchange layer can achieve significant benefits for customers without requiring major IT overhauls. Estonia is a marquee example of deploying a data sharing layer that has improved customer experience with significant efficiency gains, saving the government 1,407 working years in 2018. The UK's Government Digital Service (GDS) shares ~20,000 datasets enabling data scientists and software specialists to develop new applications.

Many US cities also excel at data sharing. For example the city of Chicago makes thousands of datasets available, which citizen data scientists and developers have used to build apps, a notable example being identifying safe areas to run or ride a bike in. The city of Boston similarly shares thousands of data sets; an innovative example involved an app that used a phone's accelerometer while driving to detect where there could be potholes in the road that needed to be repaired. A final example is the city of San Francisco which also makes many datasets available, for example to track energy usage across buildings.

¹⁶⁵ "NTT Data to offer system to put trade paperwork online", Nikkei Asia, October 26, 2020, asia.nikkei.com.

This too is an area where Japan can make progress. Today data standards and requirements vary across agencies, and data is not always machine-readable or in formats that allows for joint analysis of data from multiple sources. Moreover different legal frameworks between agencies or national and local governments can create complexities regarding what data can be digitized or shared. These challenges can be addressed through many of the best practices that other governments have applied such as establishing standards for data format and data quality across data sources, deploying “data dictionaries” documenting data meaning and usage, and implementing APIs to allow for seamless but controlled access to data.

Other nations have embraced principles that Japan can emulate. An example is establishing “one source of truth” by leveraging cloud-based single sources for each data type where agencies retain data ownership and stewardship while reducing duplication of inputs. Other practices include harmonizing data protection policies to simplify secure digitization of, and exchange of, various data types; and ensuring standard privacy guarantees and appropriate access, usage, and publication rights.

Interoperability of systems across government agencies

The cloud today allows for advanced interoperability across various types of databases, middleware, and front-ends. However, there are ways to simplify interoperability by adopting common protocols or data types, reducing interoperability overhead. Fragmentation of systems and a lack of upfront agreement on data-types can exacerbate this issue. In Japan for example, disparate agencies store the same information in different characters, with one agency doing it in Katakana, another in Hiragana, and another in Kanji – requiring conversion or integration. Also different agencies use different communications protocols to communicate, making point to point connections impossible. The problem is exacerbated by strict separation of local networks and security policies, making communication and even teleconferencing difficult to coordinate.

In a future digital state, Japan eGovernment may need to develop creative solutions to the current fragmentation of IT systems and networks among agencies.

The most notable best practice example is Estonia's X-road, an interoperability platform that enables departments' systems to communicate and share data with each other, the private sector and external users, and a compulsory national digital ID. Together X-road and the digital ID make it possible to digitally sign any contract and access any public service.

Electronic ID authentication

While often touted as the main thrust of digital government, electronic authentication is but one component of it, and not necessarily a condition for success. Electronic authentication through a common ID can have user benefits, such as reducing login friction and enabling customer data sharing across various government applications. These programs have been successful in low population countries, less so in large population countries.

Singapore's SingPass is deployed in more than 60 government agencies and hundreds of services. It has an estimated 3.5 million users, some 60% of the population. The United States has Login.gov which has some 17 million users, some 5% of the US population. The UK's Gov Verify has an estimated 5.5M users, implying that less than 10% of the population are using it.

In Denmark for example, the first digital ID effort failed, necessitating a strong focus on ensuring that the second one was a success. Because a digital identity must balance ease of use and security, the Danish government chose to link the ID to bank account numbers, making it easy for users to remember since online banking is a common activity. By developing its digital ID and payments system in partnership with banks, the Danish government succeeded in creating an attractive user experience, but it had to meet banks halfway on issues such as passwords, for example by requiring smaller 6 digit passwords rather than the original 12 digit passwords proposed by the government.

While electronic ID authentication can bring user benefits, it should not be a reason to delay digitizing services, nor be seen as the silver bullet solution to digital government.

The exhibit below shows a complete picture of the types of services provided by key governments, and their approach to these underlying procurement, data, interoperability, and electronic authentication challenges.

Exhibit 18:

Case examples of government services and how they did it

	United Kingdom 	Singapore 	South Korea 
Range of services provided by e-government model	Services including those for travel, work, retirement, vehicles, residence, education, health, family and businesses	Services including those for housing, travel, public transit, parking, family, crowdsourcing, paying bills and businesses	Services including those for housing, claims, taxes, civil services, online petitions and business support
How they did it	<ul style="list-style-type: none"> Consolidated 1,700 government websites of over 300 agencies into single website Built government website using open source technology with no expensive software licensing costs Made available ~20,000 government datasets online Used GOV.UK Verify as secure way for identity authentication to access online public services 	<ul style="list-style-type: none"> Created consolidated website to deliver digital government services Created data portal for open data access with over 8,000 datasets and 100 applications Created e-procurement system, with annual transactions over \$34 billion; over 90% of all bidding done electronically Introduced SingPass to allow secure and easy access to hundreds of digital services provided by over 60 agencies 	<ul style="list-style-type: none"> Consolidated ~7,000 government services onto single website (with mobile applications for over 300 services) Managed electronically over 90% of public administrative documents Created e-procurement system, reducing average bid process from 30 to <2 hours and saving ~\$8 billion in transaction costs Launched e-residency program to pilot digital identity system

Source: Press search, government websites (gov.uk, tech.gov.sg, gov.kr), McKinsey analysis

Digital talent and literacy – ways of working

Providing citizen and business services, and addressing the underlying procurement, data, interoperability, and authentication challenges, cannot be done without digital talent at the core. To address this, governments have launched broad programs to build digital literacy and capability within their organizations. Singapore is working to create a digital-focused mindset and build digital science literacy across the whole government, by training 20,000 officers in data science and ensuring all officers have basic digital literacy by 2023. In New Zealand, digitization efforts are led by the Office of the Government Chief Digital Officer (OGCDO), and focus has been on building capabilities at all levels, with senior leaders from agencies participating in the Digital Leaders program at Harvard Business School.

Building hard skills in areas such as cloud tools and machine learning is required to understand the best options to deploy services. So is building muscle in new ways of working such as Agile and design thinking. Germany, for example, has introduced new ways of working to accelerate its digitization efforts, with ownership for different strands of service spread across federal ministries and states via ‘tandem’ teams which use digitization labs, Agile methods and design thinking to develop solutions and share results.

Data privacy and Responsible AI

Before setting out to build applications, it is important for government, citizen, and business constituencies to determine overall data privacy guidelines, as well as principles for responsible AI. On the data privacy front, the lead has been taken by the EU in the adoption of GDPR as the set of laws designed to limit violations of privacy, and enforce accountability of usage of data.

In the field of AI, specifically obtaining predictions through Machine Learning and Deep Learning can have positive consequences such as efficiency, cost savings, or improved outcomes in specific industry verticals.

There are however some uses of AI-Machine Learning which can lead to injustice, discrimination, and surveillance. Principles of Responsible AI need to be defined for applications that will have machine learning at the core. These include:

- Fairness: Avoiding discrimination across people and communities
- Accountability: Reliability, auditability, recourse avenues and procedures for redress
- Confidentiality: privacy, security, data protection, intellectual property
- Transparency: What matters to whom in terms of data, algorithms, models, and predictions

Determining Responsible AI principles is not purely a technical endeavor. Coalitions of scientists, engineers, social workers, philosophers, lawyers, regulators, concerned citizens are required to develop the right outcomes.

Technology choices

There is a broad range of technology choices to make to develop the future applications, that can be defined as where, what, and who. “Where” refers to where will information and applications be located, often a hybrid approach between the cloud and select entities. “What” refers to specific tools provided at different layers of the software stack, including databases, security layers, analytics tools, machine learning frameworks, and front-end code preferences. “Who” refers to vendors of specific pre-packaged technologies such as PaaS, IaaS, or SaaS.

An additional consideration is whether to adopt a proprietary or open-source approach: the latter can reduce lifetime maintenance cost by an order of magnitude. For example, Gov.UK was built ‘the way Amazon built Amazon’, using open source technology and an agile, iterative approach.

Financial commitment

With a coherent vision, established leadership, and a clear objective on what to build, financial commitment is of the essence. Governments across the world have committed ample resources to see digital agendas through. Singapore dedicated S\$300m to set up GovTech with further financing provided on a program-specific basis., Germany’s Ministry of Interior has dedicated €500m over 5 years to moving services online, with additional funding required from states for a total of ~€2b. This central funding pool is allocated to departments and states in tranches, tied to conditions such as using common digitization methods and monitoring progress.

Ensuring that key use cases within journeys are funded end-to-end, or that many of the underlying initiatives (e.g., simplifying procurement) are also funded end to end will be necessary to avoid partial completion, and therefore incomplete rollouts of digitized citizen and business journeys.

Partnerships

Finally, digitizing any government requires a broad set of partnerships with technology providers, advisors, trainers, and others. Successful governments have not done it alone. For example, the South Korea government partnered with companies such as Samsung Electronics, LG Electronics and others to invest in R&D and develop critical technology domestically and at a lower cost. This partnership accelerated the development of e-government programs and also led to an increase in jobs in the ICT sector.

Some governments have forged partnerships late in the process, after learning costly lessons. In 2016, the UK government started to build ‘Gov.UK Verify’, an online identity verification service, but experienced difficulties in putting this together with an identification success rate of only 47%. After spending £130m on the initiative over 6 years, the Government decided in October 2018 to cease subsidizing the program and instead transition to a private sector-led model.

Whatever the initiative, considering partners that can supplement technical or process needs can help accelerate and drive success.

Barriers to digital transformation

For this big move to come to realization, addressing mindsets, talent constraints, legacy technology issues or regulatory changes may be needed. A few examples are:

Risk averse mindsets of both government agencies and citizens discourage changes: Japan ranked 27th overall in IMD's 2020 Digital Competitiveness Ranking; one of the constituent factors of the ranking, 'regulatory framework', was rated 44th, and was a key factor dragging Japan's ranking down.¹⁶⁶ The strict regulation that sometimes impedes digitization may be an outcome of risk aversion among both government officials and Japanese citizens, along with a disproportionate focus on digital risk over benefits that shapes the regulatory environment. Citizens may not feel comfortable with the idea of their information being readily accessible to government bodies, and there have been concerns surrounding an initiative to link personal health data to citizens' My Number. Data privacy and security concerns were exacerbated in 2015 when the national pension system was hacked and over one million files of personal data were leaked. In a nation with a culture that places great value on trust, regaining and maintaining trust that data will be stored and used securely presents a considerable challenge. It requires relentless emphasis on the benefits and potential cost savings of digitization, along with a mechanism to build trust through ongoing investments in cybersecurity solutions and policies that will reduce and mitigate risk.

Agency regulations require paper-based processing: Thousands of procedures – including business applications for permits, and citizen applications for residency certificates – require a hanko stamp, a rule that in many cases is mandated by regulation or national law. This requirement for physical objects - whether they be hanko, or paper copies - reduces the potential for digital uptake. While some city governments, such as Fukuoka – where hanko usage was made unnecessary for over 3,000 types of administrative procedure documents¹⁶⁷ – have taken steps to digitize, central and prefectural government rules currently make it extremely difficult to remove hanko from all processes. Under Article 3 of the Electronic Signature Act, a certain electronic signature is presumed to have legal force to the same effect as putting a seal on the legal documents in the cases of a civil lawsuit. However, it is unclear whether cloud-based electronic signature services apply to the Article 3 of the Electronic Signature Act and have the same effect as a physical seal.

Digital literacy is low among government officials: Ranked at 46th globally, talent was the constituent factor of the IMD's 2020 Digital Competitiveness Ranking where Japan fared poorest in relation to other factors; this highlights the need for more digital-savvy employees within government ministries and agencies - people who understand both the processes and the technologies. While many digital initiatives rely on third parties and vendors for implementation (e.g. outsourcing an application to a third party), there is value in digitally empowered leadership fostering digital understanding at an earlier stage, when strategies are being conceived and planned, not just when they are being rolled out. Since so much of the existing infrastructure is based on legacy systems, many established vendors and systems integrators working with government continue to offer outdated solutions, missing an opportunity to adopt new and cutting-edge digital technologies that can be leveraged now as well as for future proposals. This is particularly crucial in cybersecurity, where threats are constantly evolving; as they become increasingly sophisticated and automated, the technologies to combat them must stay at the cutting-edge.

¹⁶⁶ IMD World Digital Competitiveness Ranking 2020, International Institute for Management Development, 2020, imd.org.

¹⁶⁷ "Japan Local Govts Advancing "Hanko"-Free Procedures", Nippon Communications Foundation, October 13, 2020, nippon.com.

Digital governance is unclear: Another barrier that will likely be addressed by the 2021 Digital Agency is the limited authority that current technological agencies (e.g. MEXT) have over other government ministries. Some governments, such as France, have solved this problem by having an overarching agency¹⁶⁸ that is in charge of coordinating certain digital inter-ministry projects and approving those with high value. It is not clear what precise role Japan's Digital Agency will play in governance: it could turn out to be a further barrier, or a key success factor.

Fragmented regional operations reduce potential impact of digitization: While this is in no way unique to Japan, insufficient coordination amongst government agencies adds an additional layer of complexity to digital transformation. Different ministries display distinct processes, initiatives and user interfaces on their websites. Practices differ even between municipal offices within prefectures: for example, certain offices such as Shibuya and Ichikawa allow *juminhyou* requests to be made via LINE; however, most others do not have such a service rolled out. Moreover, open data published or shared across different agencies is offered in different file types, and formats such as CSV, making it difficult to ingest and integrate across systems. As mentioned by Yoshihide Suga, Japan's Prime Minister, during a 2020 ministerial meeting on digital transformation, insufficient links between different systems have led to inefficiencies in governance. There is hope that the Digital Agency planned for 2021 will alleviate some of the difficulties around fragmented processes and data. Governments that have successfully consolidated operations, such as the UK – which offers the services of all government departments on a single merged website – can serve as examples of how to tackle this challenge.

¹⁶⁸ In France's case, this is the 'Direction Interministérielle du Numérique (DINUM)

Enablers for digital transformation

Enablers are strategies, mindsets, talent, technology, or regulation that need to evolve to accelerate transformation. For this move, some potential areas to address include:

Shift focus from avoiding digital risk to minimizing risk through improved cybersecurity, in order to overcome risk averse mindset of both government agencies and citizens: Japan's culture typically promotes a risk-averse environment, where attitudes towards shared and open data are less trusting than in other economies such as the Nordic states. Japanese citizens have already expressed privacy concerns about linking their My Number card with personal health data. While a cultural mindset shift is also needed, one method to alleviate concerns is through strong cybersecurity. Cyber risk must be treated as an inevitable rather than an avoidable risk - one that must be mitigated through investment in cybersecurity. Simply prioritizing data security, and viewing it as a cost center - ignoring all the benefits of open data - would impede Japan's digital potential. Improved cybersecurity and data protection systems, as well as interfaces allowing customers to securely access and view their data, will be key to creating a more trusting culture around data. In order to do so, the government could actively seek partnership with global leaders in cybersecurity, and actively communicate the established security to citizens. Recent efforts, through the introduction of the Information System Security Management and Assessment Program (ISMAP) to certify cloud services based on whether or not their security measures satisfy the ISMAP criteria, are helpful; however, many companies have expressed that ISMAP's cost of assessment is high and the current system is proving burdensome. More streamlined, less costly cybersecurity verification programs are likely to yield greater adoption and success.

Use electronic forms and signatures to fully eliminate need for paper-based processes across all government administration: An essential step is the replacement of traditional stamps and physical signatures with electronic signatures to legally validate documents. The next step to this would involve creating a national identity card that links together all citizen data, with biometric or digital verification in place; such mechanisms of 'identity as a service' have emerged in countries such as Estonia. From a business perspective, e-signatures are a necessary step towards digital notarization which obviates the need for printed documents. In the US, for example, authorized cloud services can provide e-signature functionalities to

government agencies to securely automate and speed up contract processing: in 2020, Adobe Sign was used by a state government to set up a small business relief application system in under two days, and deliver \$2 million in relief in three weeks.¹⁶⁹ It should be noted that any electronic signatures Japan adopts or promotes should ideally be harmonized and compatible across borders with major trading partners.

Augment digital talent and digital capabilities within government agencies to reduce high reliance on vendors: There is a need for 'translators' in the space - those who understand both government processes and the digital tools and technologies needed to transform them. This can be achieved by various means: digital training courses and capability building programs to build talent within government ministries and agencies; targeted hiring of graduates with digital backgrounds or degrees; and partnerships with digital companies - not just system implementation vendors, but global digital leaders - to augment digital talent from the outside. For digital proposal writing specifically, an easy win can be created by establishing a new in-house team with relevant skills. Better-written proposals would in turn push the third-party vendors and systems integrators to offer more cutting-edge solutions, through both internal capability building as well as partnerships and collaborations with leading tech companies.

Digitize high-frequency, low-complexity government citizen and business processes to demonstrate early impact: Given Japan's fragmented governmental landscape, all-encompassing horizontal initiatives (e.g. creating an exhaustive cloud database) are likely to prove both costly and time-consuming. Better to focus initial efforts on implementing a single vertical use case in a targeted geography - one that has mass appeal, is of medium difficulty in implementation, and offers immediate improvement in citizens' experience once launched. Once success has been proven in the target geography, use case implementation can be expanded. Shibuya's LINE application is a good example of a targeted roll-out of digital technology that led to a direct and immediate improvement of the citizen journey.

Establish clear digital governance amongst government agencies: While the 2021 Digital Agency could be the enabling factor for this aspect, its effectiveness was yet to be seen as of late 2020.

¹⁶⁹ Ashley Still, "Adobe announces next milestone on vision for digital modernization in government", Adobe, August 6, 2020, blog.adobe.com.

There is a clear benefit from having clear digital leadership amongst the various agencies: a central agency that can coordinate digitization efforts and take charge of budget approvals and procurement for digital initiatives, could be crucial to the overall success of the government's digital efforts.

Digitize government processes and services end-to-end with no paper or analog exceptions, to fully capture productivity gains:

While it is not essential for digital technologies to be implemented in a horizontal fashion that cuts across ministries and processes, they will be most impactful if applied consistently and coherently. As an example, some local governments had to suspend online applications for COVID-19 subsidies due to the manual labor burden involved in processing the submitted applications¹⁷⁰: even though the front-end was automated, the back-end involved printing and manual input. In order for a process to be sustainable, both front and back-end and all steps in between need to be fully digitized. Furthermore, emphasis needs to be put on not only putting technology wrappers on steps within existing business processes, but on rethinking business processes altogether. True digitization involves revamping and streamlining processes to eliminate redundancies, which is why the transformation involves a mindset shift as well; rather than surface-level automation, changes can be made on a deeper business process level as well.

Define e-government user experience standards, and user interface design principles:

While implementing individual use cases is an effective way to realize quick impact in the short run, this approach does carry the risk of complicating consolidation efforts in the long run. Setting standards and design principles up-front relating to programming languages, front end interfaces and application development will enable code-sharing, integration and consolidation down the line.

Define a secure future state cloud architecture, and back-end migration guidelines:

With over 700 information systems built by different vendors and utilizing different servers, operating systems, databases, middleware and security applications,

government agencies and prefectural offices are highly fragmented in their websites, but also in their underlying IT infrastructure. As Japan sets out to build a new wave of digital applications, it will be critical to lay out best practices for cloud architecture, which all government agencies nationwide can aspire to, in order to ensure security, compatibility, scalability and flexibility of new systems. Additionally, Japan could create guidelines on how to migrate existing legacy databases to the newly developed cloud system.

Define data governance, publish select datasets, and make secure application programming interfaces (APIs) available:

On the data front, principles on how data is collected and stored securely, including standardization of data specifications, are essential to facilitate the building of future data-based applications. To avoid large data migrations and integration efforts, APIs can play a pivotal role in providing access to required data that will enable applications in a secure way. Countries such as Singapore allow easy access to public datasets through a single website; Japan could do the same if it developed the necessary data standards, APIs, and enabling regulations for safe data access.

Consolidate and streamline the government procurement process of digital solutions:

The government of Japan has begun consolidating the procurement process through the Seifu Kyotsu Platform in an effort to reduce time, cost and administrative burden. However, more pressure from the government on agencies to migrate to the platform could help increase its adoption. The government has also begun setting out cloud service evaluation criteria that specify what elements should be considered when making a judgement on bids¹⁷¹; supplementing this with a specialized procurement team of digitally native experts is likely to speed up and improve the quality of the procurement process.

¹⁷⁰ "Tokyo 23 ward COVID-19 payment: application and payment schedule by ward", Real Estate Japan, May 28, 2020, realestate.co.jp.

¹⁷¹ 第二期政府共通プラットフォームにおける クラウドサービス調達とその契約に係る報告書を公開しました" [Report on cloud service procurement and contracts for the second phase of the government common platform released], Government CIOs' Portal, August 5, 2020, cio.go.jp.



Big move 9: Government and industry collaborate to scale smart cities, building on Japan's public infrastructure endowment

Japan is already endowed with world-class cities and infrastructure, the highlights of which include: an efficient and well-connected transport system featuring one of the world's fastest trains – the *Shinkansen*; and the world's most advanced earthquake resistant infrastructure, and earthquake warning systems such as the Japan Meteorological Agency's *Kinkyuu Jishin Sokuhou* (Earthquake Early Warning), which have been responsible for saving countless lives and averting potential disasters. Japanese cities are renowned worldwide for their safety, low crime and cleanliness. In terms of creating best-in-class cities and infrastructure, Japan has already done a commendable job. This is a solid base on which to build the next step: using digital technology to upgrade highly-developed cities into smart cities, that can better serve citizens, while protecting their privacy through enhanced cybersecurity and protocols around data handling.

Smart cities are an area where governments can work closely with industries to shape the quality of life for both citizens and businesses. Certain Japanese companies, such as Toyota, are already taking the lead in developing holistic smart cities that integrate digital across a variety of use cases. Toyota's planned 'Woven City' at the base of Mount Fuji is slated to begin construction in 2021, and house 2,000 people¹⁷². The futuristic endeavor will integrate machine and deep learning, robotics and smart homes into a connected ecosystem for new technologies. Some characteristics of the planned city include a carbon-neutral environment fully powered by hydrogen fuel cells, solar and geothermal energy; an underground network for goods delivery, power generation and water filtration; sensors integrated into buildings to monitor and assist inhabitants' daily lives; and different roads for pedestrians and self-driving zero-emission vehicles respectively. As stated by Toyota, building a complete city from the ground up represents a unique opportunity to test and further develop future technologies in this arena. Toyota's endeavor could very well pave the way for smart cities of the future, an area where Japan could establish best-in-class expertise and emerge a global leader.

Use cases across smart cities

Smart cities such as Toyota's Woven City, combine traditional infrastructure with an "intelligent" layer of connected objects. They are built on five key pillars - buildings, mobility, infrastructure, energy and public services - all of them digitally driven and enhanced. Exhibit 19 illustrates some key examples of smart city digital use cases.

An undertaking such as Toyota's Woven City incorporates multiple digital use cases to create a fully-connected digital ecosystem. However, single use cases can be introduced to 'smarten up' existing city infrastructure on an incremental basis. Below are some examples of specific use cases of connected infrastructure, which have been deployed in Japan, and other cities globally.

¹⁷² Katie Warren, "Toyota is building a 175-acre smart city in Japan where residents will test out tech like AI, robotics, and smart homes. Here's what the 'city of the future' will look like.", Business Insider, January 28, 2020, businessinsider.com.

Exhibit 19:
Digital use case roadmap for smart cities

Economic development & housing

3D printing of homes
Peer to peer accommodation platform
Online re-skilling programs

- ▼ Citizen expenditures ~ 1-3%
▲ Formal employment ~ 1-3%

Disaster management

Disaster early warning systems
Digital wireless system for emergency communications
Anti-seismic technology

- ▼ Emergency response time ~ 20 -35%
▼ Fatalities ~8 -10%

Health and safety

Telemedicine & remote patient monitoring
Lifestyle wearables
Infectious disease surveillance
Crowd management

- ▼ Disease Burden ~ 8-15%

Mobility

Real time public transit information
Predictive maintenance of transport system
Intelligent traffic signals
Smart parking
Car sharing
Congestion pricing

- ▼ Commute time ~ 15 – 20%
▼ Time spent interacting with health-care and government ~ 45 -65%

Environmental quality & wastage

Water & energy consumption tracking
Home energy automation systems
Real-time and water quality monitoring
Renewable energy usage
Waste collection route optimization

- ▼ Greenhouse gas emissions ~ 10 -15%
▼ Water consumption ~ 20 – 30%
▼ Unrecycled waste ~10-20%



Source: McKinsey

Early warning systems for natural disasters

Impact: quicker evacuations, reduced fatalities and damages to property

Early warning systems for earthquakes consist of two phases: detection and dissemination. In the detection phase, sensors pick up seismic vibrations, and algorithms, including deep learning models, use the sensor data to predict the magnitude, timing and epicenter location of an earthquake. In the dissemination phase, necessary alerts are issued to smartphones, TVs and radios, warning citizens in advance so they can evacuate. Early warning systems are crucial for saving lives, as well as reducing property damage, since some systems will cause elevators and trains to stop, or shut down the flow of natural gas in pipelines to reduce the risk of fire¹⁷³.

This is a use case where Japan excels: the world-renowned earthquake early warning system that the Japan Meteorological Agency began operating in 2007 consists of 4,000 stations across its seismic network, and has the most extensive record for earthquake early warning performance¹⁷⁴. While Japan's early warning system has played a vital role in reducing earthquake response time and increasing the survival rate, there have been instances of false alarms and miscalculations of magnitude. Public opinion in Japan remains positive – most people appreciate being notified promptly, even in the case of a false alarm¹⁷⁵ – but there is opportunity to continue developing deep learning models in the space to improve prediction accuracy going forth.

Smart signage for tourists

Impact: improved experience for tourists, more effective tourism marketing

In 2019, Cisco installed smart signage in Arashiyama station in Kyoto, a major tourist hub¹⁷⁶. Cisco's smart signage involved interactive digital touchscreens displaying nearby tourist spots and maps. The touchscreens were embedded with multiple language concierge functionality, and were equipped with sensors. In addition to providing quick information to tourists, the signage system collected data, which could be leveraged for marketing purposes.

Smart solutions to reduce energy consumption

Impact: reduced energy consumption

In Paris, smart streetlights, equipped with sensors and connected to a central control system, adjust brightness based on surroundings, including motion and presence of people. Such smart lighting can drive up to 45% reduction in energy consumption, and include enhanced functionalities such as gunshot detection sensors to deter crime¹⁷⁷. Cisco Systems has also partnered with 120 cities globally to provide a range of smart city digital solutions. An example is Copenhagen's connected digital platform that supports multiple parking, waste and environmental sensing functions, improving the citizen experience and enabling the city to achieve carbon neutrality.

¹⁷³ "Smart cities: Digital solutions for a more livable future", McKinsey Global Institute, June 2018, McKinsey.com.

¹⁷⁴ Fumiko Tajima and Takumi Hayashida, "Earthquake early morning: what does "seconds before a strong hit" mean?", Progress in Earth and Planetary Sciences, October 10, 2018, progearthplanetsci.springeropen.com.

¹⁷⁵ Ryo Yamagashi, "Early earthquake alert system remains flawed but tolerated", The Asahi Shimbun, July 25, 2020, asahi.com.

¹⁷⁶ "京福電気鉄道株式会社 - Cisco スマート シティ ソリューション 導入事例" [Keifuku Electric Railroad - Cisco smart city solution case study], Cisco, accessed December 3, 2020, cisco.com.

¹⁷⁷ Mark Halper, "Paris: No LED streetlights, but it still goes for intelligent controls", Lux Review, April 20, 2015, luxreview.com.

3D printing for construction

Impact: reduced building costs, quicker build times

Modular construction, a process where buildings and structures such as bridges are constructed off-site in sections, and then shipped to the site to be assembled, is a rising trend in the construction industry.

3D printing is a technology that can be employed in modular construction to rapidly and accurately print physical structures, using materials such as concrete, metal, resin and plastic. For example, in 2020, Japanese construction company Taisei Corporation built the country's first ever pre-stressed concrete bridge using a 3D printer¹⁷⁸. Taisei plans to further explore applications of 3D printing technology towards building structures such as pillars and beams.

Countries such as Dubai have also moved into the 3D printing space, constructing the world's largest 3D printed structure to house a municipality building; the effort required only three workers, saving considerable manpower¹⁷⁹. The government has stated the city's ambition to 3D print 25% of all buildings by 2030. Singapore - where 80% of the population lives in government buildings - is also investing in 3D printing for public housing and has established the Singapore Centre for 3D Printing to explore the feasibility of this technology¹⁸⁰.

¹⁷⁸ "Japan's Taisei Builds Bridge Using 3D Printer", February 18, 2020, nippon.com.

¹⁷⁹ Mary Meisenzahl, "This building in Dubai is the largest 3D-printed structure in the world — and it took just 3 workers and a printer to build it", Business Insider, December 31, 2019, businessinsider.com.

¹⁸⁰ Michael Molitch-Hou, "Singapore makes plans to 3D print public housing", 3D Printing Industry, February 10, 2016, 3dprintingindustry.com.

Enablers for digital transformation

Enablers are strategies, mindsets, talent, technology, or regulation that need to evolve to accelerate transformation. For this move, some potential areas to address include:

Building successful smart cities at scale involves putting together a range of digital use cases across various industries. The barriers to this are largely the same as those facing each industry. In addition, according to a report by the McKinsey Global Institute¹⁸¹, there are some overarching enablers that would catalyze smart city development, which are listed out below.

Ensure cybersecurity to protect smart city infrastructure, and address citizen privacy and security risk: Cybersecurity is a necessity for any digital use case, but even more so for smart cities, which embed digital into almost every aspect of human life. Smart cities present an extensive ‘surface area’ from which information could leak, or which hackers could attack; cities need to prioritize assets based on criticality and ensure rigorous cybersecurity is in place to protect them, before digitization is rolled out on a large scale. Moreover, plans are needed for how smart cities will respond to and communicate about any breaches in security. In addition to protecting data from external threats such as hackers, it is also critical to establish protocols and safety around data handling and protection of sensitive personal data, to ensure that the increased surveillance does not lead to intrusions into citizen privacy.

Foster public and private sector collaborations that combine smart city planning with asset development: While investment in physical infrastructure and assets is inevitable, it locks cities into long, capital-intensive plans with limited flexibility to meet changing demand. This can be resolved by supplementing such

developments with more scalable smart solutions, e.g., an on-demand smart-bus service to meet demand in far-off neighborhoods until the railway service can be extended.

Create digital feedback mechanism to continuously improve city offerings: Technology can be used to continuously collect feedback from citizens, which can in turn be used to continuously improve the functionality of public digital offerings to better serve citizen interests. By encouraging smart city residents to give feedback, smart cities also create a culture that is transparent and accountable.

Embrace an open approach to investment to support innovation and private-sector participation in smart city development: The government does not have to be the principal investor for every component of smart city infrastructure. Incentivizing private sector investment in certain elements that do not fall under the category of public goods – e.g., connected devices to monitor health, autonomous vehicles – can increase scope for investment and reduce the load on governments.

Add civic tech talent across city agencies: Smart cities can function successfully if the civic talent behind them possesses the digital know-how to understand each of the smart components in place. Teams within municipal offices that employ specific digitally-native roles such as designers and data scientists, as well as capability building programs to ensure that all smart city civic employees have a minimum level of digital knowledge, are required to run smart city initiatives to best effect.

¹⁸¹ “Smart cities”, June 2018.



Big move 10: Startup ecosystem to develop a concept-to-exit formula that produces globally scalable ventures

Startups are a critical element of economic renewal. In 2020, the US had 1,072 companies in the NASDAQ that did not exist 20 years ago, accounting for 18% of the total market cap¹⁸². An “ecosystem” that helps entrepreneurs create new concepts, fund them, scale them up, and realize their value in the market can drive significant new value creation.

In the “best of best” ecosystems, a high concentration of entrepreneurship is often the result of dynamic academic institutions with industry ties to produce highly skilled talent, networks of angel investors to mentor and support new entrepreneurs, and accelerator and incubator programs to bring together ideas, founders, investors, and talent.

The Japanese formula to produce startups has seen progress in recent years, but there is room for fine tuning. Tokyo is home to 1,200 startups, equivalent to 1 per 10,000 inhabitants. As a benchmark, Tel Aviv has 61 startups per 10,000 inhabitants, London has 17, and New York 13¹⁸³. In order to explain such difference in order of magnitude, this chapter will illustrate the key components in the formula for a thriving startup ecosystem that can produce high-value startups (Exhibit 20).

Exhibit 20:
Best in class entrepreneurship formula relative to Japan

Best of Best	Japan current situation
Entrepreneurship based on providing global solutions via software	Entrepreneurship based on providing local solutions via hardware
Founders have access to system benefits, structural incentives to attract foreign founders	Limited incentives to become a founder given risk of becoming estranged, and limited foreign founders
Streamlined company registration , incorporation, banking, real estate setup in hours	#106 worldwide for ease of starting a business; 7 agencies and 10+ days to create a business
Broad angel funding from previous generations of employees, and favorable angel conditions	Limited angel investor community given limited equity assigned to employees, leading to low recycle
Flexible financing options including SAFE, KISS, convertible notes and others with simple terms	Multiple flexible options with J-KISS and Angel Zeisei ; room to increase flexibility
High work mobility , entrepreneurship as viable career option, and international talent attractor	Low work mobility , entrepreneurship stigma, as well as limited stock option upside for joiners
Accessible VC funding for global scaling , with ability to fund late-stage software	Currently limited VC funding ecosystem focused on early stage, limited networks for expansion globally
Focus on growth and scaling to drive large valuation; IPO to drive maximum value	Early focus on profitability vs growth, and early sub-scale IPO leaving money on the table

Source: McKinsey

¹⁸² S&P Capital IQ, S&P Global Market Intelligence, November 2020, capitaliq.com.

¹⁸³ Tracxn, August 2019, tracxn.com.

Concept:

Entrepreneurship based on providing global solutions via software

As an objective, today's world-class entrepreneurs look to solve customer problems in a way that has global market applicability. While establishing a foothold in their local geography serves as a starting point, many have ambitions to scale globally. Moreover, entrepreneurs often look disproportionately to software as the underpinning of the offering, given the ability to constantly improve it in cycles and the lower scaling costs. Venture Capitalists (VC) subscribe to this logic, investing in large markets with customer needs, and in software technologies they deem strategic. For example, in 2019 and 2020, Silicon Valley VCs focused their deals on the life sciences, healthcare-tech and fintech industries, and on ventures that leveraged artificial intelligence, machine learning (AI/ML), and Software as a Service (SaaS)¹⁸⁴.

Japanese entrepreneurs tend to remain locally oriented and have limited focus on software. As of 2020, no major Japanese software company had emerged on the global scene, and data from the Teikoku COSMOS2 company database shows that fewer than only 5% of new ventures between 2015 and 2019 focused on software¹⁸⁵. While countries with economies as large as Japan naturally provide significant domestic opportunities, a global outlook is important for long-term growth, not least given the importance of succeeding in the US market. From a technology perspective, recent VC deals in Japan share some similarities with Silicon Valley, but there is still a large bias towards hardware, robotics, and drones¹⁸⁶.

Japanese entrepreneurs can change their mindset to look for big customer problems that have global market relevance and can be solved with software, not only via bespoke hardware with firmware. Japanese VCs can also evolve. Locally, they could help entrepreneurs launch SaaS companies, overcome difficulties in driving enterprise sales and accelerate local customer readiness. Abroad, they should be creating broader networks outside Japan to help Japanese startups grow internationally.

Founders:

Encouraging local founders, and attracting foreign founders

Startups need founders. Being a founder is hard: it often requires giving up job security, building a product over long nights, and digging into personal savings. Many founders choose to pay themselves small salaries or sometimes forgo salary entirely while they build out their companies. In dynamic startup countries, being a founder is a prestigious role, and despite the career choice, founders can typically rely on safety nets such as credit or unemployment insurance.

In Japan, becoming a founder can mean cutting oneself off from social benefits such as unemployment payments, parental leave or even access to credit, which tend to be restricted to permanent employees (正社員, *seishain*). Getting a home loan or renting an apartment can require three or more years of employment, almost creating an incentive for founders to stay at a large corporation while working on starting a company. Also, because some founders may not be paying into the unemployment insurance system (雇用保険, *koyouhoken*), they may not be entitled to parental leave. Being a founder can create the perception of being seen as a tax dodger. Japan may need to find ways to remove these obstacles and encourage local founders.

Attracting foreign entrepreneurs is also a key ingredient for a diverse and thriving ecosystem. For example, 51% of Silicon Valley unicorns (startups valued at over \$1 billion) were founded by immigrants¹⁸⁷; the US has several visa options for entrepreneurs, from the International Entrepreneur Rule, which grants a 30-month period of stay, to the O-1 "extraordinary ability individual" visa, which allows entrepreneurs who have raised significant funding to stay for three years.

¹⁸⁴ PitchBook, November 2020, pitchbook.com.

¹⁸⁵ 企業概要データベース COSMOS2 [Company profile database COSMOS2], Teikoku Data Bank, December 2020, tdb.co.jp.

¹⁸⁶ PitchBook.

¹⁸⁷ Yoree Koh, "Study: Immigrants Founded 51% of U.S. Billion-Dollar Startups", Wall Street Journal, March 17, 2016, wsj.com.

When it comes to attracting foreign entrepreneurial talent, Japan offers a startup visa, which gives individuals the right to reside in the country for up to 12 months as they start a business. This timeframe is hardly sufficient since it can take three to five years to get a new business to a meaningful level of activity. The visa is also limited to seven “national strategic special zones”, and business managers are required to meet several conditions, such as registering an office and raising ¥5 million or hiring two full-time employees, in order to stay beyond the startup visa’s expiry date¹⁸⁸.

Flexible policies that attract talented foreign entrepreneurs can be a way to accelerate the startup ecosystem.

Setup:

Streamlining startup incorporation and administration

Incorporation and administrative setup are a key milestone in the launch of a company. When governments simplify the process or—better still—offer support, entrepreneurs are able to complete registrations swiftly, at low cost and with minimal staff involvement. For example, in Singapore, which ranks 4th in the OECD Doing Business (DB) index for ease of starting a business, founders can register a name, apply for incorporation, and register for tax through a single website, in less than one hour. They can also sign up for employee compensation insurance through the same site in just a day¹⁸⁹. Another good example is Stripe Atlas: this service allows a founder to form a legal entity in the US, issue stock, and procure startup services online, in a matter of minutes.

In contrast, starting a company is a relatively complex process in Japan, which ranks 106th for ease of starting a business in the OECD DB report. The largely paper-based process involves seven different agencies and can extend over 11 days, incurring additional costs when specialist support is required. Local entrepreneurs often have to process volumes of paperwork to open a bank account, and to clear various credit-checks to secure real estate.

Government, banks, real estate companies need to recognize the opportunity to cater to entrepreneurs and address their processes to enable startup activity.

Funding:

Enabling early-stage Angel funding

Early-stage startups get off the ground with pre-seed and seed rounds funded by Angel investors. Angel financing is often the tail-end of a recycling mechanism. This mechanism starts with founders and engineers that worked at successful startups before, were given equity, and made enough money from a liquidity event to fund future startups.

For this formula to work, it requires startups to allocate part of their equity to employees, which will create a multiplier effect later on. In Japan this happens to a lesser extent given little equity is allocated to employees, and upon going public not enough value is created at the individual level. Going forward, startups could consider being bolder in employee distribution, which will have a multiplier effect.

Japan does have favorable regulation to incentivize Angel investing. The Angel Zeisei law, which grants income deductions for the purchase of early-stage startup equity provides an incentive to do early-stage funding¹⁹⁰. This not only happens at the individual level but at the corporate level. In a move to promote such synergies between startups and established corporates, the Ministry of Economy, Trade, and Industry (METI) established a corporate tax reduction scheme for companies investing in startups¹⁹¹. Furthermore, addressing the issue of funding concentration, METI established “women, youth, and

¹⁸⁸ “Promoting acceptance of foreign entrepreneurs”, Japan External Trade Organization, accessed December 2020, jetro.go.jp.

¹⁸⁹ *Doing Business*, World Bank Group, 2020, doingbusiness.com.

¹⁹⁰ “エンジエル税制のご案内” [Information on angel tax system], Small and Medium Enterprise Agency, accessed December 2020, chusho.meti.go.jp.

¹⁹¹ “オープンイノベーション促進税制” [Open innovation promotion tax system], METI, December 2, 2020, meti.go.jp.

senior entrepreneur support funds", which allow underrepresented population segments and less experienced entrepreneurs to access funding¹⁹².

Financing:

Ease and flexibility of financing

Another key component to financing is finance flexibility, allowing the use of a variety of instruments beyond debt and equity, such as convertible notes or promissory arrangements, in seed rounds. Startup accelerators such as Y-Combinator and 500 Startups have SAFE (Simple Agreement for Future Equity) and KISS (Keep It Simple Securities) respectively, standard contracts which allow startups to receive early funding without prolonged negotiations.

In this regard, more can be done to address ease of financing: while both Angel Zeisei and "open innovation promotion" policies have been applauded for improving incentives, they are restricted to stocks and do not include alternative financing instruments such as convertible notes, or J-KISS (the Japanese version of KISS documents). Moreover, open innovation frameworks are often tailored to the strategic needs of the investor company and risk limiting the freedom and agility of the funded startups.

Another way to enable simpler and more flexible financing would be to create an approved set of standard documents that define how capital is governed, set market norms around board membership, and in some cases serve as a template for fund creation. Government and higher education institutions could work on this to generate more frictionless financing for startups.

Talent:

Talent attraction, mobility, and entrepreneurial rewards

Talent is required to build the product. Software-driven startups do not necessarily require large teams to deliver value: Instagram, for example, had just 13 employees when it reached 30 million users and was acquired by Facebook for \$1 billion¹⁹³. But it was a high-quality team, in part attracted by the promise of entrepreneurial rewards.

Convincing future employees to join a startup can be difficult in Japan. According to the 2019 Global Entrepreneurship Monitor report, only 23% of Japanese respondents agreed that entrepreneurship was a good career choice, ranking second lowest in prestige among all the countries surveyed¹⁹⁴. Given the limited pool of digital talent in Japan, the bench of professionals willing to join startups by leaving stable industry roles is even smaller.

Employee mobility, or the liquidity of the Japanese labor market, is low. Multiple factors contribute to this including the perception that moving from company to company runs counter to the valued tradition of lifetime employment. Additionally, many employees in large companies often opt to "level-up" in seniority rather than take a risk. Finally, there are structural elements, such as the practice of allocating a significant portion of employee compensation to annual or biannual bonus payments, which, acting as "deferred salaries", constrain mobility. An additional disincentive is the difficulty in porting pension schemes to a new company, which can require significant paperwork; in the case of corporate defined contribution programs, funds may even be cancelled if a future entrepreneur leaves before serving three years with their current employer.

As more examples of successful ventures emerge, the social attractiveness of startup jobs is bound to increase, garnering more interest from new graduates and experienced workers alike. However, structural elements need to be addressed to incentivize workforce mobility.

¹⁹² "女性、若者 / シニア起業家支援資金" [Women, Youth / Senior Entrepreneur Support Funds], METI, May 13, 2014, meti.go.jp.

¹⁹³ Adam Putz, "M&A flashback: Instagram joins Facebook in \$1B deal", PitchBook, September 11, 2018, pitchbook.com.

¹⁹⁴ GEM 2018/2019 Global Report, GEM Consortium, January 21, 2019, gemconsortium.org.

Entrepreneurial rewards are often the counterweight for risk or the stigma of career choice. Startups in markets such as the US offer upside in the form of Restricted Stock Units (RSU) or Stock Options (SO) at early stages. These compensation packages help companies retain liquidity while holding out the prospect of high returns for employees depending on future performance.

The Japanese government has been encouraging wider use of stock options, by letting startups use them as compensation for external experts and employees¹⁹⁵: such solutions often benefit both parties, allowing companies to retain liquidity and professionals to reduce their taxable income. One potential barrier regarding options is that in many markets, taxes are due when options vest, whereas in Japan taxes are due when options are issued or granted, creating an up-front tax burden for many, or discouraging use of options altogether.

One further enabler for attracting talent will be a more widespread understanding of the high potential value of equity as a means of compensation: at university, career counselors and startup clubs can provide such education, while future examples of early employees finding success will also help improve the public image of startups.

Scaling:

VC funding to scale globally

As startups grow, they often rely on successive rounds of funding for liquidity, rather than the cashflow they generate themselves. This allows them to focus on achieving higher growth and capturing larger market share, before needing to optimize costs for long-term profitability. Access to series A, B, and C funding within a rich VC ecosystem is a critical component in sustained growth.

Access to VC capital is key to scaling, and major startup clusters have broad VC ecosystems. As of 2020, Silicon Valley counted over 2,600 VCs for a total of \$552 billion in funds, corresponding to 68% of the Bay Area's GDP. In other major clusters such as New York, London and Beijing, available funds correspond to about 30% of the region's GDP, at \$454 billion, \$227 billion, and \$171 billion respectively. The Tokyo VC landscape is more modest compared to its international counterparts, with 233 funds accounting for \$35 billion, corresponding to only 3% of the prefecture's GDP¹⁹⁶.

In Japan, the availability of funding has been growing steadily, with the total capital invested in startups increasing by 23% per year between 2015 and 2020. However, while funding rounds B or later have captured the majority of capital invested in this period, over 70% of deals have been early-stage funding as opposed to later stage scale-up funding¹⁹⁷. With a focus on driving more software startups in the future, a stronger follow-on funding VC funding ecosystem may be needed. Software companies have low startup costs but are expensive to scale. Often, they burn large amounts of cash as they need to frontload customer support and sales, and revenue comes in later. The current VC landscape in Japan is not yet structured to underwrite big cash burns, which drives companies to grow organically over a long time without funding, or to go public early, reducing maximum growth.

¹⁹⁵ 社外高度人材に対するストックオプション税制の適用拡大" [Expanded application of stock option tax system to highly skilled personnel outside the company], METI, October 7, 2020, meti.go.jp.

¹⁹⁶ PitchBook; Tokyo Metropolitan Government, 2020; US Bureau of Economic Analysis, 2020; Beijing Municipal Bureau of Statistics, 2020; UK Office for National Statistics, 2020.

¹⁹⁷ PitchBook.

As for international expansion, conversations with investors reveal that Japanese startups are often not aware of the nuances of operating in international markets, or the need to hire local leadership that understands the culture and can adapt to different expectations on work style and compensation. In order to increase the likelihood of success, Japanese companies could secure funding and expertise from investors in the target markets to build their foreign presence.

Finally, it also has to be said that the English language is a barrier that many Japanese entrepreneurs will have to overcome if they are to succeed in global expansion.

Exit:

Maximizing value versus exiting early

Between 2015 and 2020, the US witnessed 706 VC-backed IPOs: in this period, the average amount raised in an IPO was \$208 million, and in 2020 the average reached \$298 million. VC-backed companies that have gone public have created an enormous amount of value, totaling an aggregated market capitalization of nearly \$12 trillion, 31% of the total market¹⁹⁸.

In Japan, startups are going public too early. Startups appear to aim for early profitability rather than driving growth. Between 2015 and 2020, 255 VC-backed companies went public, raising just \$49 million in average¹⁹⁹. For contrast, GitHub's first round of funding in 2012 was \$100 million for a \$1 billion valuation, and it was later acquired for \$7.5B by Microsoft²⁰⁰.

There are several reasons why Japanese companies are going public prematurely. First, the relative scarcity of funding in follow-on rounds can push companies to try to tap into the public market at an earlier stage to raise funds. Second, Japanese VCs and CVCs may seek a liquidity event for companies in their portfolio before the funds mature, in order to achieve high performance; this may result in pressure on startups to IPO. Third, public companies provide prestige and perceived employment stability: by going public, startups may find themselves in a better position to attract talent, as well as contribute to the image of the VCs they are supported by.

Japanese startups can establish a global mindset upstream, but they should also evaluate the value left on the table from going public early as opposed to building up scale, valuation and access to large global markets.

¹⁹⁸ Ibid.

¹⁹⁹ AVCJ Database, AVCJ Research, January 2021, avcj.com.

²⁰⁰Dana Olsen, "The big winners from the GitHub acquisition", PitchBook, June 4, 2018, pitchbook.com.

In summary, to create a more global, dynamic, and rich startup ecosystem, a few adjustments to the “Japanese Startup formula” could be addressed:

1. Mindset shift for entrepreneurs and advisors to tackle customer problems with global market relevance and lead with scalable software offerings
2. Support for local founders by providing access to employment system benefits, and attracting foreign founders
3. A streamlined incorporation process and administrative setup; from registering, to setting up banking, to securing real estate
4. Expanded incentives for Angel investing
5. Creation of standard mechanisms for frictionless capital raising, and added flexibility in existing mechanisms
6. Higher work mobility with entrepreneurs leading the way, and system enabling portability of benefits from large employers to startups
7. Broader VC ecosystem with enough firepower to do late-stage financing and underwrite global software startups
8. Startup focus on growth, share gain, and global relevance; aim at IPOs to capture maximum value rather than focus on early profitability resulting in early sub-scale IPOs



Big move 11: Systems integrators and technology providers to help their clients accelerate transformation, by building talent in the core and leveraging global best practices

Japanese systems integrators (SIs) such as Fujitsu, NTT Data, NEC and Hitachi, as well as technology companies, are a large and integral part of Japan's services sector. In 2017, Japanese SIs generated \$230 billion in revenue, accounting for 44% of B2B ICT spending in 2017²⁰¹, and employed 72% of Japan's IT talent²⁰². These companies manage some of the major technological infrastructure nationwide, including the government's My Number Card System, and various core banking systems for banks such as Mizuho. Due to their structural position in various industries, many of which rely on proprietary hardware, SIs will play a critical role in the impending digital transformation of Japan.

The clients that SIs serve will increasingly be looking to enable specific digital outcomes or use cases such as machine learning enabled defect detection in industrial manufacturing; deep learning to detect diseases in healthcare; and chatbots facilitating citizen services such as document registration for digital governance. Client expectations will be to deploy these outcomes across the full stack, from infrastructure, connectivity, security, analytics, and applications – in cloud environments which allow provision of all these services with high flexibility and scalability.

Changing B2B client preferences are leading to a fundamental shift in IT spending in Japan. The spend in traditional Japanese IT Services is expected to decline over the next three years, from 73% of the total spend in 2020, to 50% by 2023²⁰³. Taking its place is the growing spend on digital products and services such as cloud services, which are expected to grow from 27% of total spend to 50% in the same period²⁰⁴.

SIs shifting to the cloud and bringing their clients along will be paramount. In 2019, the introduction rate for cloud computing services amongst Japanese enterprises surpassed 60% for the first time²⁰⁵. With multiple competitors offering quick and easy ways for enterprises to move to cloud, SIs could transform to maintain their position as part of the technology backbone of Japan's industries.

The education system, industry, and government all may need to build a broad range of use cases across their value chains, and this represents a significant opportunity for SIs to get involved and drive the digital agenda. To seize this opportunity, SIs may need to: evolve their strategies to deliver digital outcomes rather than stand-alone technologies; assist their clients' transition away from legacy systems and into modern cloud-based applications; select where in the tech stack to build their own proprietary offerings from scratch as opposed to establishing partnerships or performing acquisitions; and engage in digital talent development within their organizations while supporting clients in capability building.

Evolve strategies to deliver digital outcomes for customers versus stand-alone technologies

Enterprises look at digital as a set of use cases with a business outcome. Retailers are looking to drive omnichannel transformations; manufacturers to establish digital factories; banks to move into mobile contactless banking; clinics to provide telemedicine services. For enterprises, digital is not a single technology in the stack, such as a data-center, a security layer, or an analytics engine. While these technologies underpin outcomes, as stand-alone technologies they will not be enough to capture the value for enterprises.

²⁰¹Gupta et al., Forecast: Enterprise IT Spending by Vertical Industry Market, Worldwide, 2016-2022, 1Q18 Update, Gartner, April 30, 2018, gartner.com.

²⁰²*Information and Communications in Japan 2017*, Ministry of Internal Affairs and Communications (MIC), 2017, soumu.go.jp.

²⁰³国内ITサービス市場予測を発表 [Domestic IT service market forecast], IDC, February 17, 2020, idc.com; 国内プライベートクラウド市場予測を発表 [Domestic private cloud market forecast], IDC, October 19, 2020, idc.com; 国内エンタープライズIT市場予測を発表 [Domestic enterprise IT market forecast], IDC, May 14, 2020, idc.com.

²⁰⁴国内プライベートクラウド市場予測を発表 [Domestic private cloud market forecast], IDC, October 19, 2020, idc.com.

²⁰⁵FY2019 Communication Usage Trend Survey, MIC, May 29, 2020, soumu.go.jp.

There are thousands of cloud technologies available to build, which is why driving outcomes is what matters most, and can prove to be a point of differentiation for SIs, if they can pivot their strategies from selling stand-alone technologies to enabling use cases. Rather than approaching their clients with a product mindset, SIs can become technology partners that bring to clients the best of global innovation in the digital space; essentially shifting their role from systems “integrators” to “outcome hyper-scalers” – constantly evolving and helping their clients evolve and scale up their systems to enable more and more use cases.

In order to achieve this, SIs can consider structuring their offerings around digital outcomes, such as enabling a host of data-centric use cases that require an integrated data warehouse to function, rather than selling the idea of specific enabling technologies, such as a stand-alone data warehouse for its own sake.

Modernize legacy systems and transition to cloud based applications

Legacy systems are often stable and fulfill their job at the expense of flexibility and scalability. Since they are often written in older programming languages, it is hard to find programming talent, which limits adding features or makes doing so expensive. These systems are also often difficult to integrate with newer systems and technologies. Cloud platforms overcome many of the challenges surrounding legacy systems in that they are agile, scalable, and can be easily integrated with other technologies.

Despite the superior benefits offered by cloud technologies that have been broadly available over the past 5-10 years, legacy systems are still prevalent in Japan. Including partial use, more than 85% of Japanese enterprises were still using legacy systems as of 2018²⁰⁶. Usage is especially high in the finance sector, with over 95% of enterprises using legacy systems to some extent²⁰⁷. Some of these are written in 60-year-old programming languages such as COBOL, running to as many as 50 million lines of code. There is a palpable need for organizations to modernize, and SIs can support the transition to cloud to create more scalable and flexible applications over the next decade.

Choose where in the tech stack to build versus partner or acquire

The stack of technologies required to deliver digital outcomes includes infrastructure, cybersecurity, connectivity, data storage, analytics, machine learning, APIs, and front-end interfaces among others. Today there are companies specializing in technologies in all layers of the stack. SIs may need to make strategic choices on what to leverage, what to own, or what to buy. Partnerships with large international players such as AWS, Microsoft Azure and Google Cloud can accelerate the move in key areas of the stack.

For example, NEC Corporation partnered with AWS in 2020 in a Strategic Collaboration Agreement²⁰⁸. With AWS’s support, NEC is developing a suite of cloud services to accelerate digital transformation among government and enterprises, with a range of solutions encompassing migration, integration and consulting. NEC also, in 2020, acquired Avaloq, a European fintech provider, in a deal that will allow NEC to combine Avaloq’s cloud services with its own biometrics and data analytics, to provide digital solutions to financial institutions and governments²⁰⁹. By being deliberate about where in the tech stack to build versus partner or acquire, SIs can optimize their resources and offerings to best serve clients across multiple use cases.

Cultivate digital talent within SIs and helping clients with capability building

A successful digital transformation requires digital talent. The type of roles required to do this include product managers, full stack developers, Agile coaches, designers, data engineers, machine learning engineers and cybersecurity engineers. Cultivating this talent is another opportunity for active engagement by SIs. First, they can build digital capabilities within their organizations, by re-skilling their own employees – who have the requisite skillset base to quickly pick up and learn new technologies –

²⁰⁶ITシステム「2025年の崖」克服とDXの本格的な展開 [*Overcoming the IT System “2025 Cliff” and full-scale deployment of DX*], Ministry of Economy, Trade, and Industry, March 2019, meti.go.jp.

²⁰⁷Ibid.

²⁰⁸“NEC signs Strategic Collaboration Agreement with AWS – a first-of-its-kind in Japan”, NEC, November 13, 2020, nec.com.

²⁰⁹Makiko Yamazaki, Sam Nussey, “NEC to buy Swiss software firm Avaloq for \$2.2 billion”, Reuters, October 5, 2020, reuters.com.

in areas such as deep learning, and new ways of working such as Agile methodology. Through trainings and capability building programs, SIs can expand the roles of their existing employees to cover new roles such as product management.

As SIs cultivate their existing talent, they can build capability for their clients as well. Digital transformations require companies to employ talent in their core operations rather than fully outsourcing – a model reserved for IT infrastructure and legacy software. SIs can help if they expand the scope of their relationships with Japanese enterprises, taking on roles mapping out digital agendas, canvassing use cases, and building digital literacy at the management and executive level.

In conclusion, Japanese SIs could modify their business models to remain competitive in a digital world and help their clients make the transition. Because these SIs are embedded in many industry verticals, and have developed deep relationships and knowledge of client operations, they are in a unique position to influence these outcomes. However, if SIs opt out of driving the digital transformation agenda and staying updated on the newest technologies, they face an existential threat. Clients could dislodge their entire proprietary infrastructure, data, and applications, by picking a combination of ‘best of breed’ cloud products that are all readily available today. In one recent example, a retailer replaced a full-stack of legacy hardware and software with cloud infrastructure from one provider, a data platform from another, an e-commerce platform from another, and multiple digital marketing technologies. There is nothing stopping enterprise from building up their talent, and optimizing their technology stack right now.

At this moment, it is a race between enterprises building talent and digital literacy in the core on the one hand, and incumbent SIs building outcome-based offerings on the other. SIs need to encourage themselves to build the future they want, rather than trying to prevent the future they fear. All they need is the will to transform.



Roadmap 2030: summary of recommendations

Japan's 2030 digital scorecard

Over the next decade Japan may need to make exponential advances in many areas to restore digital competitiveness. The roadmap from today is dotted with important milestones.

By 2025 Japan may need to have stopped its productivity decline and climbed to Top 15 in digital competitiveness. It may need to double its digital talent base by then to enable creation of use cases and applications in the major sectors such as industrial manufacturing, retail, and healthcare – all of which offer immediate opportunities. To set an example, the government may need to have digitized at least half of its citizen and business journeys.

By 2030, Japan may need to have more than tripled its digital talent base, and achieved double-digit penetration metrics in industry sectors. Sixth-generation secure connectivity should be mainstream, and incumbent industry sectors and government may need to be digital at scale. Equally important, a refreshed start-up ecosystem may need to have taken hold, with new ventures representing at least 25% of market cap.

While these goals seem bold, some may say unattainable, Japan has more than enough intrinsically smart people and endowments to build a digital future. And all the major use cases that need to be built across industry and government have existing proof points either in Japan or globally – and the technologies are proven and available. Will and the attainment of skill are all that is needed. Exhibit 21 shows potential scorecards for 2025 and 2030 that Japan can aspire to.

Exhibit 21:

How Japan's digital scorecard could evolve between 2020 and 2030

Objectives	Metric	Japan 2020	Japan 2025	Japan 2030
Digital and global competitiveness	Total factor productivity (5 year average % growth)	-0.11%	0%	>0.5%
	Digital competitiveness - IMD ¹	27	Top 15	Top 10
Digital talent	Universities with software-related programs	29	100	>200
	Digital talent ² as % of workforce	1%	2%	3%
Digital industry	Industrial Mfg.: Lighthouse 4.0 factories - WEF	2	10	30
	Retail: e-commerce penetration	9%	20%	>30%
	Healthcare: telemedicine penetration - IPSOS	5%	20%	40%
	Finance: % mobile banking penetration	6.9%	25%	>75%
Digital government, infrastructure	Government: % citizens using digital govt. apps	7.5%	50%	>90%
	Smart city ranking - IMD	#79 (Tokyo)	1 in top 20	3 in top 20
Digital technology and leadership	Public cloud spend (% of IT spend)	3%	25%	50%
	% of global published AI conference papers	6%	9%	12%
Startup economy	Startup market cap as % of total market cap	1%	10%	>25%
	# of unicorn startups ³	5	20	76

1. IMD World Digital Competitiveness Ranking measures the capacity and readiness of 63 economies to adopt and explore digital technologies as a key driver for economic transformation in business, government and wider society.

2. Engineering talent including software engineering, data engineers, and developers. Excludes consultants, project managers and process related occupations.

3. Companies with a valuation >\$1B, including public companies that received such valuation before IPO: Mercari, Preferred Networks, SmartNews, Liquid, Playco.

Source: McKinsey, McKinsey Global Institute, IMD, WEF, Gartner, Stanford HAI's Global AI Vibrancy tool, press search

These targets involve over 90 use cases across thousands of companies to facilitate Japan's digital transformation and some 50 enabling recommendations to catalyze implementation. The startup ecosystem and systems integrators have an enormous stake in making this happen.

While we have projected some milestones in 2025, there are no major constraints on executing use cases and recommendations today, other than talent, funds, and executive focus. These things could be achieved in a shorter timeframe with bold action. A key issue is how to get started. We have developed a two-wave approach to execution, based on availability of talent with sufficient digital literacy in relevant topics; ease of implementation given existing and required technological infrastructure; and complexity, reflecting the required level of coordination between different companies and government agencies involved.

Wave 1 – Quick wins from scaling up proven successes

Quick wins can be obtained with those use cases that build upon existing proof points and employ technology that has already seen successful adoption in Japan and widespread adoption globally.

Recommendations to enable such wins involve putting into place practices, rules and standards; rolling out digital training and capability building; and carrying out basic digitization and automation activities. These recommendations can be adopted by individual companies or agencies without the need to rely on external parties. Exhibit 22 shows a summary of wave one use cases and enabling recommendations.

Wave 2 – Cementing global competitiveness with differentiating bold ideas

The longer-term roadmap involves use cases that deploy bolder technologies in broader applications, some of which have not yet been widely adopted. Longer-term enabling recommendations are expected to be more challenging to implement than those in wave one, due to higher required digital skill levels, technological complexity, stakeholder complexity and time. They involve regulatory changes, and various partnerships or multiple stakeholder collaborations. Exhibit 23 shows a summary of wave two use cases and enabling recommendations.

With respect to startups and systems integrators, rather than executing specific use cases, these two stakeholder groups will be supporting the education system, industries and government in implementing the entire roadmap. Enabling recommendations that would allow them to do this are outlined in Exhibit 24.

The key to success is a combination of building technology use cases and enabling them with the right talent, regulation, mindsets, and infrastructure. These need to go hand in hand. Building out use cases without the right talent or regulatory changes will only result in prototypes or unscaled technology. And waiting for regulation or mindset shifts without setting out to build applications is a recipe for very slow progress or none at all.

The transformation of the education system, industries, government, startup ecosystem and systems integrators in line with global standards, will be crucial to achieving positive economic productivity growth. By executing on these roadmaps, Japan can establish itself as a global hub for digital – attracting global talent, becoming the Asia headquarters of multinational companies, building lighthouse digital sites and global R&D centers; and leading the Asia Pacific region on digital innovation, regulation and infrastructure. Over the next decade, Japan has an opportunity to embark on an ambitious transformation to realize its digital potential and re-emerge as a global leader.

Exhibit 22:

Wave one use case roadmap and enabling recommendations

	 Mindset	 Talent	 Regulation	 Strategy	 Tech, data & infrastructure
Big move	Use case roadmap			Enabling recommendation	
1, 2, 3 Education, industry, and government sector to create a globally competitive and adaptive pool of digital talent	Primary & secondary <ul style="list-style-type: none"> Adaptive literacy training Mastery-based study schedules Online homework delivery and grading Student management & parent communication Online teacher collaboration platforms Tertiary & professional <ul style="list-style-type: none"> Online and hybrid tertiary learning Interactive professional curriculum design tools Employee learning tracking dashboards Personalized language instruction 				Build digital capabilities of teachers and school leaders to enable use of learning management systems
					Focus on solutions for teacher effectiveness to reduce administrative working time and drive adoption
					Create a knowledge base of best-practice EdTech tools to simplify procurement and implementation for schools
4 Industrial manufacturing to build on hardware, robotics, and automotive endowments by leapfrogging with software, machine learning and deep learning	<ul style="list-style-type: none"> ML for predictive product feature selection Logistics optimization through geospatial analytics DL for manufacturing defect detection DL enabled aftermarket parts commerce NLP for field expertise chatbots ML for automated procurement ML for predictive service agreement targeting Predictive maintenance using IoT & OTA DL for field installation support 				Upskill industrial workforce in areas of software development and machine learning
					Create practices to gather and label unstructured data for machine learning purposes
					C-level to drive resource reallocation into software, analytics, AI to achieve future digital state
5 Retail to capitalize on shifting customer trends by delivering digital omnichannel experiences	<ul style="list-style-type: none"> DL driven demand prediction ML for customer segmentation & assortment optimization ML for in-store pricing ML for dynamic pricing online Deployment of turnkey online experiences ML optimized inventory management Fleet management for delivery optimization ML powered personalized customer promotions ML & geospatial analytics for store network optimization 				Leverage turnkey online marketplaces, and two- and three- sided platforms, and other technologies to drive e-commerce penetration
					Create in-house digital teams with technology and retail domain expertise to build capabilities and deploy digital products
					Leverage user-friendly analytics and machine learning tools to enable retail employees to develop ongoing customer insights
					Enhance incentive systems to reward employees for driving omnichannel (physical and online) purchases
					Standardize product codes, customer IDs and other data to enable smoother operations and supply / demand analytics
6 Healthcare to lead globally on next-generation personalized, remote solutions targeting elderly care	<ul style="list-style-type: none"> Digital prescriptions & online pharmacies Apps / wearables for event response & disease tracking Apps / wearables for disease therapy, mgt. & adherence Connected point of care diagnosis (telemedicine) ML enabled regulatory process optimization ML enabled clinical trial optimization ML enabled drug discovery optimization DL for disease detection ML for back office optimization Robotic and prosthetic limbs 				Use digital forms and signatures to eliminate the need for paper and seals across healthcare processes
					Roll out digital training for doctors, patients, and government to drive adoption of digital applications and overcome risk averse mindset
					Convene new generation of digitally native doctors to drive digital adoption
					Create regulations to scale up frictionless ordering and reimbursement of online health services

7

Financial services

providers to build mobile and broad accessibility solutions by leveraging cloud infrastructure and open network

Banking

- Decentralized global payments with blockchain
- Instant loans with data-driven underwriting
- Banking-as-a-Service
- Payment gateways / PSPs
- Online marketplace lenders
- Investment and brokerage platforms
- Trade & supply chain finance
- Market data & info services
- Post-trade compliance with NLP



Attract domestic and international digital talent to raise the strategic importance of digital initiatives



Accelerate legacy banking and finance systems migration to the cloud in order to increase resilience, operational efficiency, and flexibility of product development

Insurance

- Digital brokers and aggregators
- New risk coverage (cyber, etc.)

8

Government to define a vision and bold goals to provide digital citizen and business services

Citizen journeys

- Online account for childcare support
- Digital residence certification (*juminhyou*)
- Online driver's license renewal
- Electronic pension applications



Use electronic forms and signatures to fully eliminate need for paper-based processes across all government administration



Define e-government user experience standards and user interface design principles



Define a secure future state cloud architecture, and back-end migration guidelines



Define data governance, publish select datasets, and make secure Application programming interface (APIs) available



Digitize high-frequency, low-complexity government citizen and business processes to demonstrate early impact



Shift focus from avoiding digital risk to minimizing risk through improved cybersecurity, in order to overcome risk averse mindset of both government agencies and citizens



Augment digital talent and digital capabilities within government agencies to reduce high reliance on vendors

9

Government and industry collaborate to scale **smart cities**, building on Japan's public infrastructure endowment

- Smart solutions to reduce energy consumption
- Intelligent traffic control
- Real-time air & water quality monitoring
- Waste collection route optimization
- Peer to peer accommodation platform
- Lifestyle wearables
- Infectious disease surveillance
- Home energy automation systems
- Real time public transit information
- Predictive maintenance of transport system



Ensure cybersecurity to protect smart city infrastructure, and address citizen privacy and security risk



Create digital feedback mechanism to continuously improve city offerings



Add civic tech talent across city agencies

Source: McKinsey

Exhibit 23:

Wave two use case roadmap and enabling recommendations

	 Mindset	 Talent	 Regulation	 Strategy	 Tech, data & infrastructure
Big move	Use case roadmap			Enabling recommendation	
1, 2, 3 Education, industry, and government to create a globally competitive and adaptive pool of digital talent	Primary & secondary <ul style="list-style-type: none"> • Early-warning systems • Special needs education: accessibility and tailored learning • AR/VR for immersive learning Tertiary & professional <ul style="list-style-type: none"> • Adaptive standardized tests, automated grading • Credential networks for professional associations • AR/VR for situational professional learning 				Harmonize privacy regulations countrywide to enable wide solution rollout
					Foster collaboration between EdTech, education publishers, and teachers to design solutions with proven positive learning outcomes
4 Industrial manufacturing to build on hardware, robotics, and automotive endowments by leapfrogging with software, machine learning and deep learning	<ul style="list-style-type: none"> • Fully autonomous vehicle deployment • NLP to gather early sentiment on prototypes • DL for vibration interpretation & control • Audio-based installation quality testing • NLP for prediction of supplier negotiation potential 			 	Launch agile digital divisions to operate unencumbered in a 'test and learn' environment with latitude from legacy organization
					Accelerate development of L5 autonomous vehicles to maintain global leadership, and enable with regulatory change
				 	Develop legal and insurance frameworks for autonomous driving to reduce development reluctance
					Foster partnerships between automotive players and leading tech companies
					Create initiatives to incentivize industrial manufacturing companies to adopt digital through public-private collaboration
5 Retail to capitalize on shifting customer trends by delivering digital omnichannel experiences	<ul style="list-style-type: none"> • Connected stores for streamlined shopping • Robots for last mile delivery • Robots for automated shelf stocking • AR/VR for omnichannel product experiences • Robots for locating, sorting and packing • Full product traceability through stored digital data 				Leverage secure cloud data platforms to process high frequency and volume of retail customer data to enhance operations and customer centricity
6 Healthcare to lead globally on next-generation personalized, remote solutions targeting elderly care	<ul style="list-style-type: none"> • Robots for surgical assistance • Robots for physical therapy, rehabilitation & lifestyle support • Robots for delivery & dispensing • Biofabrication for medical devices • Biofabrication for research and testing 			 	Roll out pervasive, secure connectivity in hospitals nationwide to ensure seamless data transfer across the network
				 	Create cloud-based interoperable data platform to support safe sharing of patient data, backed by regulations and adequate cybersecurity
				 	Create financial incentives for digital solution development to support pre-clinical and clinical trial period
				 	Create partnerships between healthcare players and cloud / AI companies to leverage combined expertise

7

Financial services

providers to build mobile and broad accessibility solutions by leveraging cloud infrastructure and open network

Banking

- Digital wallets
- POS and merchant services
- Data-driven investing for expanded customer segments
- Open Banking
- Account management and personal finance
- Digital business lending



Reorganize divisions around products to achieve greater agility and data sharing to benefit customers



Foster extensive Open Banking and data flows to facilitate the implementation of broader use cases



Explore partnerships with fintechs as well as non-financial industry players to launch innovative services and revenue streams

Insurance

- Usage-based policies with IoT
- Automated insurance claims
- Micro-insurance
- Digital underwriting and analytics

8

Government to define a vision and bold goals to provide digital citizen and business services

Citizen journeys

- Remote voting for expats
- 1-stop shop for all government-to-citizen services
- Online scholarship application portal



Establish clear digital governance amongst government agencies



Digitize government processes and services end-to-end with no paper or analog exceptions, to fully capture productivity gains



Consolidate and streamline the government procurement process of digital solutions

Business journeys

- 1-stop shop for all government-to-business services
- Platform for IP applications
- Digital admin from day 1

9

Government and industry collaborate to scale **smart cities**, building on Japan's public infrastructure endowment

- Integrated smart cities
- 3D printed homes & buildings



Foster public and private sector collaborations that combine smart city planning with asset development



Embrace an open approach to investment to support innovation and private-sector participation in smart city development

Source: McKinsey

Exhibit 24:
Enabling recommendations for startup ecosystem and systems integrators

 Mindset  Talent  Regulation  Strategy  Tech, data & infrastructure

Big move

10

Startup ecosystem

to develop a concept-to-exit formula that produces globally scalable ventures

Enabling recommendation

 Shift mindsets of entrepreneurs and advisors to tackle customer problems with global market relevance and lead with scalable software offerings

 Support local founders by providing access to employment system benefits, and attract foreign founders

 Streamline incorporation process and administrative setup; from registering, to setting up banking, to securing real estate

 Expand incentives for angel investing

 Create standard mechanisms for frictionless capital raising, and added flexibility into existing mechanisms

  Support higher work mobility with entrepreneurs leading the way, and system enabling portability of benefits from large employers to startups

 Grow venture capital ecosystem with enough firepower to do late stage financing and underwrite global software startups

 Focus on growth, share gain, and global relevance; aim at IPOs to capture maximum value versus focusing on early profitability and early sub-scale IPOs

11

Systems integrators

and technology providers to help their clients accelerate transformation, by building talent in the core and leveraging global best practices

 Support clients in moving away from legacy systems towards newer technologies (e.g. cloud solutions)

  Switch from selling products and application specific technology to becoming technology partner that brings best of global innovation across digital use cases

 Develop compelling digital offerings that abide by global best practices, open standards & design principles

 Choose where in the technology stack to build versus where to partner or acquire

 Re-skill own employees in areas such as machine and deep learning

 Expand scope of client relationships to support with strategic visioning and building digital literacy

  Lead client digital capability building efforts

 Adopt practices such as Agile methodology



Lessons learned from the last decade of ICT progress

It is for the education sector to develop digital talent, for the industry sectors to undertake initiatives that apply digital technologies, for the government to create digital citizen and business journeys, and for startups and systems integrators to drive economic renewal. Together, these big move themes will be required to drive a countrywide digital transformation. In this context, much can be learned from looking at what worked and what didn't in Japan over the past decade. The basis of this retrospective is a previous white paper titled 'Achieving the Full Potential of the Internet Economy in Japan' that was published in 2009 by the American Chamber of Commerce in Japan.

The white paper explored 66 tactical recommendations along 12 themes, to drive policy reform, as well as critical public and private sector initiatives. Accordingly, the recommendations have been subdivided into policy initiatives and sector initiatives. To form a view on how far the policy and sector initiatives were realized, we surveyed a broad range of over 100 experts, with experience in both private and public sectors.

Incremental progress in ICT initiatives

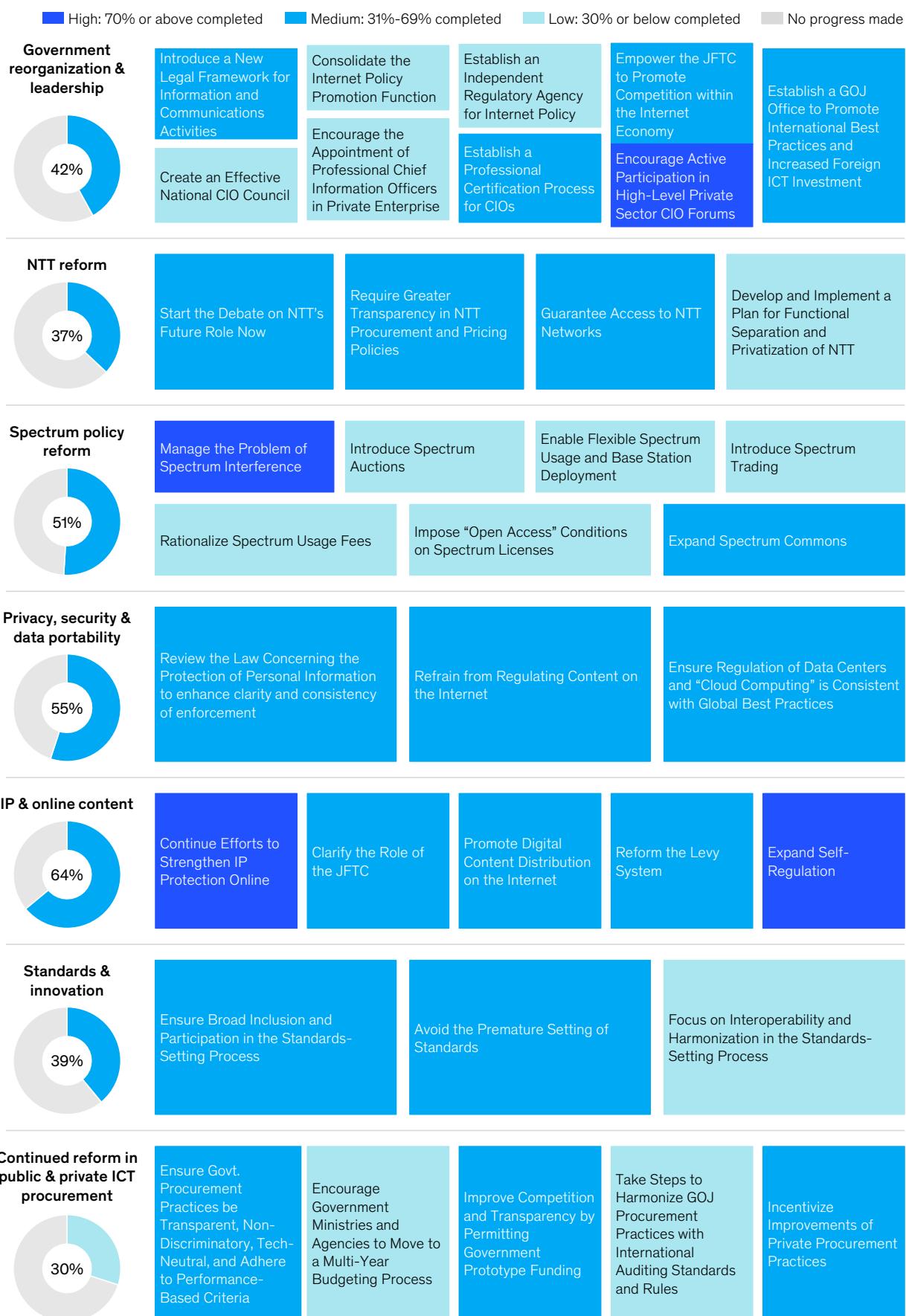
The heat maps below indicate average progress across all initiatives classified under policy and sector respectively. While the donut graphs indicate average progress of all initiatives within that category, the color of the individual boxes corresponds to the level of progress that respondents deemed was made over the 10-year period in implementing that specific initiative.

Progress across policy initiatives ranged between 30% and 50% per category, as displayed by the graphs. At an initiative level, 4 out of 36 policy initiatives, representing 11% of the total, were perceived as having achieved a high rate of progress above 70%. 19 policy initiatives - just over half - were perceived as having a medium rate of progress between 31% and 69%. 13 policy initiatives - accounting for 36% of the total - were perceived as having low progress rates under 30%.

Among the policy initiatives, bright spots were 'Encouraging Active Participation in High Level Private Sector CIO Forums' and 'Manage the Problem of Spectrum Interference'. For the latter, comments noted participation in various roundtables and study groups over the years, as well as the timely collection of data through frequency usage surveys by the Japanese Ministry of Internal Affairs and Communications. Another policy initiative with a large number of positive responses and comments - and an average score of 69% - was 'Ensure Regulation of Data Centers and Cloud Computing is Consistent with Global Best Practices'. Comments here noted alignment and enhanced cooperation with the US, promotion of frameworks such as APEC CBPR (Asia-Pacific Economic Cooperation Cross-Border Privacy Rules), and the 2019 DFFT (Data Free Flow with Trust) policy put forward by the Japanese government as concrete indications of traction gained in this arena.

On the other hand, lows were seen in categories such as 'Government Reorganization & Leadership' where the lowest rating policy initiative was 'Establish an Independent Regulatory Agency for Internet Policy'. Ratings for this initiative ranged between 0 and 28% and the general commentary was that there was no movement and action in this area. Mention was made of the Digital Agency slated to be established in 2021 - still in the concept phase at the time of the 2009 white paper. But respondents commented that the Agency was likely to lack organizational power and that the assignment of responsibilities - many cutting across MIC and METI - was unclear, creating additional challenges. Moreover, while the new Digital Agency was viewed as a positive sign of progress, indications show that it is likely to focus only on digitization of government services rather than more holistic aspects such as talent development.

Exhibit 25:
Policy initiatives – heat map of progress



n = 118 total respondents

Source: Survey on Assessing Ten Years of US-Japan Cooperation on Building the Internet Economy, 2020

On the topic of digital governance, a respondent, who was highly involved in the US-Japan economic policy dialogue, noted that leaders only infrequently introduce new legal frameworks and establish new agencies; further, a decade prior to the publishing of the 2009 white paper, Japan had just undergone reorganization of its agencies – late in the 1990s, effective in 2000 – making it unlikely for such an event to occur again in the near future. The extent to which the digital revolution has disrupted the ways of thinking and working across both industries and government was not something that could be fully grasped back in 2009, and is something that poses challenges even today. While looking at the progress of policy initiatives in the 2009 white paper may paint a dispiriting picture, it is important to note that the paper did aim extremely high, and undershot the magnitude to which the internet economy and the rest of the economy would intertwine over the coming years.

High-level progress across sector initiatives ranged between a 25% and 50% per category. Only 1 sector initiative out of 30 was perceived as having achieved high completion. 16 sector initiatives - just over half - were perceived as having achieved medium progress, and 11 sector initiatives - or 37% - as low. Overall, sector initiatives performed worse than policy initiatives, with an average progress score across the category of 39%, compared to policy's average of 45%.

Some sector initiative categories had quite a lot of variability among their constituent initiatives. For example, although 'Promotion of Online E-commerce' had a high average, scores fluctuated between 0 - 99%, with lows in 'Expand Subsidies and Advisory Services to Improve Small Business Operations and Interconnectivity Online'; and conflicting opinions among respondents on 'Actively Promote an Internationally Harmonized Approach to Online Business and Cloud Computing' as well as 'Support Growth of Online Financial Transactions through Non-Bank Institutions'. In reality today, Japan stands at a single digit e-commerce penetration, so promotion did not translate into building applications.

The overall highlight among sector initiative categories was 'Promotion of Green ICT' with consistently high scores ranging between 50 and 70%. Key areas of progress here included public and private sector discussion around improving power usage effectiveness and data center efficiency, deployment of smart sensors and building of smart grids, deregulation of the energy market by METI in 2016 for medium-scale customers, and a boost in telecommuting and mobile work spurred by the COVID-19 pandemic.

With regards to Japan's progress in Green ICT, there were a couple of interesting insights noted in the submitted commentary. Firstly, while Japan made improvements, the progress was still perceived as lagging other economies like the US. Secondly, much of the progress was perceived as being driven by external factors, e.g., COVID-19 forced a transition to remote work; climate change and increasing international policy awareness coupled with pressure on Japan to decarbonize drove the development of green data centers. It is likely that these factors will persist going forward, creating an opportunity for the government to institutionalize some of the changes to drive further progress. Areas where further progress can be made include the promotion of renewable energy-powered data centers and greater integration of variable renewable energy and distributed energy resources.

The lowest performer in this category - which was also the lowest performer overall - was the 'Convergence of Internet with Education', for which scores ranged between 10 and 50%, followed by 'Delivery of Government Services Online'.

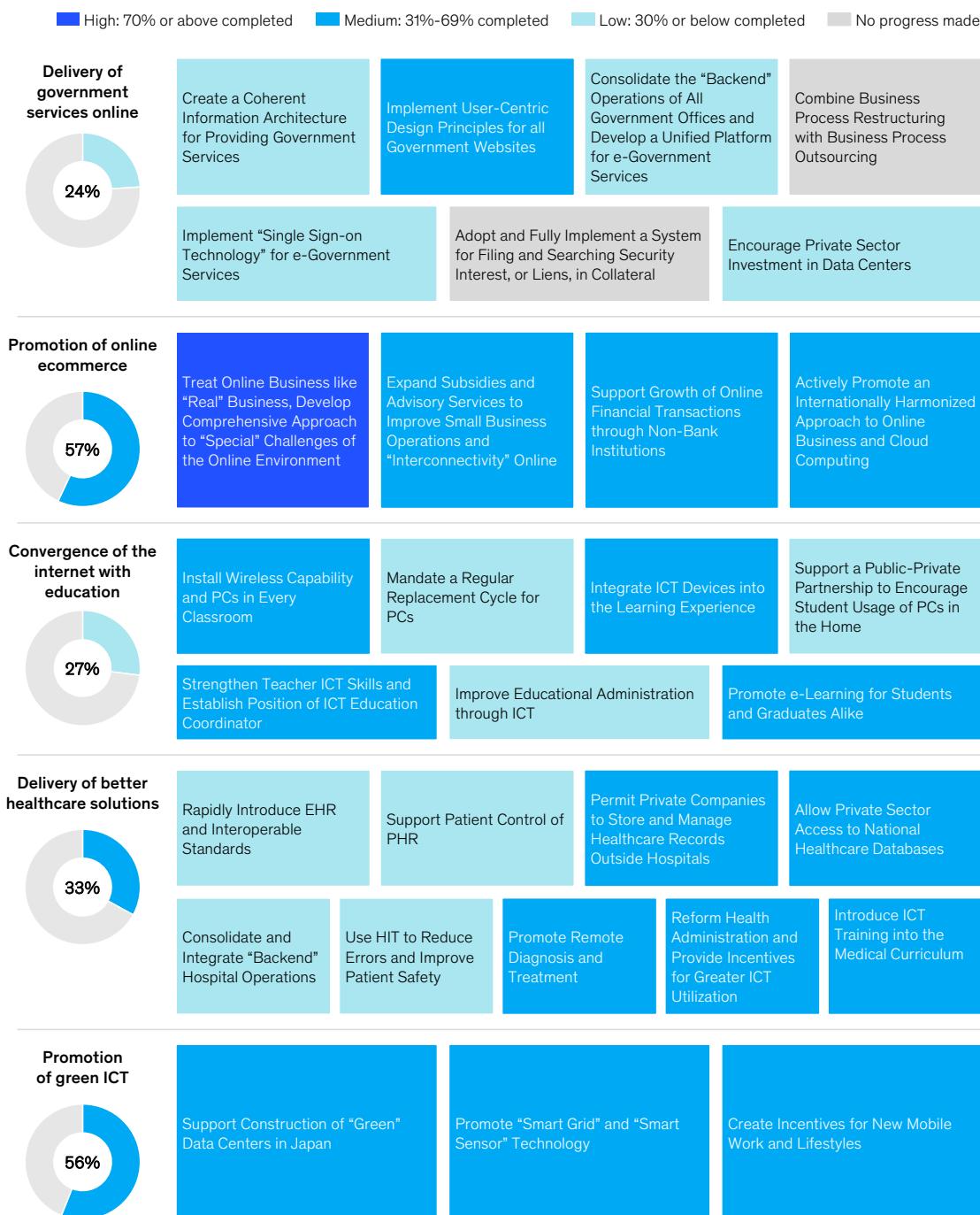
Looking into specific areas where limited progress was noted across both policy and sector initiatives, respondents noted two common themes:

- **Directives not translating into action:** a common thread among the comments suggested discussions often did not lead to concrete actions. An initiative that had unusually low rankings was 'Support Patient Control of PHR', which had scores ranging between 3 and 13%. Here, the rationale was that while respondents were aware of the high-level movement to connect My Number Card to PHR, there was little to no administrative action to create infrastructure, technology, or a financial and legal framework to support this. E.g., there was no consensus on the funding and investment needed to create an interoperable system.

- **Impact did not carry over to public sector or rural areas:** Many comments focused on the low digital literacy and the limited support available to implement sector initiatives in rural areas. Digitization efforts were viewed as driven by the private sector rather than the government. E.g., most progress related to education via the internet seems to have been made in private schools, while no change has been seen in public schools in this area. For ‘Improving Educational Administration through ICT’, the rankings were between 4 and 9%. Similarly, it was perceived that rural businesses received less government support when it came to online e-commerce. Progress on the sector initiative ‘Expand Subsidies and Advisory Services to Improve Small Business Operations and Interconnectivity Online’ averaged around 20%.

Exhibit 26:

Sector initiatives – heat map of progress



n = 118 total respondents

Source: Survey on Assessing Ten Years of US-Japan Cooperation on Building the Internet Economy, 2020

A disconnect between dialogue and execution

The chart below shows a summary of progress made on initiatives, based on what discrete stage was reached in implementation, aggregated across all categories for policy and sector initiatives respectively. The numbers in the circles indicate what % of recommendations reached that stage, whereas the numbers in the arrows indicate drop-off between the two stages.

Exhibit 27:

Dialogue to execution continuum of progress across policy and sector initiatives



1. Total includes 4 initiatives (3 in policy, 1 in sector) which lost relevance as the market developed

Source: Survey on Assessing Ten Years of US-Japan Cooperation on Building the Internet Economy, 2020

Overall, it can be seen that over a ten-year timeline, plenty of initiatives were started but very few reached an effective conclusion. While actions were taken, only 1% each of policy and sector initiatives were perceived as achieving 100% progress.

Looking at the execution continuum for policy initiatives, it was seen that in spite of dialogue having started on nearly three fourths of all initiatives, only 21% were viewed as having achieved good or completed progress. The drop-off occurred in the planning and decision-making stages, with the steepest drop-off of 23% between once decisions were taken and implementation was started. Another notable point was that for nearly a quarter of policy initiatives, no progress was made at all. The phase between planning and decision-making had the lowest drop-off of 9%, indicating that lack of consensus was not the key bottleneck here.

There was a similar pattern in sector initiatives, where in spite of four fifths of all initiatives proceeding till the dialogue stage, only 14% achieved good or completed progress. The key drop-off here was at the same stage as with policy, between decision-making and implementation, although the drop-off was steeper at 31%. For 18% of sector initiatives, no progress was made at all.

Overall, policy initiatives progressed better than sector initiatives. 7% more policy initiatives made it to a stage of good progress, and 27% of commenced policy initiatives made good progress compared to just 16% of commenced sector initiatives, indicating that sector initiatives had steeper drop-offs through the execution process. Especially at the implementation stage, sector initiatives had a drop-off that was 35% higher than policy's drop-off. This may be due to the complexity of implementing sector versus policy initiatives - while policy initiatives end with changes on paper, sector initiatives often call for concrete actions that impact the end users.

This could imply that challenges arose from sector initiatives that directly affected end users, e.g., patient access to health records or student PC usage in homes. Often, policy changes are the enablers for sector initiatives, e.g., patient access to health records depends on regulations regarding patient data usage. So, until a policy or regulation change is fully enacted, the dependent sector initiatives cannot make progress.

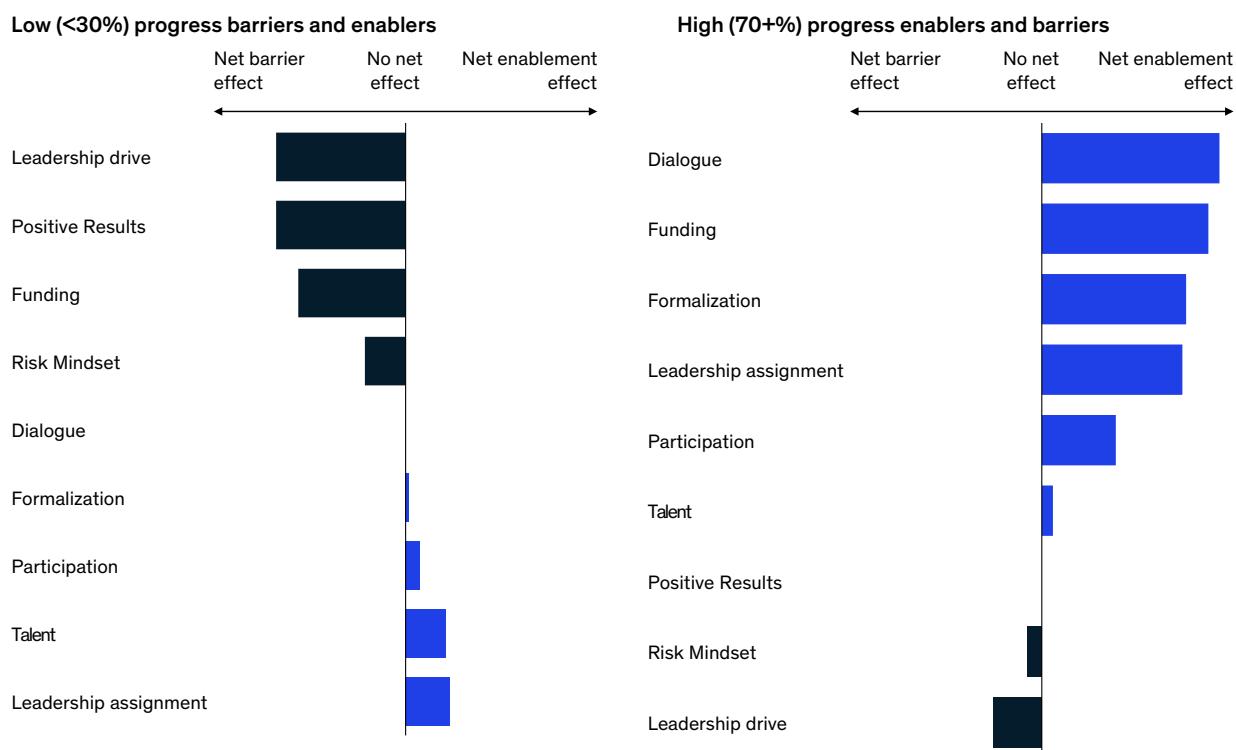
The findings for this question are consistent with the respondent comments for the previous question, namely that there was a gap in concrete government direction to see the dialogue to execution continuum through. Decisive action is needed, and perhaps the new Digital Agency will prove pivotal in this regard. Future policy and sector initiative rollouts should consider where the process stalled in the past to avoid making the same mistakes twice.

Enablers and barriers to progress

To identify the root cause behind the limited progress, we asked respondents to rank the top 5 factors that served as enablers or barriers to the progress of each initiative. Based on the responses, each factor was given a net score - if positive, the factor functioned overall as an enabler and if negative, the factor functioned as a barrier.

Exhibit 28:

Policy initiatives - barriers and enablers



Note: net effect calculated by averaging weighted enabler / barrier rankings of each element where enabler ranking of 1 corresponds to 5 points, 2 corresponds to 4, etc. and barrier counts as negative

Source: Survey on Assessing Ten Years of US-Japan Cooperation on Building the Internet Economy, 2020

For policy initiatives, limited leadership drive and positive results were seen as the strongest barriers that brought about low progress, followed by funding and risk-averse mindsets. The topic of risk aversion came up in multiple comments, and it would seem that Japan faces a bit of a 'precedence gridlock' - where no party or agency wants to be the first to adopt something that has never been tried before and does not have proven results. The vicious cycle of all parties waiting around for someone else to go first - exacerbated by the unwillingness to take risk - hinders progress on digital policy initiatives. On the other hand, achieving small, scalable successes - even at a local level - may provide the 'positive result' incentive needed to encourage a change in attitudes. For leadership drive and funding, given the cross-ministry nature of various policy initiatives, a clear leader with decision-making authority and oversight is needed - the lack of this figure seems to have hindered progress. There is hope that the planned Digital Agency will have the necessary mandate for this, as well as control of procurement and budgeting, to ensure that adequate funding is available where needed. It was noteworthy that funding showed up as the second highest enabler for high-progress, i.e., more-successful, policy initiatives.

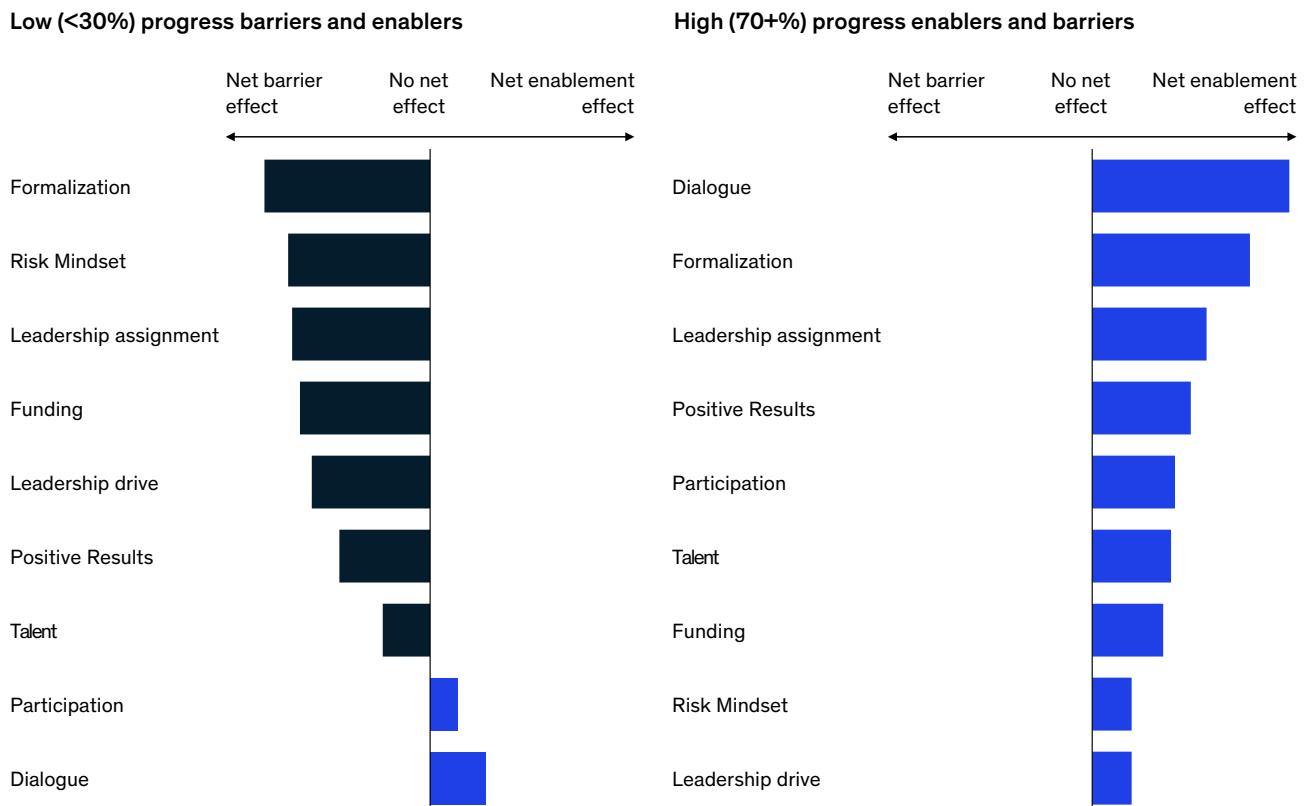
On the other hand, dialogue showed up as the highest-ranked enabler in high-progress policy initiatives. Leadership assignment, participation, and formalization were also viewed as factors that enabled progress, along with talent. Interestingly, talent scored higher in low-progress policy initiatives as an enabler, and in-house digital understanding was viewed as a necessary skill that had not been achieved. Resistance among government officials to implementing technologies beyond their understanding and comprehension was stated as a reason for the government avoiding certain digitization actions altogether, in spite of the productivity gains those technologies may bring.

For sector initiatives, limited formalization was viewed as a key barrier. This reinstates the idea that it is policy that drives implementation, and that private sector initiatives are often dependent on government support for direction, funding, and conducive regulations. Here, too, risk-averse mindsets are a barrier: private sector companies in Japan are less willing to break the rules and face litigation than their western counterparts. Private sector activity is often dependent on what the government institutionalizes and regulates, and if regulations are conservative, private sector activity is accordingly affected.

In addition, leadership assignment and funding availability were also viewed as key barriers. Further commentary on sector initiatives surrounding education noted the lack of consensus between local and regional governments on funding for students lacking adequate connectivity for e-learning. When private sector funding was not easily available, this proved to be a challenge.

For high progress, the commentary noted dialogue, formalization, and leadership assignment as key enablers. Given four fifths of all sector initiatives made it past the dialogue stage as demonstrated by the previous section, it seems Japan has made progress in starting communications. The focus needs to be on ensuring those communications materialize into concrete plans and actions, which are then driven forward.

Exhibit 29:
Sector initiatives - barriers and enablers



Note: net effect calculated by averaging weighted enabler / barrier rankings of each element where enabler ranking of 1 corresponds to 5 points, 2 corresponds to 4, etc. and barrier counts as negative
Source: Survey on Assessing Ten Years of US-Japan Cooperation on Building the Internet Economy, 2020

Reflecting on the past, and looking ahead

The final recommendation in the 2009 white paper called for the creation of a ‘process’ through which the US and Japanese governments and their respective private sectors might work together in driving the other recommendations found in the white paper, through a ‘US-Japan Dialogue on the Future of the Internet Economy’, with government, private sector, and academic participation.

The recommendation was developed with the express intention of avoiding in the Internet space many of frictions that had characterized the US-Japan economic and trade relationship from the early 1970s forward:

“Collaboration on the Internet Economy escapes the zero-sum dynamic of many trade talks and can help nurture the innovation that is essential to the future of our economies. This dialogue would break new ground for the United States and Japan since the emphasis would be on mutual learning, exploring areas of convergence and transferring agreement between the two countries into a broader regional and global consensus.” – (ACCJ Internet Economy White Paper 2009)

The proposal struck a responsive chord in government and business circles in both countries, resulting in the formal launch of the US-Japan Policy Cooperation Dialogue on the Internet Economy on November 10, 2010 with the participation of the two governments, led respectively by the US Department of State and the Japanese Ministry of Communication and the two business communities represented by the ACCJ and Keidanren.

Subsequently, over the past decade, the Dialogue has been convened 11 times, most recently on September 25, 2020 (Exhibit 30).

Exhibit 30:
A decade of US-Japan policy cooperation on the internet economy

Key issues

Dialogue One <i>Tokyo / November 10, 2010</i>	Utilization of cloud technologies in education and health; better security for commercial networks; preserving openness of the Internet.
Dialogue Two <i>Washington, D.C. / June 9-10, 2011</i>	ICT role in disaster response; protecting critical infrastructure; joint research on future technologies; working with multi-stakeholder partners in international institutions.
Dialogue Three <i>Tokyo / March 22-23, 2012</i>	Stronger cooperation on global data privacy concerns; creation of a bilateral cloud computing working group; enhanced measures to respond to cyber incidents.
Dialogue Four <i>Washington, D.C. / October 18-19, 2012</i>	Collaboration on interoperability and data portability in the Cloud; sharing best practices on e-government and open data; steps to strengthen consumer data protection.
Dialogue Five <i>Tokyo / March 12-13, 2014</i>	Addressing growing cross-border cybersecurity issues; supporting APEC Cross-Border Privacy Rules; promoting industry-led standards development for cloud computing.
Dialogue Six <i>Washington, D.C. / September 16-17, 2014</i>	Support for the transition of IANA to ICANN; affirmation of proposals from “NETmundial” conference; research cooperation on New Generation Network/Future Internet
Dialogue Seven <i>Tokyo / February 25-26, 2016</i>	Presentation on “Smart City” concept and IOT; concern with data localization and other obstacles to cross-border data flows; coordination on domestic approaches to privacy.
Dialogue Eight <i>Washington, D.C. / September 21-22, 2017</i>	Encouraged greater participation in APEC CBPR; reaffirmed bilateral coordination on digital trade concerns; shared information on cybersecurity challenges.
Dialogue Nine <i>Washington, D.C. / July 23-24, 2018</i>	Harmonizing of domestic regulation on AIT and IOT; joint session with US-Japan Cyber Dialogue on managing cyber risk; commitment to cooperation on digital trade rules.
Dialogue Ten <i>Tokyo / October 10-11 2019</i>	Welcomed Japan-US Digital Trade Agreement; partnership on digital policy issues in international fora; report from WG on Japan US Strategic Digital Economy Partnership
Dialogue Eleven <i>Virtual Web Conference / September 25, 2020</i>	Digital response to global pandemic; promotion of secure deployment of 5G technologies; sharing views on US-Japan Digital Trade Agreement and Data Free Flow with Trust initiative

The “habits of cooperation” nurtured in the Dialogue over the years resulted in announcement on October 7, 2019 of the US-Japan Digital Trade Agreement. The agreement includes *inter alia* provisions prohibiting custom duties and discriminatory taxes on digital products, a commitment to ensure the free flow of data bilaterally, including with regard to financial services; mutual recognition of digital signatures; a prohibition on data localization requirements that restrict where data can be stored; and protections against forced disclosure of proprietary source code algorithms.

As the Dialogue continues to mature, discussions will likely increasingly move from bilateral concerns to developing shared positions in international fora, such as the Organization for Economic Cooperation and Development, and in coordinating positions vis à vis third parties, such as the EU and China.

For example, the “Statement on Innovation and Digitization” released at the G-20 meeting at Osaka in 2019 highlighted philosophical differences between the US/Japan and the EU with respect to rulemaking for the digital economy: the Europeans favor a larger government role in Internet governance while the US and Japan support more market-driven solutions.

This partnership between the two countries on shared international concerns is vitally important to ensuring the future growth and innovation of the global digital economy from which both countries benefit. Leveraging the cooperation and progress that have been cultivated by the Dialogue, Japan must act rapidly and decisively to push further changes in both public and private sectors, if it does not want to lose another decade.

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The 2030 Digital Road Map for Japan is a Chamber-wide initiative since all ACCJ companies are involved with and have benefitted from the ongoing digital transformation of Japan's economy. We are especially grateful to the 16 ACCJ members companies that provided financial support and practical input for the content and analysis found in this study.

There is a great deal of information in the report about the technologies that are driving innovation in Japan's digital economy and specific sectors of the economy where these can potentially have the most impact.

But an equally important theme throughout the report is that of the partnership between US companies operating in the digital space and Japanese businesses and consumers, who have welcomed the new technologies and business models that US firms have pioneered in Japan. This is especially the case for the sponsors who have made this report possible.

AT&T and **IBM** have a long history in Japan and have worked closely with Japanese companies, such as NTT, mega-banks, large manufacturers and other domestic technology infrastructure and service companies to provide hardware, software and service solutions to support Japanese competitiveness globally. **Verizon** has been a key player in the Japan market since 2000 and has emerged as another trusted provider of secure global connectivity and collaboration solutions to large MNC's including Japanese corporations to drive their vital digital transformation initiatives.

Intel has a long collaboration history with Japanese industry from innovative personal computer development such as mobile computing and broadband deployment in Japan to cutting edge semiconductor manufacturing technology. **Cisco Systems** helps to securely connect the unconnected, offering a mix of cloud-based services, software and hardware solutions to creating long-lasting customer partnerships in Japan. **Microsoft** was an early pioneer in bringing the personal computer to offices, schools, and homes in Japan and is now leading the shift to cloud-enabled services.

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Palo Alto Networks helps address today's security challenges leveraging the latest breakthroughs in artificial intelligence, analytics, automation, and orchestration, protecting organizations in Japan across clouds, networks, and mobile devices.

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The 2009 ACCJ White Paper proposed many areas for US-Japan cooperation on the Internet Economy from finance to healthcare to improving government operations. It also helped launch a government-to-government dialogue with industry representation that came to both symbolize and offer a practical mechanism for improved bilateral cooperation on shared issues. The current report is clearly in this tradition.

Our goal is to build on this process of exchange between the governments and the now close cooperation between our business sectors, forged importantly by our Sponsors and the broader Chamber membership, to further assist in the growth of Japan's digital economy and to help sustain a global economic and business environment supportive of future innovation in the digital space.