ECONOMIC IMPACT REPORT:

THE VALUE OF DIGITAL TRANSFORMATION TO JAPAN AND GOOGLE'S CONTRIBUTIONS

αlphaβeta
strategy x economics

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CONTENTS

PREFACE

I believe that this Economic Impact Report will provide useful insights for the advancement of Digital Transformation (DX) in Japan.

Amidst the serious COVID-19 crisis, we need to create a next-step growth story with a view to 2030 and beyond. The pillars of this story are DX and carbon neutrality.

The Growth Strategy formulated in 2016 laid out a policy to promote Industry 4.0 by utilizing technological breakthroughs in all fields. At the time, there was a debate that Japan was lagging in building a platform for virtual data, but had an advantage in real data and should leverage this. However, with the COVID-19 pandemic, we are now confronted with the reality that this predominance has yet to be demonstrated.

This is not because Japan's technology is inferior, but is attributed to the delay in structural reforms for leveraging technology. Vaccination failed to progress in this country not because of technology. Our system and structure are to blame. Technology is also not the reason why innovative services used by many in other countries, such as ride-sharing and online education, are not available in Japan. Japan has been lagging in reforms and has missed out on the fruits of innovation.

However, Japan is now embarking on initiatives to catch up and move ahead of the times. One such initiative is the launch of the Digital Agency.

The Digital Agency is expected to serve as the government's DX command center, revamping the disparate digital policies of government offices from the perspective of the Japanese people. The key to this is the development and spread of a scheme that can leverage the My Number system (Social Security and Tax Number System) and the development of a base registry that can serve as the foundation for DX. This will not only improve the efficiency of existing public services, but also enhance security to protect the public.

And, after more than three years since the government started considering the “Super City Initiative” in 2017, the concept is now in full swing. The first public offering this spring gathered applications from 31 organizations. The National Strategic Special Zones endeavor launched in 2013 has resulted in 381 projects and 114 regulatory reforms. The "Super City Initiative" is expected to see more groundbreaking initiatives from local governments than ever before, and the accumulation of best practices.

All of these initiatives will have a monumental impact if a diverse range of human resources from the private sector were to participate in them. The secret to success is the participation of not only technology experts, but also many talents who can conceive new businesses and design the future as architects. It would be great to see the people participating in these initiatives becoming active as innovation leaders around the world.

With regard to carbon neutrality, the government has set the very aggressive goal of reducing greenhouse gas emissions by 46 percent by FY2030 (compared to FY2013) and achieving carbon neutrality by 2050. In response to the Paris Agreement and the Intergovernmental Panel on Climate Change (IPCC) Report, Europe and the United States have been rapidly transforming their industrial structures, and Japan has decided to take on the bold challenge of lining up with the United States and Europe in the next decade. Needless to say, use of digital technology will expand, and there are also hopes towards renewable energy. However, promoting private sector participation in infrastructure management (concessions, etc.) and expanding private sector investment in forestry are also essential to realizing goals. Not only do we need to stimulate decarbonization efforts in the industrial sector, but we also need to introduce private management methods into the infrastructures managed by the government, to allow the results of decarbonization and green technology to be incorporated swiftly without being bound by the rigid rules of government. To this end, the promotion of DX in Japan is imperative.

To address the grand challenges that are DX and carbon neutrality, it is crucial to create an environment that allows talent from around the world to work in Japan. There is a serious shortage of human resources in Japan, calling for the need to reassess the rigid labor market and create an environment where everyone can work flexibly to make Japan a nation that attracts people who can innovate. This is also a crucial reform to ensure that Japan does not miss out on the inbound boom when human traffic is restored.

Both governments and businesses need to be agile in their actions. The attitude of taking action only after confirming that there is a clear need for it does not allow for the promotion of innovation that promises unexpected breakthroughs. The current situation in Japan cannot wait. We should spread the challenge to those who are willing and capable to try and retry if there are adverse effects, and proceed to take actions if there are not.

If we can face up to the structural problems highlighted by the COVID-19 pandemic and make steady progress in our reform efforts, the landscape that unfolds in 2030 should be very different.

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UNLOCKING JAPAN'S DIGITAL POTENTIAL

BY 2030, IF LEVERAGED FULLY, DIGITAL TRANSFORMATION CAN CREATE UP TO...

JPY67.7 TRILLION (USD628 BILLION)
in annual economic value[1]

69%
of this value[1] could come from technologies that mitigate the impact of the COVID-19 pandemic

Three pillars of action

1 PROMOTE AN INNOVATION-ORIENTED ENVIRONMENT

2 ENHANCE DIGITAL SKILLS TRAINING AND EDUCATION

3 SECURE DIGITAL EXPORT OPPORTUNITIES

Examples of Google's contributions to each pillar

Google Cloud increases operational efficiency in traditional sectors and provides a platform to build innovative applications in growing sectors

Google offers support by providing free digital skilling training through Grow with Google, and by providing **Chromebooks/ Google Workspace for Education**

Japanese businesses leverage **Google Play and YouTube** to export mobile apps and digital content

Google's broader economic benefits

BUSINESSES

Google supports **JPY3.2 TRILLION (USD30.1 BILLION)** in annual benefits to businesses in Japan[2]

CONSUMERS

Google supports **JPY4.4 TRILLION (USD40.7 BILLION)** in annual benefits to consumers in Japan[2]

SOCIETY

Google supports non-profits assisting underserved SMEs with a USD2.5 million grant funding and promotes arts and culture in Japan by collaborating with government agencies

1. Economic value refers to GDP increments, productivity gains, cost savings, time savings, increased revenues, increased wages and increased tax collection.
2. Figures are estimated based on the latest available annual data as at time of research in 2020.

Note: Estimates are based on AlphaBeta analysis using a range of original and third-party sources. See report's Appendix for methodology.

EXECUTIVE SUMMARY

Digital transformation[1] is important for uplifting productivity in Japan. Even before the COVID-19 pandemic, Japan's economy had been facing multiple headwinds such as a dwindling workforce, and slowing labor productivity and economic growth. Due to its aging population, Japan's workforce is expected to fall by 20 percent between 2017 and 2040, and annual labor productivity growth has remained below two percent over the last two decades.[2] As a result of these trends, the International Monetary Fund (IMF) has predicted that real gross domestic product (GDP) in the country could decline by over 25 percent between 2019 and 2059.[3] Digital transformation is therefore essential to uplift economic productivity and recharge Japan's growth engine.

Despite Japan's long-standing status as a global innovator, the country has seen a falling rate of technology development in recent years. Japan is known for innovations such as the bullet train and breakthroughs in the electronics industry. However, the country is at risk of losing its innovative edge today. According to the Global Innovation Index, which evaluates nations across 80 innovation indicators, Japan fell by three spots within a year from 13th in 2019 to 16th in 2020.[4] This points to significant missed opportunities for businesses in the country. By harnessing digital technologies, businesses could transform traditional business models to enhance the value of their offerings while improving productivity. This trend has become more pronounced against the backdrop of the pandemic.[5] In light of the delay in digital adoption to combat the impact of the virus outbreak, the Minister of Digital Transformation remarked last year that the country had suffered a "digital defeat" against the pandemic. A survey conducted in March 2020 found that only 28 percent of the country's corporations had online remote work systems in place, while 45 percent were either not considering or were not aware of such digital technologies.[6]

To tackle these digital adoption challenges, a crucial starting point is to understand how digital technologies can benefit Japan's economy – particularly in its traditional, non-tech sectors.[7] Despite comprehensive research on the economic impact of the technology sector, there is limited research on the economic benefits of technologies applied in traditional sectors. Neglecting the impact of digital technology on traditional sectors such as agriculture, health, consumer, retail and hospitality risks overlooking its transformative effects beyond the technology sector. Digital technologies applied in traditional industries have the potential to revolutionize the way businesses are conducted.

1. Digital transformation (DX) refers to the adoption of digital technologies to transform the way businesses deliver value. According to OECD, it holds great potential to spur innovation, generate efficiencies, improve goods and services, enable trade and investment, and push out the productivity frontier. Source: Organisation for Economic Co-operation and Development (2019), Promoting digitalisation. Available at: https://www.oecd.org/policy-briefs/Japan-Policy-Brief-Digitalisation.pdf

2. World Economic Forum (2020), "Japan's workforce will be 20% smaller by 2040". Available at: https://www.weforum.org/agenda/2019/02/japan-s-workforce-will-shrink-20-by-2040

3. International Monetary Fund (2020), "Japan". Available at: https://www.imf.org/en/Publications/CR/Issues/2020/02/07/Japan-Selected-Issues-49033

4. World Intellectual Property Organization (2020), Global Innovation Index 2020. Available at: https://www.wipo.int/edocs/pubdocs/en/wipo_pub_gii_2020.pdf

5. The Straits Times (2020), "Japan Digital Transformation Minister Hirai says he plans to launch a digital agency next year". Available at: https://www.straitstimes.com/asia/east-asia/japan-digital-transformation-minister-hirai-says-he-plans-to-launch-digital-agency

6. The Straits Times (2020), "Commentary: COVID-19 reveals how low-tech Japan actually is - and has chosen to be". Available at: https://www.channelnewsasia.com/news/commentary/coronavirus-covid-19-japan-emergency-tech-remote-work-from-home-12644282

7. Digital adoption refers to the extent to which digital technologies are available and adopted by all the key agents in an economy such as businesses (firms). World Bank (2016), Digital Adoption Index (DAI): Measuring the Global Spread of Digital Technologies. Available at: https://pubdocs.worldbank.org/en/587221475074960682/WDR16-BP-DAI-methodology.pdf

This report finds that, if leveraged fully in the economy, by 2030, digital technologies could create an annual economic value of JPY67.7 trillion (USD628 billion).[8] This is equivalent to about 13 percent of Japan's GDP in 2020.[9]

The key messages of this report include:

- **Eight key technologies hold transformative potential for businesses and workers in Japan.** These include mobile Internet; cloud computing; big data; Artificial Intelligence (AI); financial technology (Fintech); the Internet of Things (IoT) and remote sensing; advanced robotics; and additive manufacturing. By allowing for new business models, revenue streams, productivity savings, and GDP increments, these technologies could create significant economic value for both businesses and the government in Japan.

- **If leveraged fully, digital transformation can unlock JPY67.7 trillion (USD628 billion) worth of economic value in Japan by 2030.**[10] By generating productivity gains, revenue boosts, cost savings, and GDP increments, digital technologies can reap up to JPY67.7 trillion (USD628 billion) worth of economic value annually in Japan by 2030. The largest projected beneficiaries are the manufacturing, consumer, retail and hospitality, and health sectors. About 43 percent of the total economic value or JPY29.3 trillion (USD272 billion) is estimated to be captured by small and medium-sized enterprises (SMEs).[11]

- **Of the total economic benefits from digital technologies, about 50 percent is likely to be concentrated in two of the country's eight regions.** Based on current economic trends,[12] about 50 percent (JPY33.8 trillion or USD313 billion) of Japan's digital growth is likely to be concentrated in two of eight regions (i.e., Kanto and Chubu) – suggesting a geographical digital divide that is important to bridge.

- **Digital transformation is also crucial for the country to gain resilience during the COVID-19 crisis and in the post-pandemic future – pointing to the need to accelerate it right now.** By allowing businesses to engage customers

8. Economic value refers to GDP increments, productivity gains, cost savings, time savings, increased revenues, increased wages and increased tax collection.

9. Based on AlphaBeta analysis. See Appendix A for details on the methodology.

10. The technology sector (e.g., Information and communications) has been excluded from the sizing because the sector is the source of these technologies – and therefore serves more as an enabler rather than a beneficiary of digital technologies.

11. The share of digital opportunity for SMEs is calculated based on the share of total gross value added contributed by SMEs in each sector. Source: e-Stat (2016), "2016 Economic Census of Business Activity". Available at: https://www.e-stat.go.jp/en/stat-search/files?page=1&layout=datalist&toukei=00200553&tstat=000001095895&cycle=0&tclass1=000001106235&tclass2=000001106275&tclass3=000001114495&tclass4val=0

12. The 2030 projections made for the distribution of the country's digital opportunity across different regions assume that the level and mix of economic activities in each region remains constant from 2019 to 2030.

digitally, resume business operations despite physical manpower shortages, and address logistical bottlenecks, technologies can help businesses manage the severe economic impacts of COVID-19. Of the total JPY67.7 trillion (USD628 billion) economic opportunity arising from digital technologies, about 69 percent, amounting to JPY46.8 trillion (USD434 billion), could be derived from technology applications that could mitigate the impact of COVID-19.[13] Beyond managing the direct impacts of the pandemic, digital transformation will also be important to boost resilience in the post-pandemic future – the use of online sales platforms, for example, will be important to boosting Japan's heavily pandemic- impacted export sector.

- **Three pillars of action are required for Japan to fully capture its digital opportunity.** While Japan is already making significant progress in some of these areas, there is scope for the country to push further. The three pillars are:

  – First, it is important to ensure that Japan continues to ***promote an innovation-oriented environment*** for businesses. The country is already making significant policy strides in some areas. For instance, the government has been focusing on policies for supporting SMEs, which make up over 99 percent of the total number of businesses in the country, in developing new products and services and the designation of "National Strategic Special Zones" that allow companies to pilot new products and services under relaxed regulatory environments.[14] However, the country could go further to nurture local start-ups and promote industry-academia collaborations to commercialize new technologies. This could in turn support the development and adoption of digital solutions for the country to earn a strong reputation as a global technology leader. South Korea's "Innovative Startup Package" and Singapore's "A*StartCentral" offer international best practices in this regard.

  – Second, there is strong scope to ***further enhance digital skills training and education***. The Japanese Government is already making significant investments here; it is collaborating

13. Based on AlphaBeta analysis. See Appendix A for details on the methodology.
14. SME Support Japan (2020), Available at: https://www.smrj.go.jp/english/about/#:~:text=The%203.5%20million%20SMEs%20account,essential%20in%20sustaining%20our%20economy

with academia and industry to identify the digital skills required and bridge shortages in digital talent (e.g., through the "Strategic Council for AI Technology" and recommendations to create internship programs in AI), inculcating a strong focus on digital technology in educational curriculums (e.g., through the introduction of computer programming into curriculums), and promoting access to digital technology to everyone in education especially in public schools (e.g., through its "Global Innovation Gateway for All (GIGA)" school plan to ensure every student in elementary and junior high schools owns a PC or tablet throughout the country). The country could go further in deepening the digital expertise of workers today. Recent research has shown that while 58 percent of Japan's workers already apply digital skills in their jobs today, only 14 percent apply advanced digital skills[15] such as cloud architecture design - which is lower than other high-income countries in the region such as South Korea (21 percent) and Singapore (22 percent).[16] The study further shows that the number of workers requiring advanced skills such as data modeling, web and software development, and cloud architecture design skills could grow by more than 40 percent per year between 2020 and 2025. The availability of short-term, flexible courses in such skills will need to be enhanced to plug these rapidly emerging skill needs.

- Third, it is important to ***secure digital export opportunities*** for businesses. The Japanese Government has been active in providing capacity-building support for businesses to tap into overseas markets and promoting open cross-border data flows through taking part in trade agreements and multilateral negotiations. The country can go further to consider capacity-building support for SMEs to participate in digital trade such as Singapore's "Multichannel E-commerce Platform" program, which connects SMEs to and teaches them how to leverage global e-commerce platforms for exports. In addition, the country could also participate in high-standard plurilateral and bilateral digital trade agreements with like-minded partners to promote digital trade in the region such as the "Digital Economy Partnership Agreement" (DEPA) signed between Singapore, New Zealand, and Chile. This will also help micro, small and medium-sized enterprises (MSMEs) in Japan take advantage of opportunities from digital trade.

- **Through its various programs and initiatives in Japan, Google has been instrumental in advancing the country's digital transformation journey, with specific contributions to each of the three pillars.** The company promotes an innovation-oriented environment by partnering with local start-ups, universities, and government institutions in co-creating digital and AI-based solutions. It also releases open-sourced innovations, such as TensorFlow, to provide businesses in Japan access to the latest technologies such as AI and machine learning, reducing the otherwise high costs required to adopt such technologies. Google is also contributing to enhancing digital skills training and education, for instance, the company aims to equip ten million individuals with digital skills through its Grow with Google program by 2022. To date, 7.5 million people have participated in the program. Grow with Google now has over 140 partners (77 percent of these are companies, 12 percent are local government agencies, and the remaining 11 percent are non-profit organizations) - a significant increase from ten when it was first launched. A survey conducted on the participants of Japan's Grow with Google program between April 2019 and March 2020 found that 88 percent of participants learned new skills and 74 percent

15. Advanced digital skills refer to skills which are either at the "integrator" or "innovator" proficiency level based on the APAC Digital Skills Index. AlphaBeta, commissioned by Amazon Web Services (2021), Unlocking APAC's Digital Potential: Changing Digital Skill Needs and Policy Approaches.
Available at: https://pages.awscloud.com/APAC-public-DL-APAC-Digital-Skills-Research-2021-learn.html

16. AlphaBeta, commissioned by Amazon Web Services (2021), Unlocking APAC's Digital Potential: Changing Digital Skill Needs and Policy Approaches.
Available at: https://pages.awscloud.com/APAC-public-DL-APAC-Digital-Skills-Research-2021-learn.html

of participants gained confidence in applying the skills they have picked up during the program.[17] Google also has a strong focus on AI skilling through various programs that aim to advance AI research, increase AI deployment in businesses, enhance the quality of AI education and talent development, and support AI-driven businesses in the country. Finally, the company also plays a part in helping businesses in Japan secure digital export opportunities. For example, its Grow with Google program provides business owner digital marketing training to allow them to broaden their outreach to overseas markets. In addition, Japanese businesses can leverage platforms such as Google Play and YouTube to export mobile apps and digital content globally.

- **Google also delivers wider benefits to businesses, consumers, and the broader society in Japan through its products and services.** Businesses and consumers in the country are estimated to derive total annual economic benefits from these products **worth JPY3.2 trillion (USD30.1 billion)** and **JPY4.4 trillion (USD40.7 billion)**, respectively.[18] The products that these benefits were derived from include Google Search, Google Ads, AdSense, Google Play, Google Maps, Google Drive, and Google Docs, Sheets, and Photos.
  For businesses, such benefits come in the form of increased revenue through better customer outreach and access to new markets, as well as improved productivity through time savings. It is estimated that over 109,000 jobs are supported in the economy, including traditional sectors such as consumer, retail and hospitality, and infrastructure, through the use of Google Ads and AdSense.[19] These sectors were also some of the most severely COVID-19 affected sectors in Japan - in 2020, the restaurant industry witnessed the largest number of pandemic-related bankruptcies, followed by the construction and hospitality industries.[20] These jobs are created through the use of Google products that enable businesses to expand their customer base and increase revenue, thereby leading to increased hiring demand. In addition, the Android operating system supports more than 540,000 jobs in Japan's economy.[21] Consumers, on the other hand, experience greater convenience, more opportunities to access information, and more avenues for learning and skills development. Beyond its economic contributions to businesses and individuals, Google delivers benefits to the broader society by supporting non-profit organizations in delivering support to businesses during the COVID-19 pandemic and promoting the country's art and culture.

17. Kantar (2020), Japan Economic Impact. Available at: https://www.kantar.com.au/Google/Google_Economic_Impact.pdf
18. Based on AlphaBeta analysis. See Appendix B for details on the methodology. Figures are estimated based on the latest available annual data as at time of research in 2020.
19. Jobs supported refer to new jobs that may have been created through a business' use of Google's platforms, as well as ongoing employment of jobs that previously existed.
20. The Asahi Shimbun (2021), "1,000 companies go bankrupt as virus continues to rage in Japan". Available at: http://www.asahi.com/ajw/articles/14159624
21. See Appendix B for details on the methodology.

SIZING THE PRIZE — THE ECONOMIC OPPORTUNITY OF DIGITAL TRANSFORMATION IN JAPAN

Digital transformation is not just about the technology sector – it affects every sector in Japan. Neglecting the impact of digital technology on traditional sectors, like infrastructure and financial services, would risk overlooking the full transformative impact of technologies. If leveraged fully, digital transformation can create up to JPY67.7 trillion (USD628 billion) worth of economic value annually by 2030. This is equivalent to about 13 percent of the country's GDP in 2020. The largest economic beneficiary of digital transformation in Japan is its consumer, retail and hospitality sector, which is estimated to account for about 23 percent of the total economic value.

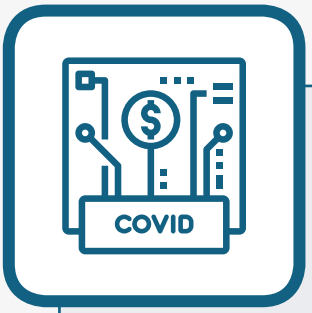
Digital adoption is also crucial for the country to gain resilience during the COVID-19 crisis and in the post-pandemic future. By supporting businesses in engaging customers and transacting with them digitally, resuming business operations, and adopting technologies that minimize logistical bottlenecks, technology applications can help businesses and their workers manage the economic ramifications of the COVID-19 pandemic. It is estimated that a substantial 69 percent of Japan's digital opportunity – at JPY46.8 trillion (USD434 billion) – could be derived from technologies that help businesses and workers manage the economic impacts.

Of the total economic benefits presented by digital technologies in Japan, about 50 percent (JPY33.8 trillion or USD313 billion) is likely to be concentrated in two of eight regions – suggesting a potential digital divide.

"SIZING THE PRIZE"
THE ECONOMIC VALUE OF DIGITAL TRANSFORMATION

IF LEVERAGED FULLY, DIGITAL TRANSFORMATION CAN CREATE AN IMPACT OF UP TO...

JPY67.7 TRILLION (USD628 BILLION)
in annual economic value[1]



69%
of this value[1] could come from technologies that help mitigate the economic impacts of the COVID-19 pandemic

... IN JAPAN BY 2030

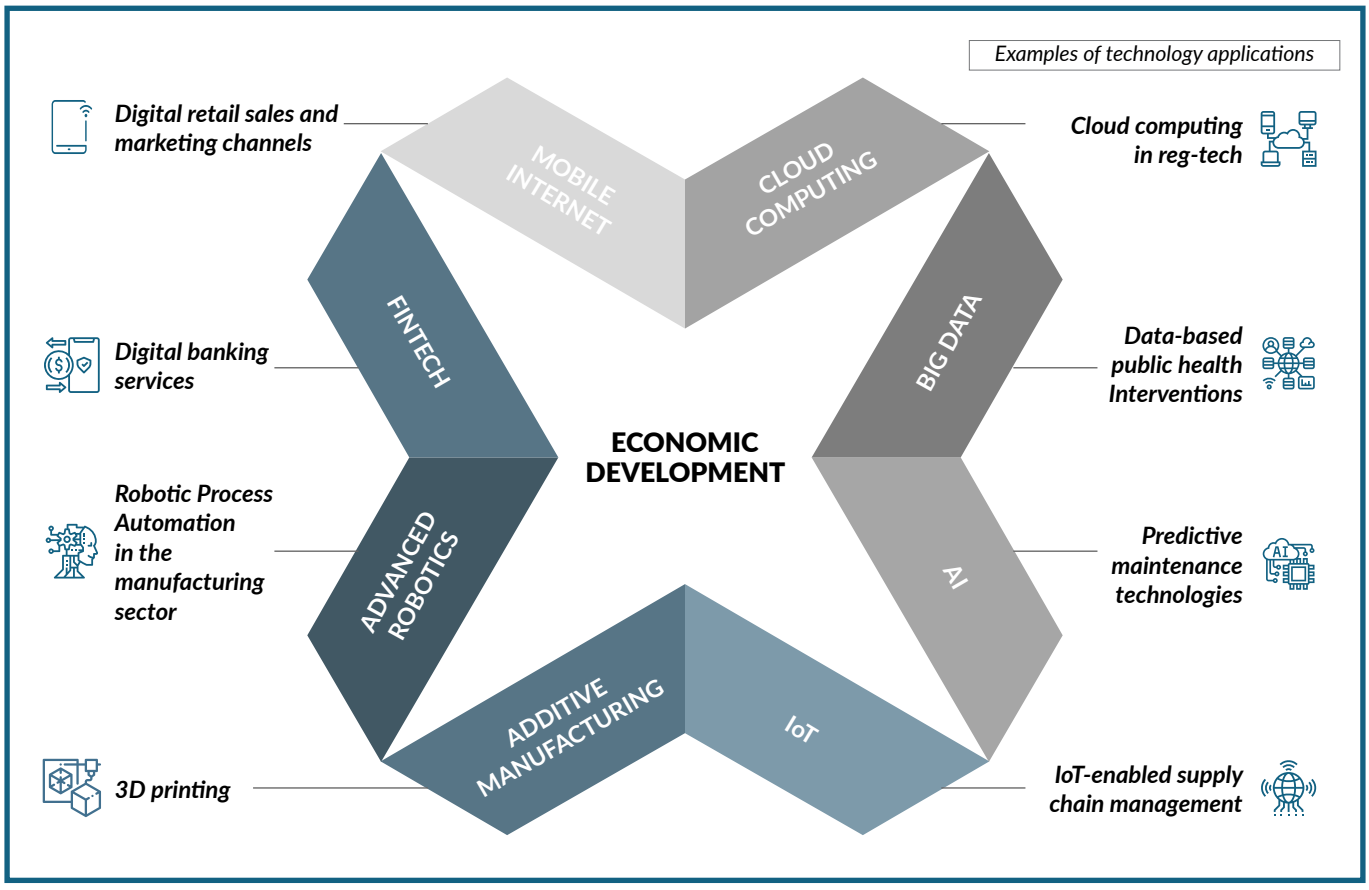
1. Economic value refers to GDP increments, productivity gains, cost savings, time savings, increased revenues, increased wages and increased tax collection.
Note: Based on AlphaBeta estimates. Figures have been rounded.

1.1 DIGITAL TRANSFORMATION CAN UNLOCK UP TO JPY67.7 TRILLION (USD628 BILLION) WORTH OF ECONOMIC VALUE IN 2030

Digital technologies can unlock significant economic value in Japan. In particular, eight key technologies hold transformative potential for the country (Exhibit 1). Box 1 shows an overview of these technologies, and the potential each has for creating productivity boosts for businesses and workers in Japan. 40 technology applications – each mapping to one of the eight technologies – were then identified across ten industry sectors. To assess the economic potential of digital transformation in Japan, the economic value of each technology application was estimated under a scenario of full adoption in 2030 (Exhibit 2).

Exhibit 1:

Current research reflects eight transformative technologies with strong economic potential



Box 1.
Eight key technologies with transformative potential for Japan

Drawing upon an extensive range of literature on emerging technologies and their potential economic benefits, eight key technologies that hold transformative potential for workers, businesses and the government have been identified.[22] These include:

- **Mobile Internet.** The The rapid rise of the smartphone and associated increase in mobile Internet penetration rates have accelerated the growth of Internet services worldwide. While the mobile Internet in Japan has already driven the adoption of new business models such as the app economy, over-the-top (OTT) services, and mobile-commerce (or "m-commerce"), there are several mobile Internet-enabled applications that have yet to see full adoption in the country. These include the use of mobile telehealth applications in the health sector, and the use of smartphone-based government e-services to streamline the delivery of public services.

- **Cloud computing.** Referring to the delivery of information technology (IT) resources over the Internet, cloud computing technologies allow individuals and entities to access technology services such as enhanced computing power, data storage, and management tools on an as-needed basis. Buying, owning and maintaining physical data centers and servers can be cost-prohibitive particularly for SMEs. In addition, public cloud hosting boosts productivity by providing tailored productivity tools, enabling improved security, and making resources available on an on-demand basis. Cloud computing has also become essential for leveraging other technologies such as AI and machine learning.

- **Big data.** Big data, and the analysis of it, refers to the ability to analyze extremely large volumes of data, extract insights and act on them – often in or close to real-time. Predictive analytics can help workers and businesses analyze customer preferences more effectively to increase customer satisfaction. With the information derived from analytics, businesses can also design targeted programs for enhancing customer engagement.

- **Artificial Intelligence (AI).** AI is a computer program that is capable of learning and adapting. This enables computers to perceive, learn, reason, and assist in decision-making to solve problems in ways that enhance our ability to understand the meaning of content at scale.[23] Examples of AI applications include virtual assistants, autonomous vehicles, and speech recognition tools.

- **Financial technology (Fintech).** Sometimes referred to as Digital Financial Services (DFS), Fintech has been instrumental in boosting the financial services sector through facilitating deposits, payments and providing individuals with access to more advanced financial products such as loans, savings, and investments. Moreover, by allowing for cashless payments, Fintech has also been responsible for driving greater growth in other sectors (e.g., consumer, retail and hospitality).

22. Sources include: McKinsey Global Institute (2013), Disruptive technologies: Advances that will transform life, business, and the global economy. Available at: https://www.mckinsey.com/business-functions/mckinsey-digital/our-insights/disruptive-technologies; Wilkinson (2019), "5 frontier technology trends shaping international development", Bond News. Available at: https://www.bond.org.uk/news/2019/06/5-frontier-technology-trends-shaping-international-development; Google and AlphaBeta (2020), The Digital Sprinters: Public policies to support economic development through digital technologies. Available at: https://alphabeta.com/our-research/the-digital-sprinters-capturing-a-us34-trillion-through-innovative-public-policy/

23. Microsoft (2018), The future computed. Available at: https://blogs.microsoft.com/wp-content/uploads/2018/02/The-Future-Computed_2.8.18.pdf

- **Internet of Things (IoT) and remote sensing.** IoT systems relate to the network of physical objects ("things") that are embedded with sensors, software, and other technologies to connect and exchange data with other devices and systems over the Internet. These systems can monitor and manage the performance of the connected objects and machines.[24] IoT has several applications across sectors with significant economic potential: wearable devices can help monitor and maintain health and well-being thereby lowering public health expenditure; energy consumption can be monitored and optimized in buildings; farms using IoT sensors can improve yield while utilizing resources more efficiently, and the health and safety performance of factories improved.

- **Advanced robotics.** While simple robots have increasingly been a staple of factory floors in mature economies like Japan, the advent of advanced robotics has allowed for an expanding range of tasks that robots can perform. Compared with conventional robots, advanced robots have superior perception, integrability, adaptability, and mobility.[25] These improvements permit faster setup, reconfiguration, as well as more efficient and stable operations. For instance, in the manufacturing sector, advanced robotics can increase productivity and flexibility in both the factory and the supply chain, and enable producers to rapidly adjust to changing customer needs.

- **Additive manufacturing.** This relates to technologies that build three dimensional (3D) objects by adding layer upon layer of material. There is a range of potential benefits, such as the ability to handle complex, low-volume components where rapid turnaround is critical.[26]

24. MGI (2019), The rise of Digital Challengers – How digitisation can become the next growth engine for central and eastern Europe.
Available at: https://digitalchallengers.mckinsey.com/files/McKinsey%20CEE%20report_The%20Rise%20of%20Digital%20Challengers.pdf

25. Boston Consulting Group (2019), Advanced robotics in the factory of the future.
Available at: https://www.bcg.com/publications/2019/advanced-robotics-factory-future

26. Sharp (2019), "Is additive manufacturing the right choice for your electronic assembly?" JJS Manufacturing Blog.
Available at: https://blog.jjsmanufacturing.com/additive-manufacturing-electronic-assembly

Exhibit 2:

40 digital technology applications across 10 sectors were identified to size Japan's economic opportunity from digital transformation

Agriculture & food
- Precision farming technologies
- IoT-enabled supply chain management
- Food safety technologies

Consumer, retail & hospitality
- Digital retail sales and marketing channels
- IoT-enabled inventory management
- Automation & AI customer service in hotels
- Data analytics on travel patterns
- Online F&B delivery channels

Education & training
- E-career centers and digital jobs platforms
- Personalized learning
- Online retraining programs

Financial services
- Big data analytics
- Reg tech
- Digital banking services

Government
- E-services
- Cloud computing
- E-procurement
- Geographic Info. System enabled tax collection
- Data analytics for government transfer payments

Health
- Remote patient monitoring
- Telehealth applications
- Data-based public health Interventions
- Detection of counterfeit pharmaceutical drugs
- Smart medical devices
- Electronic medical records

Infrastructure
- Smart grids
- 5D BIM & project management technologies
- Predictive maintenance technologies
- Smart buildings

Manufacturing
- Big data analytics
- Additive manufacturing
- IoT-enabled supply chain management
- Automation & robotics

Resources
- Smart exploration and automation in mining operations
- Predictive safety technologies
- Predictive maintenance technologies

Transport services
- Smart roads
- Smart ports
- Autonomous vehicles
- Geospatial services

Key technologies:

- *Mobile Internet*
- *Advanced robotics*
- *Cloud computing*
- *AI*
- *Fintech*
- *Additive manufacturing*
- *Big Data*
- *IoT*

Taking into account the combined potential economic value of the 40 technology applications, it is estimated that **digital technologies have the potential to create an annual economic value of JPY67.7 trillion (USD628 billion) in Japan by 2030**.[27] This is a substantial value that is equivalent to 13 percent of Japan's GDP in 2020 (Exhibit 3). About 43 percent of the total economic value or JPY29.3 trillion (USD272 billion) is estimated to be captured by SMEs.[28]

The **consumer, retail and hospitality sector is projected to be technology's largest economic beneficiary in Japan**. This sector is estimated to be able to gain annual economic benefits of up to JPY15.5 trillion (USD144 billion) in 2030 – amounting to about 23 percent of the country's total digital opportunity.[29] Other top sector beneficiaries include health (JPY12.9 trillion or USD119.7 billion), government (JPY12.2 trillion or USD111.6 billion), manufacturing (JPY10 trillion or USD92.8 billion), and education and training (JPY6.2 trillion or USD57.7 billion).[30]

The key opportunities posed by digital technologies for these sectors are as follows:

- **Consumer, retail and hospitality.** Many large retail and food and beverage (F&B) businesses in Japan are turning to online platforms such as e-commerce marketplaces and mobile applications to digitize their offerings and increase accessibility for more customers. In the retail industry, the productivity gains from marketing and selling goods through digital channels have been estimated to range from six to 15 percent – these arise as a result of being able to reduce manpower requirements, harness inventory efficiencies, and cutting real estate costs (e.g., rental of store space).[31] In the tourism and hospitality industry, there is also a range of technology applications that can enhance productivity. In hotels, AI-driven conversational interfaces can facilitate quicker check-in and check-out procedures (a study found that AI could reduce the time needed for procedures by up to 70 percent),[32] and allow staff to focus on providing more personalized customer service.[33] For example, Empath, a Tokyo-based AI start-up created voice recognition software to identify emotions from human voices in real-time regardless of language. This enables agents in call centers to detect and address problems related to the emotional states of callers more effectively. Past case studies have shown that the platform could boost sales conversion by nearly 400 percent and reduced overtime work for employees by 20 percent.[34] Finally, big data analytics has the potential to offer the tourism industry a significant boost in

27. These estimates do not represent GDP or market size (revenue), but rather economic impact, including GDP increments, productivity gains, cost savings, time savings, increased revenues, increased wages and increased tax collection.

28. The share of digital opportunity for SMEs is calculated based on the share of total gross value added contributed by SMEs in each sector. Source: e-Stat (2016), "2016 Economic Census of Business Activity". Available at: https://www.e-stat.go.jp/en/stat-search/files?page=1&layout=datalist&toukei=00200553&tstat=000001095895&cycle=0&tclass1=000001106235&tclass2=000001106275&tclass3=000001114495&tclass4val=0

29. Based on AlphaBeta analysis. See Appendix A for details on the methodology.

30. Based on AlphaBeta analysis. See Appendix A for details on the methodology.

31. McKinsey Global Institute (2013), Disruptive technologies: Advances that will transform life, business, and the global economy. Available at: https://www.mckinsey.com/business-functions/digital-mckinsey/our-insights/disruptive-technologies

32. Singapore Tourism Board (2019), "Industry-wide initiatives to transform hotels for sustainable growth." Available at: https://www.stb.gov.sg/content/stb/en/media-centre/media-releases/industry-wide-initiativestotransformhotelsforsustainablegrowth.html

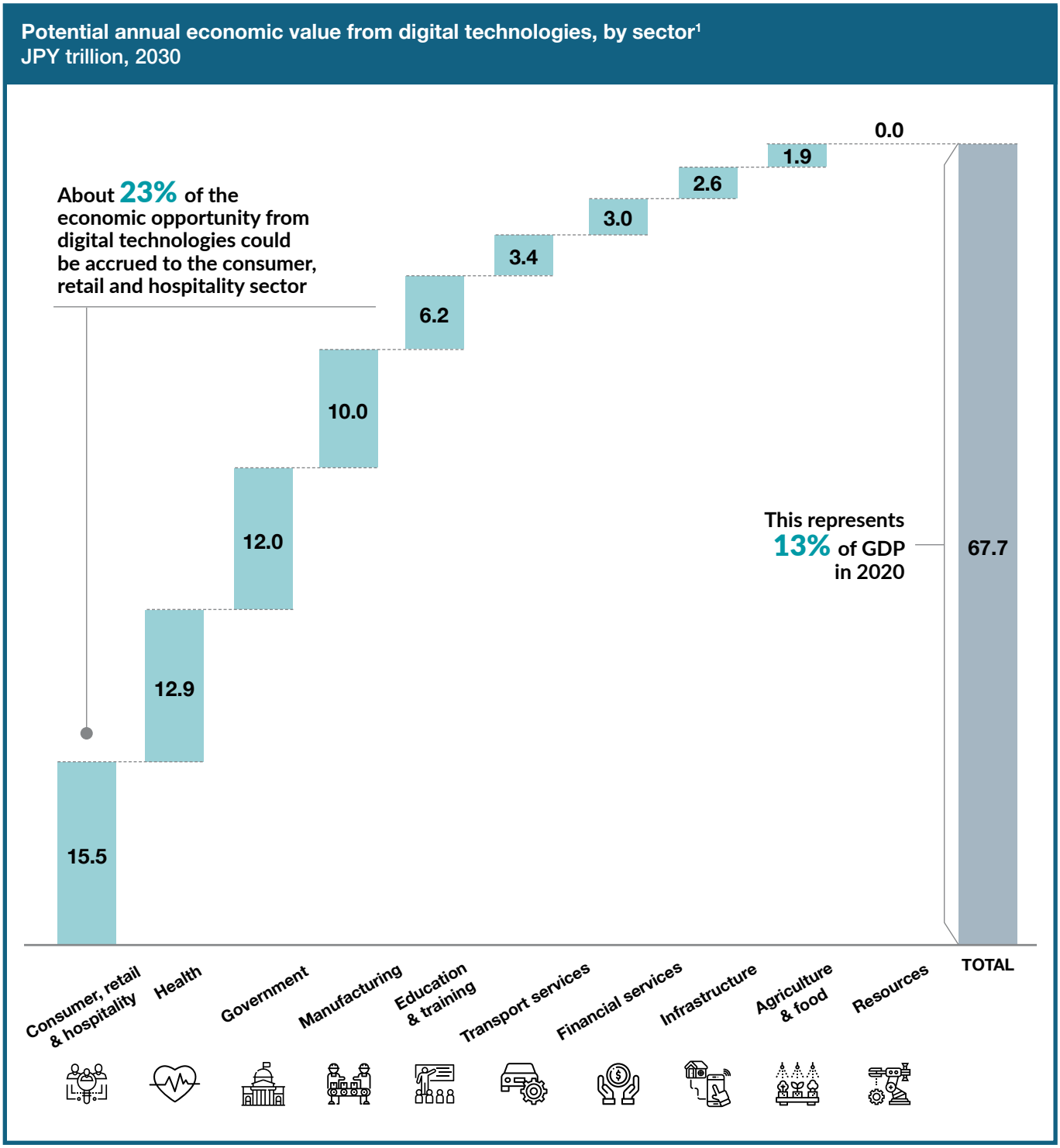
33. Ministry of Business, Innovation and Employment (2018), Artificial Intelligence: Shaping a future New Zealand. Available at: https://www.mbie.govt.nz/dmsdocument/5754-artificial-intelligence-shaping-a-future-new-zealand-pdf

34. Forbes (2019), "Japan is pioneering machine interfaces that are hardwired for kindness". Available at: https://www.forbes.com/sites/japan/2019/09/02/japan-is-pioneering-machine-interfaces-that-are-hardwired-for-kindness/?sh=d5521b0421d2

Exhibit 3:

By 2030, digital technologies could support up to JPY67.7 trillion (USD628 billion) of annual economic impact in Japan

Potential annual economic value from digital technologies, by sector[1]
JPY trillion, 2030



1. These estimates do not represent GDP or market size (revenue), but rather economic impact, including GDP increments, productivity gains, cost savings, time savings, increased revenues, increased wages and increased tax collection. In this analysis, 40 technology applications were considered.

Note: Numbers may not sum due to rounding.

SOURCE: AlphaBeta analysis

marketing and service delivery efforts. By drawing upon data about consumer preferences and running analytics on them, tourism companies stand to improve their revenues from more well-targeted promotions to prospective customers. For example, Nippon Travel, a travel agency, utilized digital search advertising to recommend tour packages based on search queries by visitors. By expanding the number of keywords by about 80 percent, the agency was able to provide more customized recommendations which led to a nine percent fall in the cost of conversion in 2019.[35] Similarly, Rakuten Travel, a travel agency, set up a custom audience for its online video campaigns by adding specific keywords, Uniform Resource Locator (URLs), and apps related to its products and services, which led to a 22 percent increase in website traffic.[36] Hankyu Travel International, a travel agency, utilized data on product purchase and advertisement distribution to identify and prioritize advertisements towards customers with potentially high conversion rates. This was 20 times more effective than targeting the masses.[37] A study has reflected that tour companies experienced a revenue uplift of six to ten percent from integrating proprietary data to create personalized tourist experiences.[38]

- **Health.** There is vast potential for the public and private healthcare entities to leverage digital technologies for greater productivity and better public health outcomes. Emerging intelligent healthcare services allow standardized data exchange between patients, mobile apps, healthcare providers, and partners. For example, Ubie, a Japanese MedTech start-up, created an AI-driven medical questionnaire to collect patients' information before seeing the doctor. Equipped with patients' information, doctors are able to increase their efficiency in examining and diagnosing the patient. After implementing Ubie, doctors experienced a 50 percent reduction in examination time, and the average waiting time for patients decreased as a result.[39] By eliminating unnecessary hospitalization for patient observation, the McKinsey Global Institute estimates that remote patient monitoring technology could reduce the cost of treating chronic diseases by ten to 20 percent.[40] Fueled by the growing inclinations of consumers to monitor their own health, advances in smart medical devices such as connected implants, wearables, and home health monitoring devices could empower patients to self-manage their health conditions. At the same time, personalized and predictive health care services could help patients to address their health conditions by leveraging data from such technologies. It has been estimated that the use of smart devices could reduce disability-adjusted life years (DALYs)[41] in high-income countries by one percent annually.[42]

- **Government.** Government agencies in Japan can tap on a range of digital technologies to enhance service delivery and cost-efficiency. With less than 12 percent of administrative work in the Japanese Government agencies being digitized, a government regulatory reform panel estimated the current cost of manually managing such work requires 323 million working hours annually, which translates into nearly USD8 million in wage costs.[43] The electronic delivery and management of administrative tasks thus offer significant cost

35. Think with Google (2020), "1905 年創業の日本旅行はどうやってデジタル推進力を発揮したのか――効率と成長を両立させる組織の動かし方とは".
Available at: https://www.thinkwithgoogle.com/intl/ja-jp/marketing-strategies/search/nihon-ryoko/
36. Think with Google (2020), "旅行検討者の興味に寄り添った多様な動画広告のビジネスインパクト - 楽天トラベルの事例から".
Available at: https://www.thinkwithgoogle.com/intl/ja-jp/marketing-strategies/video/rakuten-travel/
37. Think with Google (2019), "阪急交通社が広告投資の優先付けを見直し費用対効果を 20 倍に向上".
Available at: https://www.thinkwithgoogle.com/intl/ja-jp/marketing-strategies/programmatic/hankyu/
38. Boston Consulting Group (2020), "Bionic Revenue Management in Travel and Tourism."
Available at: https://www.bcg.com/publications/2020/bionic-revenue-management-travel-tourism
39. Ubie (2021), "Arm your clinic to stand out - By introducing ICT tools like Ubie". Available at: https://ubie.life/dxR7SjPv/FJMYRRLP
40. McKinsey Global Institute (2013), "Disruptive technologies: Advances that will transform life, business, and the global economy."
Available at: https://www.mckinsey.com/business-functions/mckinsey-digital/our-insights/disruptive-technologies
41. The disability-adjusted life year (DALY) is a measure of overall disease burden, expressed as the number of years lost due to ill-health, disability or early death.
42. McKinsey Global Institute (2018), Smart cities: Digital solutions for a more liveable future.
Available at: https://www.mckinsey.com/industries/capital-projects-and-infrastructure/our-insights/smart-cities-digital-solutions-for-a-more-livable-future
43. Sources include: The Straits Times (2020), "Japan PM Yoshihide Suga aims to get flagship digital agency running by autumn 2021: Media". Available at: https://www.straitstimes.com/asia/east-asia/japan-pm-yoshihide-suga-aims-to-get-flagship-digital-agency-running-by-autumn-2021 and Reuters (2020), "Twenty years on, Japan government's digital ambitions still stuck in piles of paper". Available at: https://www.reuters.com/article/us-japan-economy-digital-idUSKCN24P0J0

savings potential. Another important technology application in the government services sector is the use of cloud computing, which can help agencies significantly reduce IT hardware and equipment costs through the delivery of on-demand IT resources over the Internet, instead of purchasing, owning, and maintaining physical data centers and servers. Big data analytics also allows the government to analyze vast amounts of data collected to make more accurate predictions and intelligent decisions. While much literature focuses on the transformative benefits of this application to businesses in the private sector, the public sector also stands to gain from predictive and advanced analytics in many areas. These include reducing incorrect payments, increasing revenue from tax compliance, and improving policy outcomes and tracking. For example, the Japanese Government can draw on best practices in the financial services sector, using analytics to ensure payment integrity and to reduce fraud. It has been estimated that between five and ten percent of all global government transfers are improper payments, and these have the potential to be significantly reduced through the deployment of big data analytics.[44]

- **Manufacturing.** There are opportunities for technological applications such as big data analytics, additive manufacturing, IoT-enabled supply chain management, and advanced robotics to create economic value in the manufacturing sector. By improving demand forecasting and production planning leading to increased efficiency in meeting customer needs, it has been estimated that the use of big data analytics can bring about a two to three percent increase in the profit margins of manufacturers.[45] For example, Fast Retailing, a Japanese retail company, partnered with Japanese logistics systems provider, Daifuku, to automate its warehouses and distribution system. Its distribution center could now operate round-the-clock and address inefficiencies – the company was paying for costly storage after winter wear was delivered to the warehouses several months in advance.[46] By taking over labor-intensive manufacturing tasks, industrial automation and robotics also demonstrate significant potential in addressing Japan's aging and shrinking workforce – the country is projected to have the highest share of workers aged over 60 years among Organisation for Economic Co-operation and Development (OECD) economies, at 21 percent.[47] At the same time, individual workers benefit from a reduction in time spent on such tasks to focus on higher-value activities that command better wages and enjoy better work satisfaction. In addition, it has been found that by automating mundane and repetitive production tasks, industrial robotics could help improve productivity ranging from 0.8 to 1.4 percent of global GDP annually from 2015 to 2065.[48]

- **Education and training.** Digital technologies do not only hold the promise of enhancing the quality and reach of education but also facilitate the matching of demand and supply in the job market. For example, big data and analytics could be used to create personalized study plans to address each student's weaknesses while identifying programs to grow their strengths.[49] It has been found that by improving learning outcomes and ultimately the supply of skilled labor in the economy, personalized education tools, and programs – if implemented nationwide – can boost the national employment

44. McKinsey Center for Government (2017), Government productivity: Unlocking the $3.5 trillion opportunity. Available at: https://www.mckinsey.com/~/media/McKinsey/Industries/Public%20and%20Social%20Sector/Our%20Insights/The%20opportunity%20in%20government%20productivity/Government-Productivity-Unlocking-the-3-5-Trillion-Opportunity-Full-report.pdf?shouldIndex=false

45. McKinsey Global Institute (2011), Big data: The next frontier for innovation, competition and productivity. Available at: https://www.mckinsey.com/business-functions/digital-mckinsey/our-insights/big-data-the-next-frontier-for-innovation

46. World Economic Forum (2018), "Uniqlo replaced 90% of staff at its Tokyo warehouse with robots". Available at: https://www.weforum.org/agenda/2018/10/uniqlo-replaced-90-of-staff-at-its-newly-automated-warehouse-with-robots

47. OECD (2015), Workforce ageing in OECD countries. Available at: https://www.oecd.org/els/emp/2080254.pdf

48. McKinsey & Company (2017), A future that works: Automation, employment, and productivity. Available at: https://www.mckinsey.com/~/media/mckinsey/featured%20insights/digital%20disruption/harnessing%20automation%20for%20a%20future%20that%20works/a-future-that-works-executive-summary-mgi-january-2017.ashx

49. McKinsey Global Institute (2015), A labour market that works: Connecting talent with opportunity in the digital age. Available at: https://www.mckinsey.com/featured-insights/employment-and-growth/connecting-talent-with-opportunity-in-the-digital-age

rate in high-income economies by 0.5 percent annually.[50] Outside the education system, digital job platforms and e-career centers are important digital tools that enhance efficiencies and address information asymmetries in the labor market. The multiplier effects generated by an expanding network of jobseekers and employers have enabled digital jobs platforms to gather a wider universe of work opportunities, providing jobseekers with more options and a better understanding of suitable wages. Shorter search times and better job matching through digital platforms are projected to raise employment by 1.6 percent in Japan by 2030.[51]

Of the total economic benefits created by digital technologies in Japan,[52] about 50 percent (JPY33.8 trillion or USD313 billion) is likely to be concentrated in two of eight regions – suggesting a potential digital divide (Exhibit 4). The two regions, Kanto and Chubu, are also home to major prefectures and cities such as Tokyo-to (where Tokyo is located), Aichi-ken (where the country's fourth-largest city, Nagoya, is located) and Kanagawa-ken (where Yokohama is located) which are key drivers of the country's economic activity.[53] These findings are unlikely to be surprising, given regional disparities in digitization. Part of this is driven by regional differences in access to digital infrastructure. For example, the penetration rate of broadband Internet is higher in hugely populous major metropolitan regions (household broadband subscription rate reaches over 55 percent) such as Tokyo-to, Osaka-fu, and Nagoya city, and lower in sparsely populated peripheral regions (household broadband subscription rate ranges between ten and 45 percent).[54] The major challenge in deploying broadband services in these rural areas has been characterized as the "last mile" problem, which refers to the inefficiency of connections between subscribers and the nearest access points. Due to the mountainous terrain, rural regions require longer communication lines and the small population size further reduces the profitability of telecommunication companies.[55] As a result, schools in rural areas do not have the digital capabilities to switch to online lessons during school closures – many lack the necessary equipment and Internet access to conduct online learning. When the COVID-19 pandemic prompted school closures in Japan, only five percent of local government bodies, including Tokyo, launched online classes while students in the rest of the prefectures had no choice but to wait for schools to reopen.[56] To address this digital divide, the Minister for Digital Transformation, Takuya Hirai, stressed that the Digital Agency will follow a policy of "no one left behind" to create a society that is considerate of the aging population and those living outside big cities.[57]

50. McKinsey Global Institute (2018), Smart cities: digital solutions for a more livable future. Available at: https://www.mckinsey.com/~/media/McKinsey/Industries/Public%20and%20Social%20Sector/Our%20Insights/Smart%20cities%20Digital%20solutions%20for%20a%20more%20livable%20future/MGI-Smart-Cities-Full-Report.pdf

51. McKinsey Global Institute (2015), A labor market that works: Connecting talent with opportunity in the digital age. Available at: https://www.mckinsey.com/~/media/McKinsey/Featured%20Insights/Employment%20and%20Growth/Connecting%20talent%20with%20opportunity%20in%20the%20digital%20age/MGI_Online_talent_A_labor_market_that_works_Full_report_June_2015.ashx

52. The 2030 projections made for the distribution of the country's digital opportunity across different regions assume that the level and mix of economic activities in each region remains constant from 2019 to 2030.

53. Tokyo-to and Kanagawa-ken are ranked among the top five prefectures in terms of GDP contribution. Statistics of Japan (2020), Available at: https://www.e-stat.go.jp/en

54. Arai, Yoshio. Naganuma, Sae. (2010) The geographical digital divide in broadband access and governmental policies in Japan: three case studies. Available at: https://doi.org/10.4000/netcom.453

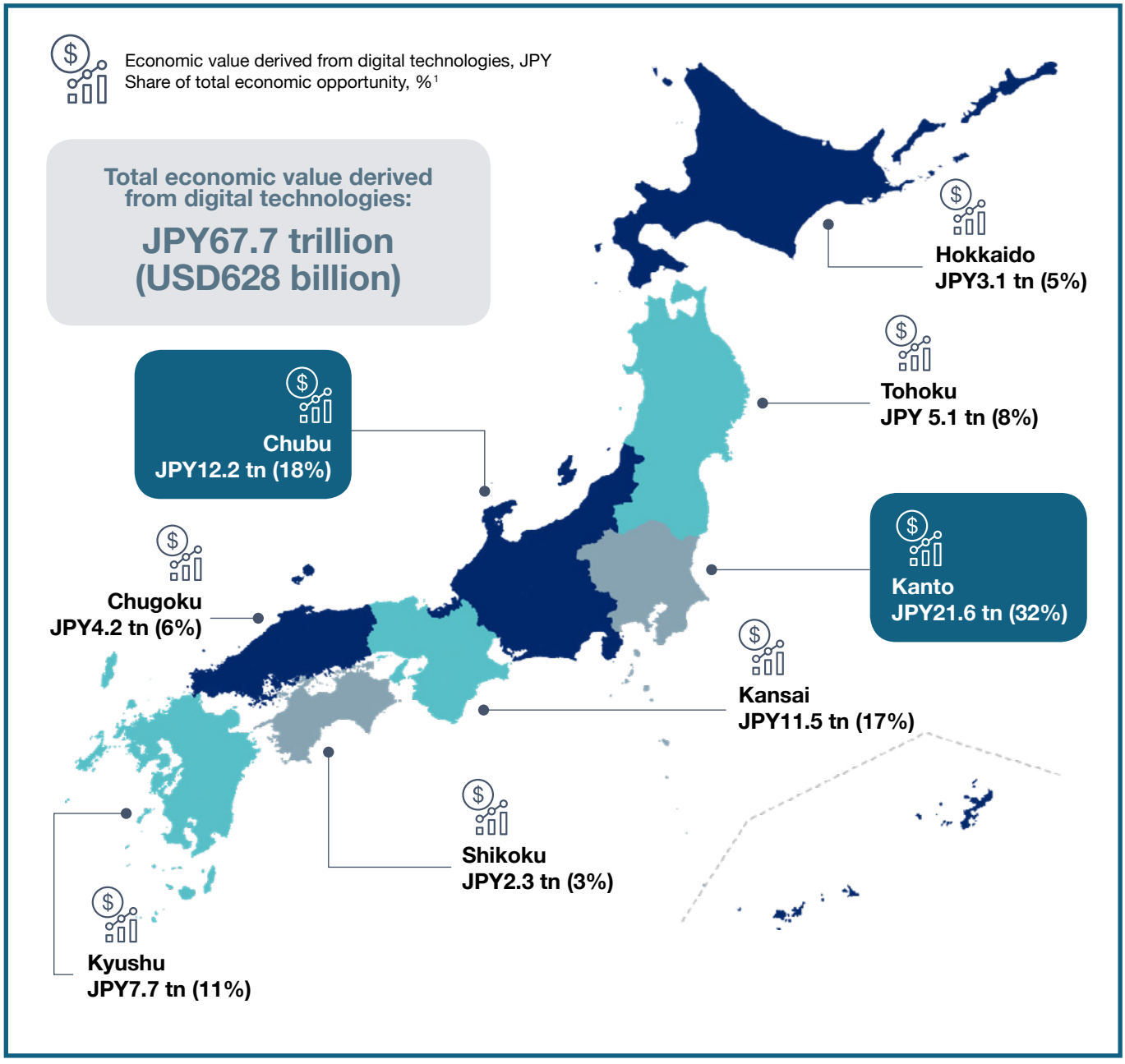
55. Arai, Yoshio. Naganuma, Sae. Satake, Yasukazu. (2012) Local government broadband policies for areas with limited Internet access. https://doi.org/10.4000/netcom.1091

56. Nikkei Asia (2020), "Japan's students left behind as the world embraces online classes". Available at: https://asia.nikkei.com/Business/Education/Japan-s-students-left-behind-as-world-embraces-online-classes

57. Foreign press Center Japan (2021), "Magazine Articles of the Month: Lose No Time in Reforms for Digital Transformation". Available at: https://fpcj.jp/en/j_views-en/magazine_articles-en/p=85996/

Exhibit 4:

50% of the country's projected digital opportunity in 2030 is focused on 2 of 8 regions, reflecting a digital divide that is important to bridge



1. Shares are computed using each region's share of GDP and number of businesses from the Statistics of Japan. See methodology for details.

1.2 TECHNOLOGIES WILL BE CRUCIAL IN ADDRESSING THE ECONOMIC IMPACTS OF COVID-19

The COVID-19 pandemic has had a significant impact on Japan's economy. In the second quarter of 2020 – shortly following the first sign of the global outbreak, Japan suffered its largest economic contraction on record at 27.8 percent amid lower domestic consumption and dampened global demand as the country entered a state of emergency and people were urged to stay home.[58] This had severe impacts on SMEs, which account for over 99 percent of all businesses and employ approximately 70 percent of the country's labor force.[59] A Teikoku Databank survey found that 500 Japanese companies declared bankruptcy between February and July 2020 due to the pandemic, with a majority coming from the food services (69 bankruptcies) and hotel industries (53 bankruptcies).[60] Although Japan's economy rebounded by five percent in the third quarter of 2020 (after lockdown restrictions were lifted), a Reuters poll forecasted that the economy would not fully return to pre-pandemic levels until at least early 2022.[61]

The economic impact of the pandemic on Japan is largely driven by the fall in exports and household consumption.[62] As the fourth largest export economy in the world,[63] Japan has been hit especially hard during the pandemic as major trading partners, such as the United States and European economies, continue to grapple with high infection rates (leading to dampened export demand), and border restrictions disrupt regional and global supply chains. As a result, shipments to the United States fell over two percent in November 2020 year-on-year, and overall, exports fell over four percent in the same period.[64] As the country implemented mobility restrictions several times to contain infections, consumers largely stayed at home and decreased expenditure on meals outside homes, medical services, public transportation, recreational services, and social expenses.[65] The Household Expenditure Survey found that household consumption in October 2020 decreased by over eight percent from the previous quarter, the largest decline on record in Japan.[66]

Technology adoption will be crucial for businesses and workers to manage the crisis's impacts. **Of Japan's total digital opportunity of JPY67.7 trillion (USD628 billion), a substantial 69 percent – JPY46.8 trillion (USD434 billion) – could be driven by technologies that help businesses and workers mitigate the impacts of COVID-19** (Exhibit 5).

JPY46.8 trillion (USD434 billion) alludes to the combined value of all technology applications that allow businesses to navigate and flourish during the pandemic and in the post-COVID future. There are three channels in which such technology applications allow for this (Exhibit 6).

- **Enabling the continuity of business operations amid remote working arrangements.** With precautionary measures implemented at

58. Nikkei Asia (2020), "Japan GDP contracts annualized 27.8% in April-June". Available at: https://asia.nikkei.com/Economy/Japan-GDP-contracts-annualized-27.8-in-April-June
59. Ministry of Economy, Trade and Industry (2019), 2019 white paper on small and medium enterprises in Japan. Available at: https://www.chusho.meti.go.jp/pamflet/hakusyo/2019/PDF/2019hakusyosummary_eng.pdf
60. Nippon (2020), "COVID-19 bankruptcies hit 500 in Japan". Available at: https://www.nippon.com/en/japan-data/h00818/
61. Nasdaq (2020), "Poll – Japan's economy needs years to return to pre-pandemic levels". Available at: https://www.nasdaq.com/articles/poll-japans-economy-needs-years-to-return-to-pre-pandemic-levels-2020-12-14
62. Share of household consumption as a percentage of GDP was 55.6 percent in Japan in 2018. Sources include: OEC (2020), "Japan". Available at: https://oec.world/en/profile/country/jpn; The Global Economy (2020), "Japan: Household consumption, percent of GDP". Available at: https://www.theglobaleconomy.com/Japan/household_consumption/
63. World's Top Exports (2019), "Japan's top trading partners". Available at: http://www.worldstopexports.com/japans-top-import-partners/#:~:text=The%20world's%20fourth%2Dlargest%20exporter,increase%20from%202015%20to%202019
64. Nikkei Asia (2020), "Japan exports post record 24th straight month of decline". Available at: https://asia.nikkei.com/Economy/Japan-exports-post-record-24th-straight-month-of-decline#:~:text=TOKYO%20(Reuters)%20%2D%2D%20Japan's%20exports,the%20world's%20third%2Dlargest%20economy
65. Japan Center for Economic Research (2020), "How COVID-19 has impacted household consumption". Available at: https://www.jcer.or.jp/english/how-covid-19-has-impacted-on-household-consumption
66. Japan Center for Economic Research (2020), "How COVID-19 has impacted household consumption". Available at: https://www.jcer.or.jp/english/how-covid-19-has-impacted-on-household-consumption

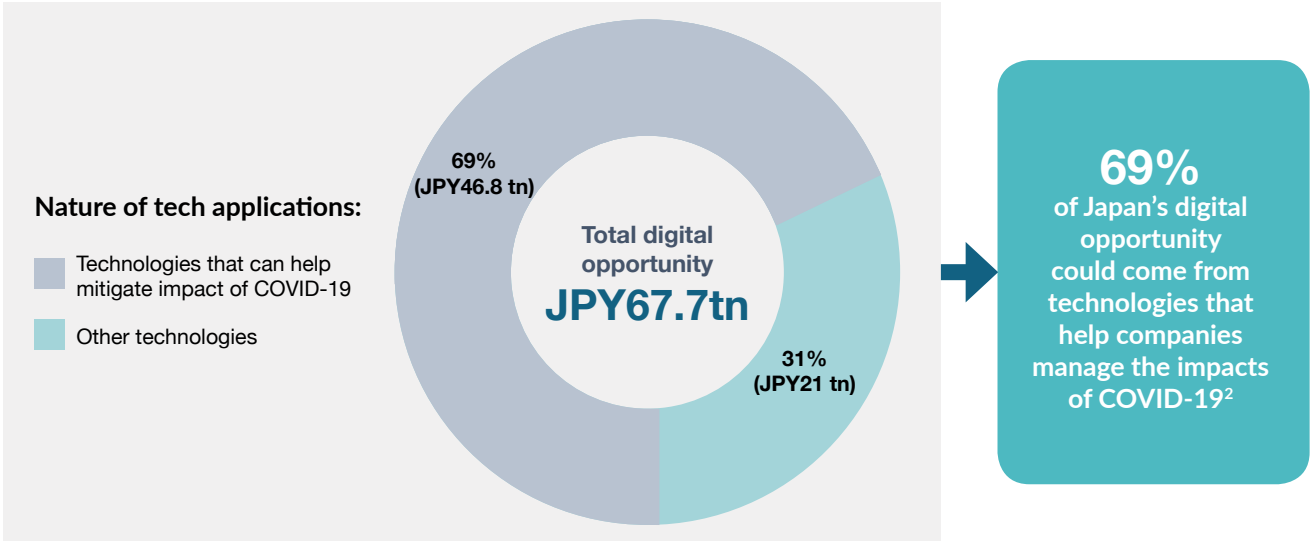
workplaces to safeguard workers' safety, the resultant reduction in on-site employees has decreased operating capacity for many businesses, while some businesses have switched to remote working arrangements indefinitely. A range of digital technologies allows for business continuity despite these circumstances, by facilitating virtual collaboration among co-workers, and through automated production processes and the remote control of physical operations from off-site locations. Examples of such technology applications include automation and AI customer service in hotels, remote patient monitoring, and robotics and automation in the manufacturing sector. Combined, such technology applications are projected to deliver a total annual economic value of JPY26.6 trillion (USD246 billion) if fully adopted by 2030 (Exhibit 6). In the hospitality industry, to ensure the safe recovery of tourism activities after the pandemic, AI-enabled customer check-in and service procedures do not only serve to address health and safety concerns by minimizing human contact, but they can also help boost staff productivity and create greater service value overall. Remote check-ins, such as the "E-Visitor Authentication" (EVA) in Singapore which uses facial recognition technology, are estimated to reduce the time taken to verify visitors' particulars by up to 70 percent.[67] At the same time, by freeing their time up from mundane administrative tasks, on-site staff may focus on higher value-add tasks, such as addressing more complex requests by customers or personalizing customer service.

- **Facilitating customer interactions, transactions and marketing through digital platforms.** Social distancing measures targeted at containing the COVID-19 outbreak have severely restricted

Exhibit 5:

Of the total digital opportunity of JPY67.7 trillion (USD628 billion), 69% is driven by technologies that can help mitigate the impacts of COVID-19

% of economic value derived from digital technologies,[1]
By nature of technology, 2030



1. These estimates do not represent GDP or market size (revenue), but rather economic impact, including GDP increments, productivity gains, cost savings, time savings, increased revenues, increased wages and increased tax collection. In this analysis, 40 technology applications are considered.
2. These refer to technology applications that enable companies to sustain business continuity and improve business performance despite implications of the COVID-19 pandemic. For example, in the retail industry, the digitization of retail platforms (e-commerce) enable companies to continue selling their products and services despite government-mandated social restrictions and reduced physical crowds as a result of the pandemic.

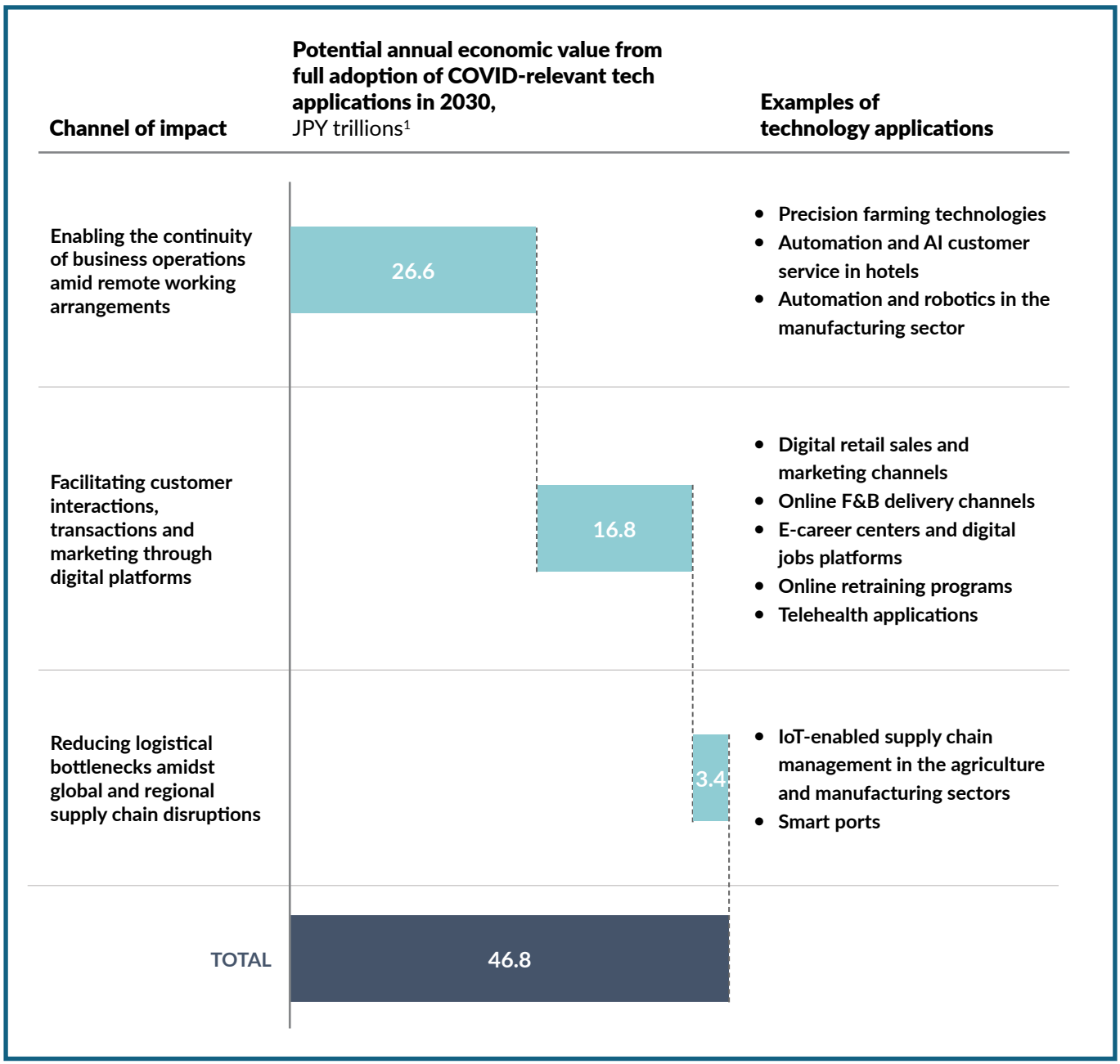
Note: Numbers may not sum due to rounding.

SOURCE: AlphaBeta analysis

67. The Straits Times (2019), "Faster check-in at Singapore hotels with new automated facial recognition system".
Available at: https://www.straitstimes.com/singapore/speedier-check-in-process-for-hotels-possible-with-new-automated-facial-recognition-system

Exhibit 6:

Technologies that mitigate the business impacts of COVID-19 can generate up to JPY46.8 trillion (USD434 billion) in annual economic value by 2030



1. These estimates do not represent GDP or market size (revenue), but rather economic impact, including GDP increments, productivity gains, cost savings, time savings, increased revenues, increased wages and increased tax collection. In this analysis, 40 technology applications are considered.
Note: Numbers may not sum due to rounding.
SOURCE: AlphaBeta analysis

customer interactions and transactions for businesses that heavily rely on physical interactions. As customers shift towards online marketplaces and services, technologies enable businesses to continue customer interactions and marketing activities online. Examples of relevant technology applications include digital e-commerce platforms, such as Google Shopping in the retail industry, online F&B delivery services, e-career centers, digital jobs platforms in the recruitment industry, and telehealth apps in the health sector. Such technology applications are projected to deliver a total annual economic value of JPY16.8 trillion (USD155 billion) if fully adopted by 2030 (Exhibit 6). Box 2 highlights an example of how a Japanese F&B business successfully leveraged digital technologies to market its offerings during the COVID-19 crisis.

- **Reduce logistical bottlenecks amidst global and regional supply chain disruptions induced by the pandemic.** Businesses have had to cope with supply chain disruptions when lockdown measures cut the supply of important raw materials and components and brought delays to the arrival of key components. These disruptions can be managed by technologies that allow for the remote tracking of goods that cross borders, and that enhance the capabilities of businesses to search and switch to alternative channels or sources. Examples of relevant technology applications include IoT-enabled supply chain management in the manufacturing sector and smart ports. Such technology applications are projected to deliver an annual economic value of JPY3.4 trillion (USD32 billion) if fully adopted by 2030 (Exhibit 6). Embedded in distribution networks, sensor data-driven operations analytics from IoT devices, such as the remote reporting of goods' locations, allow businesses to optimize transportation and improve their distribution management. The adoption of IoT in manufacturing supply chains could reduce distribution and supply chain operating costs by two to five percent.[68] IoT also has applications in "smart ports", where sensor devices can be attached to specific storage containers, raw materials or products to allow for tracking. Comprehensive real-time data on cargo schedule and ship positions allow terminal staff to plan anchorage areas and avoid critical berths from being taken out of service by quarantined vessels, reducing bottlenecks and unnecessary idle time.[69]

Moreover, technologies can boost the export capabilities of firms in Japan during the pandemic. Digital advancements have meant that companies in the country can export digital goods and services seamlessly to other countries despite restrictions on physical cross-border flows. Digital tools ranging from simple Internet search engines to more sophisticated cloud computing technologies allow enterprises to operate with ease across geographies by connecting with consumers, suppliers, and investors around the world. Past research by AlphaBeta and the Hinrich Foundation reflects that digital exports (comprising the export of digitally-enabled goods and services) accounted for over two percent of the country's total export value in 2019, and could potentially grow further by more than four-fold by 2030. Box 3 shows further details of this research and Box 4 provides examples of SMEs in Japan which have utilized digital tools to export goods and services successfully.

68. McKinsey Global Institute (2011), Big data: The next frontier for innovation, competition, and productivity. Available at: https://www.mckinsey.com/~/media/McKinsey/Business%20Functions/McKinsey%20Digital/Our%20Insights/Big%20data%20The%20next%20frontier%20for%20innovation/MGI_big_data_full_report.pdf

69. World Ports Sustainability Program (2020), WPSP COVID-19 guidance documents for Ports. Available at: https://safety4sea.com/wp-content/uploads/2020/05/WPSP-COVID-19-Guidance-document-for-ports-2020_05.pdf

Box 2.
Kyoto Beer Lab: How a brick-and-mortar F&B business reinvents its business model to integrate digital channels during the pandemic

Photo Source: https://ameblo.jp/ms-momi/entry-12662621206.html

When the COVID-19 outbreak occurred, the Japanese Government encouraged companies to switch to remote work arrangements to achieve its goal of cutting social contact by 80 percent in a bid to curb the spread of the virus.[70] A poll in April 2020 reflected that about 65 percent of companies had shifted to remote work arrangements and that the number of people leaving their homes was estimated to have decreased by between 18 and 88 percent across prefectures in the country.[71] Prefectures implementing special precautionary measures such as Tokyo and Kyoto saw a larger reduction in footfall in public areas, as compared to other prefectures such as Shiga which only saw about 18 percent fall in people going outside.[72] These restrictions hit restaurants and bars really hard. Kyoto Beer Lab, a popular bar in Kyoto, was one of the many businesses impacted by the sharp fall in footfall and tourists during the pandemic. Kyoto is heavily dependent on tourism and travel restrictions have led to huge declines in sales for many F&B businesses. Tom Ainsworth, the co-founder of Kyoto Beer Lab, remarked, "Afternoons are a bit slow without the holiday makers…".[73] Other bars and restaurants in Japan cited a 20 to 40 percent decrease in sales.[74]

In response to the crisis, Kyoto Beer Lab began selling takeaway draft and bottled beer at the front door of the bar. Recognizing the increasing demand for bottled liquor for home consumption during the pandemic, the company decided to

70. Sources include: Reuters (2020), "Some Japan firms rethink traditional office as pandemic boosts working from home: Reuters poll". Available at: https://www.reuters.com/article/us-japan-companies-office-poll-idUSKCN25E2Y8; Nikkei Asia (2020), "'Work from home' to cost Japanese companies $12.1bn, study finds". Available at: https://asia.nikkei.com/Business/Business-trends/Work-from-home-to-cost-Japanese-companies-12.1bn-study-finds

71. The Mainichi (2020), "Few areas in Japan achieve 80% reduction in people going outside: data". Available at: https://mainichi.jp/english/articles/20200427/p2a/00m/0na/002000c

72. The Mainichi (2020), "Few areas in Japan achieve 80% reduction in people going outside: data". Available at: https://mainichi.jp/english/articles/20200427/p2a/00m/0na/002000c

73. Good beer hunting (2020), "Degrees of restraint – Drinking in Japan during a disaster". Available at: https://www.goodbeerhunting.com/blog/2020/3/25/degrees-of-restraint-drinking-in-japan-during-a-disaster

74. Good beer hunting (2020), "Degrees of restraint – Drinking in Japan during a disaster". Available at: https://www.goodbeerhunting.com/blog/2020/3/25/degrees-of-restraint-drinking-in-japan-during-a-disaster

Box 2 (cont'd).
Kyoto Beer Lab: How a brick-and-mortar F&B business reinvents its business model to integrate digital channels during the pandemic

launch an online store for these takeaway drinks.[75] The online store featured freshly brewed beers sold in bottles with delivery service to any prefecture within Japan. To publicize its online business, the brewery provided a ten percent discount for a limited period during the period of the launch and created a monthly subscription program for loyal customers.[76] The Kyoto Beer Lab also created and sold their own merchandise online to customers nationwide. As a result, Internet sales have become a lifeline for the bar and brewery. Amid measures that prohibit restaurants and bars serving alcohol from opening for business, Kyoto Beer Lab was able to rely on online channels to continue serving customers while managing the waves of COVID-19 surges.

The digital adoption journey of Kyoto Beer Lab has not stopped at the online store. The bar used an online-based reservation system to manage crowd levels in the bar to ensure compliance with social distancing regulations.[77] Kyoto Beer Lab is a good example of a small enterprise in a vulnerable sector that has recovered and stayed resilient during the pandemic through the adoption of digital technologies. This has in turn created new and sustainable revenue streams that should allow the bar to continue to flourish in the post-pandemic era.

Photo Source: https://note.com/takemeout540/n/n78903e4e514d

75. Kyoto Beer Lab (2020), Available at: https://kyotobeerlab.stores.jp
76. Kyoto Beer Lab (2020), "News". Available at: https://kyotobeerlab.stores.jp/news/5fe690ce72eb4609825b4c4d
77. Retty (2021), "Kyoto Beer Lab". Available at: https://retty.me/area/PRE26/ARE658/SUB11101/100001411983/?fbclid=IwAR2CGuSS7CFuEOzlYmMx1sifIJCn_LYpbluCRcstXvHOBzBj8RLW-RDnZJk

Box 3.
The importance of digital technologies for boosting Japan's export sector

Though trade has traditionally been dominated by physical goods, growth in global goods trade has flattened while global data flows have surged, with the amount of cross-border bandwidth has grown 45 times since 2005.[78] This is projected to increase by an additional nine times over the next five years as flows of information, searches, communication, video, transactions, and intra-company traffic, continue to rise.[79] Digital trade is therefore crucial as a way to increase and diversify Japan's export base.

Past research by AlphaBeta and the Hinrich Foundation has found that digital technologies were already being leveraged to some extent to boost Japan's exports.[80] It is estimated that Japan's digital exports accounted for over two percent of the country's total export value at JPY1.9 trillion (USD17 billion) in 2019. This meant that if "digital" were a sector, it would rank as the country's ninth-largest export sector. This value encompasses the export value of **digitally-enabled products** which includes goods exported via e-commerce platforms and revenues earned from overseas downloads of domestically developed smartphone apps, as well as the export value of **digitally-enabled services** which includes telecommunication services (e.g., export of video conferencing, digital file sharing and Voice Over Internet Protocol or VOIP services) and online video advertising revenues gained from abroad. Driving Japan's digital export value in 2030 will be e-commerce exports (JPY4.8 trillion or USD43 billion) – fueled by the strong performance of e-commerce companies in Japan seeking to establish stronger footholds in global markets, as well as overseas downloads of locally developed apps (JPY1.6 trillion or USD14.3 billion) – due to the country's massive mobile gaming market.

However, most businesses in Japan have yet to tap the digital export opportunity, and the research found that a significantly larger digital export opportunity in 2030 was at stake. It estimated that in the absence of digital trade barriers such as policies that restrict cross-border data flows or the international exchange of digital services, Japan's digital export value could grow by more than four-fold to reach JPY8.2 trillion (USD73 billion) in 2030. In addition, many businesses, particularly SMEs still face substantial challenges in bridging the gap to global markets. Many lack the resources to research international sales opportunities, build global business networks and promote their products overseas. These barriers would have to be addressed – especially today in the wake of the COVID-19 pandemic and its grave impact on physical trade – in order for Japan to unlock the full value in its export economy.

78. McKinsey Global Institute (2016), Digital globalization: The new era of global flows.
Available at: https://www.mckinsey.com/business-functions/digital-mckinsey/our-insights/digital-globalization-the-new-era-of-global-flows
79. McKinsey Global Institute (2016), Digital globalization: The new era of global flows.
Available at: https://www.mckinsey.com/business-functions/digital-mckinsey/our-insights/digital-globalization-the-new-era-of-global-flows
80. Hinrich Foundation and AlphaBeta (2019), The Data Revolution: How Japan can capture the digital trade opportunity at home and abroad. (Unpublished)

Box 4.
Examples of SMEs in Japan utilizing digital platforms for export

During and after the COVID-19 pandemic, digital platforms have been instrumental in enabling both SMEs and large corporates to overcome physical cross-border flows and reach out to overseas customers and suppliers. This box offers examples of how several enterprises in Japan have leveraged such platforms to export during the pandemic.

ONLINE MARKETPLACES

While large enterprises have the capacity to build their own ecommerce site, global online marketplaces such as Rakuten and Shopee offer SMEs stable and interoperable payments infrastructure, logistics support and global visibility, which allow them to easily expand their exporting capabilities. For example, Kyoto Omuro, a local florist that sells flowers in Kyoto's prestigious Ninnaji temple, has been able to leverage such platforms to sell its potted seasonal flowers abroad. Besides selling to Asian markets, such as Singapore, Vietnam and Thailand, the florist is currently eyeing an expansion into the European market. In 2019, approximately 80 percent of Omuro's sales came from online channels, of which 30 percent were from overseas markets through online global marketplaces such as Shopee.[81] By creating an online presence and partnering with cross-border marketplaces, Omuro was able to partner directly with local logistics partners to export their products efficiently. Businesses which have created their own website, such as traditional, family-owned Japanese brewery, Sekinoichi Shuzo, have also gained success exporting to overseas markets. Despite being in the rural area of Ichinoseki City, the brewery uploaded pictures of its warehouse and physical store which gave online customers a peace of mind and foreign consumers were more willing to order from the website.

Photo Source: https://www.smrj.go.jp/english/sme/omuro/

81. SME Support Japan (2020), "Kyoto Omuro". Available at: https://www.smrj.go.jp/english/sme/omuro/

APP PLATFORMS

Smartphone application platforms are also a key avenue for game developers in Japan to reach out to overseas markets. Due to the great popularity of Japanese mobile games, the app export market in Japan has been growing rapidly. Japanese app exports in 2017 were approximately JPY155 billion (USD1.4 billion) and this number is estimated to grow potentially ten-fold to reach over JPY1.6 trillion (USD14.3 billion) by 2030.[82]

ONLINE VIDEO CHANNELS

Online video channels, such as YouTube, generate additional revenue from overseas markets for content creators in Japan. The vast targeted audience entices foreign firms to advertise their products by partnering with content creators, while local content creators who amassed a huge following could monetize their content by displaying advertisements. For example, YouTube content creator Risa Sekine's channel accumulated over one million subscribers with over 344 million views.[83] In 2017, content creators in Japan have earned over JPY6 billion (USD55 million) in advertising revenues from foreign markets through online video platforms and this figure could potentially grow to over JPY57 billion (USD508 million) by 2030.[84] Besides generating revenue from advertisements, content creators can monetize their digital goods and services, such as manga and anime, which can be transmitted instantaneously to customers anywhere in the world as long there is an Internet connection. When the pandemic occurred, Kiyuki Inc., a Japan-based consultancy supporting anime studios, helped make Studio Ghibli's films available worldwide via online streaming services to capture the rise in home entertainment demands from home-bound viewers.[85]

82. Hinrich Foundation and AlphaBeta (2019), The Data Revolution: How Japan can capture the digital trade opportunity at home and abroad. (Unpublished)
83. Kimberlee Morrison (2015), "Why influencer marketing is the new content king", Adweek SocialTimes.
Available at: http://www.adweek.com/socialtimes/why-influencer-marketing-is-the-new-content-king-infographic/618187
84. Kimberlee Morrison (2015), "Why influencer marketing is the new content king", Adweek SocialTimes.
Available at: http://www.adweek.com/socialtimes/why-influencer-marketing-is-the-new-content-king-infographic/618187
85. Roland Kelts (2020), Anime business move online to survive the pandemic. Available at: https://www.jef.or.jp/journal/pdf/234th_Special_Article_01.pdf

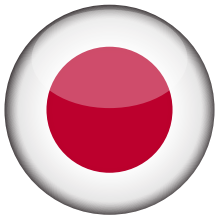
CAPTURING THE PRIZE — THREE PILLARS OF ACTION

To fully capture the digital opportunity, three pillars of action will be required by policymakers in Japan:
1) Promote an innovation-oriented environment;
2) Enhance digital skills training and education; and
3) Secure digital export opportunities.

To date, businesses in Japan have benefited from significant strides made across all three pillars. The government has been showing strong leadership to promote an innovation-oriented environment through designating "National Strategic Special Zones", which aim to encourage innovation and the application of digital technologies under a relaxed regulatory environment. To enhance digital skills training and education, the government has introduced digital skills courses and certifications and forged strong partnerships with academia and industry players to create education programs that align with industry needs. At the same time, the government places a strong focus on the use of digital technology in schools through initiatives such as the "Global Innovation Gateway for All" (GIGA) project, which aims to ensure every student owns a personal computer or tablet by 2023. In addition, as an export-oriented country, Japan has been facilitating digital export opportunities for businesses through digital platforms established by the Japan External Trade Organization (JETRO) to advance into overseas markets and the "US-Japan Digital Trade Agreement" which resolves bottlenecks in cross-border data flows.

To fully adopt digital technologies and expedite the digital-led recovery from the impacts of the COVID-19 pandemic, the Japanese Government could consider

"CAPTURING THE PRIZE"
THREE PILLARS OF ACTION



Three pillars of action are required to fully unlock the digital opportunity

1. Promote an innovation-oriented environment
2. Enhance digital skills training and education
3. Secure digital export opportunities

Significant effort has already been made in the following areas

- Providing strong support for patent development and Intellectual Property (IP) protection for SMEs
- Creating a supportive policy environment to champion the development of new technologies
- Provisioning of digital skills courses
- Addressing talent shortages through academia-industry-government partnerships
- Focusing on digital technology in education
- Promoting equitable access to digital technology in schools
- Establishing digital platforms to access foreign markets
- Minimizing border frictions

However there are areas in which Japan can further strengthen its approach

- Nurture local start-ups and create tech unicorns
- Provide channels for enterprises and research institutions to commercialize emerging technologies
- Increase availability of short-term, flexible courses in advanced digital skills
- Incentivize employees to seek digital upskilling opportunities
- Equip teachers with know-how to integrate technology in education
- Provide capacity-building support for SMEs to encourage participation in digital trade
- Participate in digital trade agreements to promote digital trade in the region

building a robust tech ecosystem that provides multi-faceted support to start-ups of various phases of growth and promotes the commercialization of R&D. Additionally, the country could implement policies that make available short-term, flexible digital skilling courses to meet the rapidly emerging demand for advanced digital skill needs like data modeling and software development. To further enhance digital trade opportunities for businesses in Japan, it may also be useful to consider participating in multilateral digital trade agreements and provide capacity-building support for SMEs to encourage participation in digital trade.

2.1 PILLAR 1: PROMOTE AN INNOVATION-ORIENTED ENVIRONMENT

To harness the productivity benefits of digital transformation and build economic resilience in the COVID-19 crisis, it is crucial for the Japanese Government to promote an innovation-oriented environment and vibrant tech ecosystem.

Japan has already made significant efforts in the following areas:

- **Providing strong support for patent development and Intellectual Property (IP) protection for SMEs.** Amid the growing distribution of products and services globally facilitated by big data and AI, Japan identified IP as a key element of the country's long-term growth strategy to assist local enterprises in the creation, management and utilization of their valuable intellectual assets.[86] A study conducted in 2020 by the World Intellectual Property Organization found that Japan holds the third largest number of patents in force globally at 2.1 million, behind the United States (3.1 million) and China (2.7 million).[87] According to a joint study by the European Patent Office and the European Union Intellectual Property Office, SMEs which have filed at least one patent are 21 percent more likely to boost its chances of growth, including exploiting their innovations commercially with an external partner, and facilitating commercial contracts.[88] Recognizing the significant growth opportunity stemming from IP, the Japan Patent Office (JPO) has been offering consultation services by "Industrial Property Rights Specialists", with deep expertise in IP rights issues, subsidizing patent registration fees and providing accelerated patent application reviews required to verify inventions.[89] In addition, to lower the risks associated with overseas IP infringements, JPO also established an overseas IP litigation scheme to support SMEs that become embroiled in IP disputes overseas and launched the "Patent Prosecution Highway" program to accelerate the process of obtaining patent rights in multiple countries and regions.[90]

- **Creating a policy environment to champion the development of innovations.** To promote the development of technological innovations, the government designated six zones in Tokyo, Kansai, Niigata, Yabu, Fukuoka and Okinawa as "National Strategic Special Zones" in 2014

86. Intellectual Property Strategy Headquarters (2017), Intellectual Property Strategic Program 2017. Available at: https://www.kantei.go.jp/jp/singi/titeki2/kettei/chizaikeikaku20170516_e.pdf

87. World Intellectual Property Organization (2020), "World Intellectual Property Indicators Report: Trademark and Industrial Design Filing Activity Rose in 2019; Patent Applications Marked Rare Decline". Available at: https://www.wipo.int/pressroom/en/articles/2020/article_0027.html

88. European Patent Office (2017), "Evidence of the importance of patents for SMEs". Available at: https://www.epo.org/about-us/annual-reports-statistics/annual-report/2017/highlights/importance-of-patents-for-smes.html

89. Japan Patent Office (2020), IP support for SMEs in Japan. Available at: https://www.wipo.int/edocs/mdocs/mdocs/en/wipo_ip_tyo_20/wipo_ip_tyo_20_t_2-related1.pdf

90. Sources include: Ministry of Economy, Trade and Industry (2016), "Lowering the risks associated with Overseas Intellectual Property Disputes". Available at: https://www.meti.go.jp/english/press/2016/0608_03.html; Japan Patent Office (2020), "Patent Prosecution Highway (PPH)". Available at: https://www.jpo.go.jp/e/system/patent/shinsa/soki/pph/

for piloting new products and services under relaxed regulatory requirements and lower taxes. For example, these zones receive special provisions under the "Special Cases of Mixed Medical Care Coverage", which permits the use of pharmaceuticals that have been approved in countries with high medical standards but not in Japan.[91] Fully autonomous self-driving tests have also been carried out on public roads within the demarcated zones.[92] Since its inception, over 100 reforms have been implemented and 350 projects initiated.[93] One key project is the "Super City Initiative" that aims to create a "Data Linkage Platform" that collects, organizes and transfers data across multiple fields such as education, finance, disaster prevention, ecology and logistics to provide holistic services to residents. For example, elderly residents can receive comprehensive community care by leveraging a taxi dispatch system that arranges transportation to and from hospitals based on appointment data.[94] Another key policy is the regulatory sandbox framework launched in 2018. Under a controlled environment with relaxed regulations, companies conduct pilot projects on early-stage business models and cutting-edge technologies applied in real-life situations. Thus far, 15 projects have successfully exited the sandbox with approvals in the field of IoT, telehealth, Fintech and mobility.[95]

While there is already a comprehensive range of policies to facilitate digital innovation by businesses in Japan, the country could go further in the following areas:

- **Nurture local start-ups and create tech unicorns.** Despite being the world's third largest economy, Japan was ranked 11th, behind countries like Brazil and India, on the number of tech "unicorns"[96] created. Although Japan's economy

91. Invest Tokyo (2020), "Overview of the Special Zone Programs". Available at: https://www.investtokyo.metro.tokyo.lg.jp/en/about/nssz/
92. Invest Tokyo (2020), "Overview of the Special Zone Programs". Available at: https://www.investtokyo.metro.tokyo.lg.jp/en/about/nssz/
93. Kantei (2020), "The National Strategic Special Zones". Available at: http://www.kantei.go.jp/jp/singi/tiiki/kokusentoc/supercity/supercityforum2019/supercityforum2019_EnglishVer.html
94. Office for Promotion of Regional Revitalization (2020), Super City Initiative. Available at: https://www.kantei.go.jp/jp/singi/tiiki/kokusentoc/supercity/supercityforum2019/AboutSuperCityInitiative.pdf
95. Japan External Trade Organization (2018), New regulatory sandbox framework in Japan. Available at: https://www.jetro.go.jp/ext_images/en/invest/incentive_programs/pdf/Detailed_overview.pdf
96. "Unicorn" is a term used to describe privately-held start-up companies valued at more than USD1 billion.

is about four times the size of South Korea, the former has only created four unicorns whereas the latter has 12.[97] The Director of JETRO's innovation promotion division has attributed the limited entrepreneurial activity in the country to "an unchallenging environment, a disjointed effort between the government and the private sector to form a start-up system, and the lack of cross-cultural and cross-industrial communication".[98] For Japan to fully embrace opportunities in the digital economy, the country will need to address the existing challenges and provide a conducive environment for local start-ups to grow. This includes building key components of a robust start-up ecosystem such as having accelerators, partnerships between start-ups and large enterprises, attracting venture capital, and creating coworking and networking spaces. As outlined in Box 5 below, South Korea offers an international best practice in this regard.

- **Provide channels for enterprises and research institutions to commercialize emerging technologies.** Despite having one of the highest government research and development (R&D) expenditures in the world at over three percent of GDP, firms in Japan have experienced minimal productivity gains.[99] As a result, R&D investments do not necessarily translate into new products and services. For Japan to promote the commercialization of new ideas, the government could consider two international best practices. These include Singapore's "A*StartCentral", and South Korea's long-held model of fostering partnerships between industry and research institutions. Box 6 provides further information on how the governments in both countries have facilitated the commercialization of research from academic institutions.

97. Nikkei Asia (2020), "Unicorns surge to 500 in number as US and China account for 70%". Available at: https://asia.nikkei.com/Business/Startups/Unicorns-surge-to-500-in-number-as-US-and-China-account-for-70 and Seoul (2021), "List of the Top ten Korean Startup Unicorns - As of 2021" Available at: https://seoulz.com/list-of-the-top-10-korean-startup-unicorns-as-of-2021/ (Information obtained in June 2021)

98. Tech in Asia (2019), "Japan is open for start-ups, but assimilation may prove difficult". Available at: https://www.techinasia.com/japan-open-startups-assimilation-prove-difficult

99. Sources include: McKinsey & Company (2020), "A new era for industrial R&D in Japan". Available at: https://www.mckinsey.com/business-functions/operations/our-insights/a-new-era-for-industrial-rnd-in-japan# ; Koji Nakamura, Sohei Kaihatsu, and Tomoyuki Yagi (2018), "Productivity improvement and economic growth". Available at: https://www.boj.or.jp/en/research/wps_rev/wps_2018/data/wp18e10.pdf

Box 5.
South Korea's "Innovative Startup Package" offers funding and mentorship to nurture local tech start- ups

South Korea is home to 12 unicorns, including e-commerce platform, Coupang, and game developer, Bluehole.[100] A key ingredient of the country's success in nurturing high-growth start-ups is strong government support. This includes a combination of strong funding support, risk-sharing, and capacity-building programs.

In 2019, the Ministry of SMEs and Startups committed USD85 million to create full support packages, known as the "Innovative Startup Package", for 1,000 tech-based start-ups through each growth phase from preparation, early stage to a full-fledged business and exit.[101] At the same time, the government has also participated in risk-sharing models with tech start-ups and innovators. Under the "Innovative Startup Package", every start-up funded by the government is only required to pay back ten percent of the funding received upon success.[102]

Besides direct monetary support from the government, the state-led incubator in South Korea, "Accelerator Investment-Driven Tech Incubator Program for Startup" (TIPS), collaborates with private sector partners to provide promising tech start-ups access to angel investment, R&D resources and mentorship.[103] For example, one of the participants, Dabeeo, a tech start-up developing mobile mapping technologies and spatial recognition software, successfully attracted sufficient investment from the private sector to expand its operations to the rest of Asia and Europe. The start-up has developed AI-powered mobile mapping technologies and spatial recognition software, securing KRW2 billion (USD16.7 million) in investment from investors.[104]

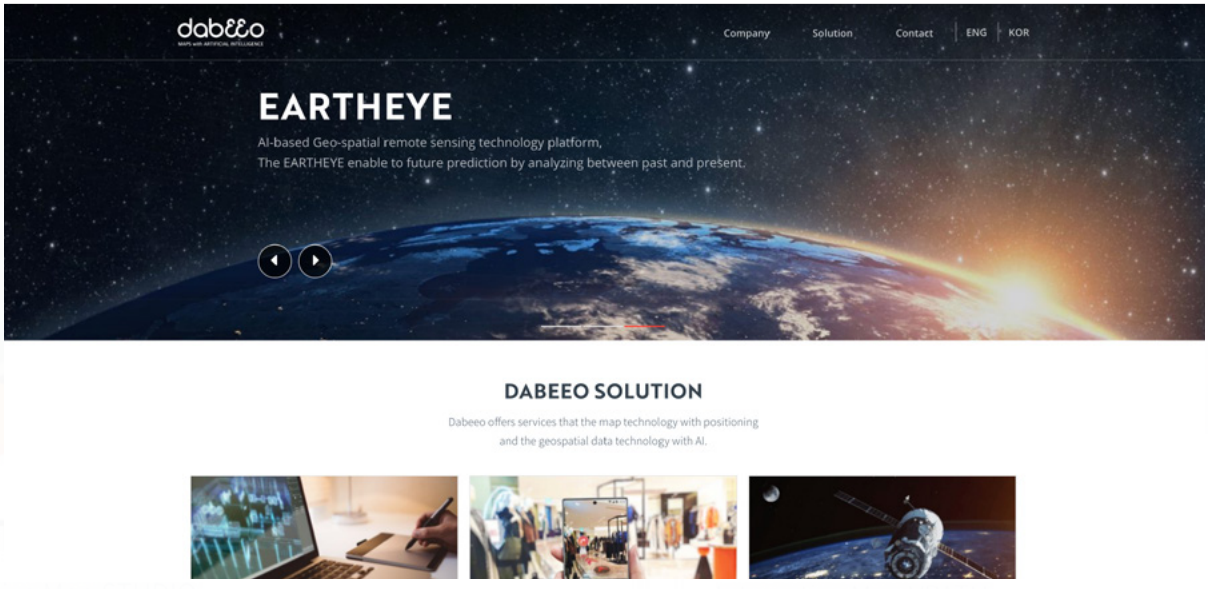


Photo Source: https://www.dabeeo.com/?lang=en

100. Seoul (2021), "List of the Top ten Korean Startup Unicorns - As of 2021"
Available at: https://seoulz.com/list-of-the-top-10-korean-startup-unicorns-as-of-2021/ (Information obtained in June 2021)
101. The Korea Herald (2019), "Supporting promising start-ups from birth to exit." Available at: http://www.koreaherald.com/view.php?ud=20190520000710
102. Tech Incubator Program for Startup (2020), Available at: http://www.jointips.or.kr/about_en.php
103. Tech Incubator Program for Startup (2020), Available at: http://www.jointips.or.kr/about_en.php
104. The Korea Herald (2019), "Korean start-ups get support from state-led incubation program".
Available at: http://www.koreaherald.com/view.php?ud=20190521000179

Box 6.
International examples from Singapore and South Korea to promote the commercialization of research

A*STARTCENTRAL" IN SINGAPORE: COMMERCIALIZING MEDICAL TECHNOLOGY INNOVATIONS

In Singapore, the medical technology (MedTech) industry has been growing with support from the government to address the increased healthcare demand emerging from its aging population – close to half of its total population was projected to be aged 65 years and older by 2050.[105] In 2018, the MedTech industry contributed about SGD13.3 billion (USD9.6 billion) to the country's economy, from just SGD3.1 billion (USD2.2 billion) in 2008.[106] Moreover, the country nurtured over 250 homegrown MedTech companies in 2018, more than double that of 2014, with over half of them being start-ups.[107] The successful commercialization of MedTech innovations despite the high costs and longer gestation periods of product development stages in this sector can be largely attributed to strong government support. A key program is "A*StartCentral", an incubation program launched by Singapore's Agency for Science, Technology and Research (A*STAR) to fast-track the commercialization of spin-offs from basic research in the fields of biotechnology and medical technology. The incubation program offers a collaborative workspace with various tools such as 3D printers, milling and cutting machines for researchers, scientists, engineers and aspiring entrepreneurs to prototype new ideas.[108]

Photo Source: https://www.straitstimes.com/business/companies-markets/astar-launches-innovation-facility-for-biotech-start-ups

105. Business Times (2019), "Greater support for medtech firms in Singapore to thrive'.
Available at: https://www.businesstimes.com.sg/hub/sff-x-switch-2019/greater-support-for-medtech-firms-in-singapore-to-thrive
106. Business Times (2019), "Greater support for medtech firms in Singapore to thrive'.
Available at: https://www.businesstimes.com.sg/hub/sff-x-switch-2019/greater-support-for-medtech-firms-in-singapore-to-thrive
107. Business Times (2019), "Greater support for medtech firms in Singapore to thrive'.
Available at: https://www.businesstimes.com.sg/hub/sff-x-switch-2019/greater-support-for-medtech-firms-in-singapore-to-thrive
108. Agency for Science, Technology and Research (2020), "Discover innovation and entrepreneurship with A*StartCentral".
Available at: https://www.a-star.edu.sg/enterprise/innovation-platforms/a-startcentral/for-a-star-staff

Box 6 (cont'd). International examples from Singapore and South Korea to promote the commercialization of research

SOUTH KOREA: A STRONG CULTURE OF COLLABORATION BETWEEN ACADEMIA, INDUSTRY AND GOVERNMENT

South Korea's position as one of the world's most innovative nations has been often attributed to the country's outstanding performance in R&D intensity, which reflects both R&D investment made by government and industry, and the number of researchers working in and between both sectors. For example, data on the industry-academia movements of individuals from 71 countries show that South Korea registered the greatest share of researchers who moved from industry to academia between 2017 to 2019.[109] This high R&D intensity has emerged from a historically "top-down" innovation system which promotes close collaboration between government, industry and the academic community. These are evident from the government's establishment of research institutes to nurture industry capabilities such as the Korea Institute of Science and Technology (KIST) in 1966, a dedicated ministry to oversee all tech and innovation efforts (the Ministry of Science and Technology) a year later, and an evergreen focus to nurture homegrown high-tech industries (from semiconductor design and manufacture in the 1990s to biotechnology, AI and cybersecurity today).[110] A case in point of a company that has benefited from strong government support and research collaborations to achieve global innovator status is Samsung. As South Korea's largest chaebol (a large family-owned business conglomerate), the company is one of the world's leaders in the design and manufacture of tablets, smartphones and computer chips. With support from the government, it has collaborated with leading academic institutions such as Sungkyunkwan University in Seoul on electrochemistry research - this partnership was one of its most productive, leading the company to develop new energy sources for its products such as lithium-ion batteries.[111] Other partnerships include Seoul National University, and the Korea Advanced Institute of Science and Technology (KAIST).

109. League of Scholars. Available at: https://www.leagueofscholars.com/

110. Leigh Dayton (2020), "How South Korea made itself a global innovation leader". Nature. Available at: https://www.nature.com/articles/d41586-020-01466-7

111. Leigh Dayton (2020), "How South Korea made itself a global innovation leader". Nature. Available at: https://www.nature.com/articles/d41586-020-01466-7

2.2 PILLAR 2: ENHANCE DIGITAL SKILLS TRAINING AND EDUCATION

It is critical to ensure that workers in Japan are able to use digital technologies to access job opportunities, run businesses and enhance productivity in their work.[112] At the same time, the seeds for fostering a future generation of adaptable and digitally skilled workforce must be planted early to ensure a healthy digital talent pipeline.

Japan is already working on building digital talent through the following action areas:

- **Provisioning of digital skills courses and certifications.** The Ministry of Economy, Trade and Industry (METI) has certified more than 100 practical courses in the fields of IT and data, some of which are eligible for a subsidy provided by the government.[113] In addition, the Information Technology Engineers Examination has been held by METI to evaluate and certify digitally skilled professionals across different areas. With approximately 600,000 applicants each year, certificates awarded upon passing these examinations have been used by workers for career development and promotion opportunities.[114]

- **Addressing shortages in digital talent through academia-industry-government partnerships.** In 2016, the Japanese Cabinet Office established the "Strategic Council for AI Technology" to develop a roadmap for the industrialization of AI through industry-government-academic collaboration and identified strategic areas in which AI could bring significant benefits such as productivity, health, medical care and welfare, mobility, and information security. For the country to increase its productivity growth to over two percent by 2030, the labor force faces a shortage of about 72,000 to 438,000 AI-related tech engineers, based on the growth of IT demand.[115] To address the potential shortage of tech engineers in Japan and boost productivity, the roadmap highlighted the need for education programs to increase the pool of workers skilled in AI-related problem-solving, possessing computer science knowledge and having the ability to apply AI on existing social issues. In response to the severe shortage of AI and data science experts, Rikkyo University established Japan's first graduate school, "Graduate School of Artificial

112. Such a vision for New Zealand as a "Digital Nation" was also laid out in the Business Growth Agenda by the New Zealand government. See: Ministry of Business, Innovation and Employment (2017), The Business Growth Agenda: Building a Digital Nation. Available at: https://www.mbie.govt.nz/assets/247943bfa5/building-a-digital-nation-bga.pdf

113. Based on an interview with the Ministry of Economy, Trade and Industry (METI) in August 2020.

114. Based on an interview with the Ministry of Economy, Trade and Industry (METI) in September 2020; Ministry of Economy, Trade and Industry (METI), "Japan Information-Technology Engineers Examination". Available at: https://www.jitec.ipa.go.jp/index-e.html

115. Ministry of Economy, Trade and Industry (2019), "IT 人材需給に関する調査". Available at: https://www.meti.go.jp/policy/it_policy/jinzai/houkokusyo.pdf

Intelligence and Science," which specialized in AI.[116] Additionally, the Council recommended partnerships between academia and the industry through internship programs that address real-life problems, international exchange programs to align with global standards, and increased collaboration between research institutions and the government with funding support from the Japan Science and Technology Agency.[117]

- **Focusing on digital technology in education.** Recognizing the importance of instilling the fundamentals of programming at an early age to improve the competitiveness of the future workforce, Japan introduced computer programming as mandatory content for all K-12 education levels starting from in elementary schools in 2020.[118] By 2022, a new subject "Information I", which includes programming, will be compulsory in high schools.[119] From 2025, "Information I" will be a compulsory subject in the Common Test for University Admissions. In tertiary education, the Tokyo Institute of Technology introduced a new graduate program, "Progressive Graduate Minor in Data Science/Artificial Intelligence (DS/AI)" to provide comprehensive knowledge and hands-on training in data science and AI utilization, enabling students to apply advanced data science (DS) and AI expertise to activities in their respective fields of specialization.

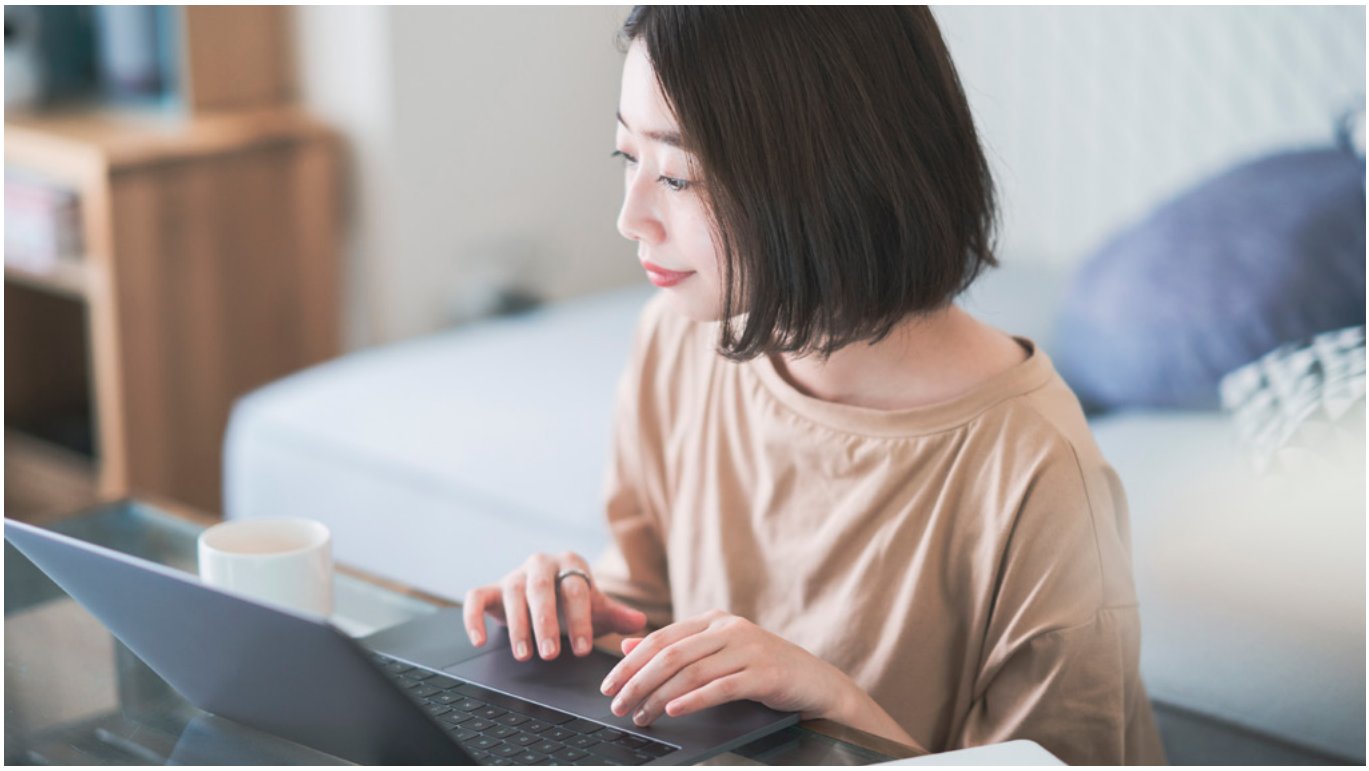
- **Promoting equitable access to digital technology in schools.** As part of the "Global Innovation Gateway for All" (GIGA) school plan, Japan's Ministry of Education, Culture, Sports, Science and Technology (MEXT) allocated a budget to ensure every school receives high-speed IT network connection and provide all elementary

116. Rikkyo University (2019), "Rikkyo University to establish Japan's first graduate school specialized in AI in April 2020".
Available at: https://english.rikkyo.ac.jp/news/2019/dn4ddm0000001d5y.html

117. Sources include: Strategic Council for AI Technology (2017), Artificial Intelligence Technology Strategy. Available at: https://www.nedo.go.jp/content/100865202.pdf; Nikkei Asia (2019), "Coding will be mandatory in Japan's primary schools from 2020". Available at: https://asia.nikkei.com/Economy/Coding-will-be-mandatory-in-Japan-s-primary-schools-from-2020

118. Nikkei Asia (2019), "Coding will be mandatory in Japan's primary schools from 2020".
Available at: https://asia.nikkei.com/Economy/Coding-will-be-mandatory-in-Japan-s-primary-schools-from-2020

119. Ministry of Education, Culture, Sports, Science and Technology (2021), High School Informatics "Information I" Teaching Staff Training Aid (Main text).
Available at: https://www.mext.go.jp/a_menu/shotou/zyouhou/detail/1416756.htm



and secondary school pupils with a PC or tablet by 2023.[120] Additionally, the Ministry of Economy, Trade and Industry (METI) provides funding to Japanese EdTech companies to offer their services and content to schools.[121]

However, there remain several workforce and skills-related challenges in the country. When the COVID-19 pandemic led to nationwide school closures, the Ministry of Education, Culture, Sports, Science and Technology (MEXT) found that public schools were struggling with the lack of IT capabilities. Only ten percent of public schools provided remote learning options to students and five percent managed to conduct classes online in real-time.[122] In addition, recent research has shown that while 58 percent of Japan's workers already apply digital skills in their jobs today, only 14 percent apply advanced digital skills,[123] which is lower than other high-income countries in the region such as South Korea (21 percent) and Singapore (22 percent).[124] The study further shows that demand for workers requiring advanced skills such as data modeling, web and software development, and cloud architecture design skills could grow by more than 40 percent per year between 2020 and 2025. The country can therefore go further in improving the digital capacities of its educational institutions and working population:

- **Increase availability of short-term, flexible courses in advanced digital skills.** To address the rapidly emerging advanced digital skill needs, it is recommended that the government expands the availability of short-term, flexible courses. Short-term courses provide micro-credentials for students to gain qualifications in specific areas, such as coding and managing social media presence. In response to new and unmet digital skill needs, the New Zealand Qualifications Authority (NZQA) introduced a micro-credential system that enables educational organizations

120. International Trade Administration (2019), "Japan educational technology opportunities". Available at: https://www.trade.gov/market-intelligence/japan-educational-technology-opportunities

121. International Trade Administration (2019), "Japan educational technology opportunities". Available at: https://www.trade.gov/market-intelligence/japan-educational-technology-opportunities

122. Nippon (2020), "Digital Divide: Majority of Japanese schools offline during coronavirus shutdown". Available at: https://www.nippon.com/en/news/fnn2020062656524/

123. Advanced digital skills refer to skills which require advanced technological know-how – these entail having the ability to customize or develop new digital tools, software, and applications. Conversely, basic digital skills refer to digital skills requiring basic technological know-how – these entail having the ability to use digital software and hardware for the broader consumers as well as having the skills involved in their use. Source: AlphaBeta, commissioned by Amazon Web Services (2021), Unlocking APAC's Digital Potential: Changing Digital Skill Needs and Policy Approaches. Available at: https://pages.awscloud.com/APAC-public-DL-APAC-Digital-Skills-Research-2021-learn.html

124. AlphaBeta, commissioned by Amazon Web Services (2021), Unlocking APAC's Digital Potential: Changing Digital Skill Needs and Policy Approaches. Available at: https://pages.awscloud.com/APAC-public-DL-APAC-Digital-Skills-Research-2021-learn.html

to create stand-alone educational products for learners to acquire specific knowledge and skills in a cost-effective and time-efficient manner.[125] In Australia, the government has announced an AUD4.3 million (USD3.4 million) investment to build and run a one-stop online marketplace for micro-credentials.[126] This provides a platform for job seekers to gain short-term qualifications and obtain a new job or get ahead in their current job.

- **Incentivize employees to seek digital upskilling opportunities.** To address low digital training rates in the existing workforce, it is critical for Japan to develop a set of support programs offering incentives for both firms and individuals to invest in digital upskilling. Through the "Jinzai Kaihatsu Shien Joseikin" program ("Subsidy to Support Human Resource Development"), firms are entitled to receive subsidies for their reimbursement of employees' wages during training, with the amount of subsidy being tailored to the type of training and size of the firm.[127] While the country has been incentivizing firms in upskilling their workers through the "Jinzai Kaihatsu Shien Joseikin" program, the country could extend its incentive program to individual employees. An international best practice Japan could refer to is Singapore's "SkillsFuture" program. Under the program, monetary credits capped at SGD500 (USD370) known as "SkillsFuture Credit" are issued to citizens to allow them to spend on approved work skills-relevant courses. This has helped stimulate increased personal investment by workers in their training, as they tend to be motivated to continue with their selected courses even after the credit limit has been reached. Over a two-year period between 2016 and 2018, over 285,000 Singaporeans had started to use their "SkillsFuture Credit".[128] By participating regularly in digital skilling programs, employees embrace a lifelong learning mindset to stay relevant on the latest technologies and increase the long-term productivity of the workforce which is essential for Japan's post-pandemic recovery.

- **Equip teachers with know-how to integrate digital technology in education.** According to an OECD survey conducted in 2018, Japan was ranked the lowest on the share of teachers who knew how to use digital devices in their teaching pedagogies.[129] Especially in rural schools, an OECD survey reported that the share of teachers requiring professional development in information communication technology (ICT) skills for teaching is higher than teachers in schools located in cities.[130] Teacher training in digital skills is, therefore, an important dimension to improve digital skills education in Japan. As outlined in Box 7, Japan could consider adapting Hong Kong's digital competency framework for teachers.

125. New Zealand Qualification Authority (2021), "Guidelines for applying for approval of a training scheme or a micro-credential". Available at: https://www.nzqa.govt.nz/providers-partners/approval-accreditation-and-registration/micro-credentials/guidelines-training-scheme-micro-credential/
126. Ministers Media Centre (2020), "Marketplace for online microcredentials". Available at: https://ministers.dese.gov.au/tehan/marketplace-online-microcredentials
127. OECD (2018), "Getting skills right: future-ready adult learning systems". Available at: https://read.oecd-ilibrary.org/education/getting-skills-right-future-ready-adult-learning-systems_9789264311756-en#page1
128. Joanna Seow (2018), "285,000 Singaporeans have used SkillsFuture Credit, with more doing so in 2017". The Straits Times. Available at: https://www.straitstimes.com/singapore/manpower/285000-singaporeans-have-used-skillsfuture-credit-with-more-doing-so-in-2017
129. The Japan Times (2020), "In era of COVID-19, a shift to digital forms of teaching in Japan". Available at: https://www.japantimes.co.jp/news/2020/04/21/national/traditional-to-digital-teaching-coronavirus/
130. OECD (2019), Learning in rural schools: Insights from PISA, TALIS and the literature. Available at: https://www.oecd.org/officialdocuments/publicdisplaydocumentpdf/?cote=EDU/WKP(2019)4&docLanguage=En

Box 7.
ICT training for teachers in Hong Kong

To ensure that teachers themselves possess sufficient digital skills in order to pass on those skills to their students, Hong Kong has developed an ICT training framework for them.[131] This framework seeks to achieve two outcomes: increase the digital competence of teachers and improve their teaching pedagogies for ICT skills in classrooms.

The training framework has four dimensions which correspond to the range of skills that teachers will need to adapt their methods to a changing technological environment:

- Technical skills in ICT;
- ICT teaching pedagogies;
- Management and supervision of digital technology in classroom settings; and
- Sociocultural awareness in online environments.

With the constant evolution of digital technologies, the training framework covers an initial training period for teachers, as well as continuing training. The training delivered to teachers is also tailored to the specific requirements of preschool, primary and secondary education – depending on the education levels taught by teachers.

131. Simon Fau and Yasmeen Moreau (2018), Managing tomorrow's digital skills: what conclusions can we draw from international comparative indicators? United Nations Educational, Scientific and Cultural Organization (UNESCO) Digital Library.
Available at: https://unesdoc.unesco.org/ark:/48223/pf0000261853

2.3 PILLAR 3: SECURE DIGITAL EXPORT OPPORTUNITIES

Finally, it is important that businesses, including those from traditional, non-tech sectors, in Japan can maximize digital platforms to export their products and services globally.

Japan has implemented the following actions:

- **Establishing digital platforms to access foreign markets.** To facilitate the export of Japanese products digitally, the Japan External Trade Organization (JETRO) established an online platform through which local producers can access international buyers and seek advice in tapping new markets. During the COVID-19 pandemic, sales negotiations with 17 global e-commerce retailers from France, Malaysia, Singapore, Thailand, United States, Hong Kong and Taiwan were conducted online through this platform, enabling Japanese products to be featured and sold on foreign marketplaces.[132] JETRO also launched the "Takumi Next" project with a focus on promoting local, cultural products from traditional industries, including textiles, wood crafts, glassware, leather goods, ceramics and washi paper products, throughsocial media such as Instagram. In 2019, a total of 133 international deals were struck and 519 items were sold.[133]

- **Minimize border frictions.** Cross-border trade would be greatly enhanced by reducing the need for local registration, removing disclosure requirements of key intellectual property, and minimizing unnecessary procedures and duties. In addition, there is a strong evidence base around the potential gains from eliminating harmful, trade-distorting non-tariff barriers; for example, past research has estimated that the potential cost of the Korea-Japan trade dispute to the Japanese economy could vary between USD346 million and USD1.6 billion.[134] Japan has been active in digital trade agreements with its key trading partners to circumvent these risks. For example, to unlock USD40 billion worth of digital trade from cross-border data transfers and enabling the digital distribution of digital products between Japan and the United States, Japan has signed a bilateral trade agreement with the United States known as the "US-Japan Digital Trade Agreement".[135] Provisions under the agreement include prohibiting data localization measures, permitting the use of electronic authentication and electronic signatures for digital transactions, protecting digital intellectual property, and promoting the interoperability of enforcement regimes.[136]

While Japan has made significant efforts to promote digital trading opportunities for its industry, there is scope for further improvement in the following areas:

- **Provide capacity-building support for SMEs to participate in digital trade opportunities.** While multinational conglomerates, such as Softbank and Mitsubishi, originating from Japan are actively involved in international markets, SMEs in Japan are largely domestically oriented. A survey finding has shown that while approximately 60 percent of large manufacturing firms export their products

132. Kyodo News (2020), "JETRO to help companies export refined made-in-Japan crafts online". Available at: https://english.kyodonews.net/news/2020/08/23925c78cc56-jetro-to-help-companies-export-refined-made-in-japan-crafts-online.html
133. Kyodo News (2020), "JETRO to help companies export refined made-in-Japan crafts online". Available at: https://english.kyodonews.net/news/2020/08/23925c78cc56-jetro-to-help-companies-export-refined-made-in-japan-crafts-online.html
134. Sangho Shin (2020), The Korea-Japan trade dispute: non-tariff barriers. Available at: https://www.econ.iastate.edu/files/events/files/jmp_sangho_shin.pdf
135. Mayer Brown (2019), US-Japan Trade Agreements mark "first stage" of tariff cuts and commitments on digital trade. Available at: https://www.mayerbrown.com/-/media/files/perspectives-events/publications/2019/10/usjapan-agreement--summary.pdf
136. Office of the United States Trade Representative (2020), "Fact sheet on U.S.-Japan Digital Trade Agreement". Available at: https://ustr.gov/about-us/policy-offices/press-office/fact-sheets/2019/october/fact-sheet-us-japan-digital-trade-agreement

and services overseas, only 25 percent of SMEs in Japan in this sector were exporters.[137] Traditionally, SMEs serve as suppliers for large enterprises that are part of keiretsu – referring to a cluster of independently managed firms, including banks, manufacturers, and supply chain partners, that work cooperatively to increase efficiency and reduce costs. On the other hand, the Small and Medium Enterprises Agency found that SMEs face several challenges in exporting which include "securing outstanding partner enterprises" and "ascertaining the needs of local enterprises and residents overseas".[138] Another major barrier to internationalization is the comparative lack of English language abilities among firms in Japan, inhibiting their ability to communicate with international distributors and export partners. In an international survey conducted in 2019 that measures the English proficiency of people in non-speaking regions, Japan ranked 53rd out of 100 non-speaking countries, lagging China, South Korea and Hong Kong.[139] However, with a shrinking domestic market, SMEs in Japan face a strong imperative to internationalize and leverage the growing digital trade opportunity in the region. It has been estimated that if exporters in Japan fully leverage digital trade, the value of the country's digital exports could potentially more than quadruple to become JPY8.2 trillion (USD73 billion) in 2030.[140] To support companies in accessing the right information and resources for export, Japan could consider implementing a similar program to Singapore's "Multichannel E-commerce Platform" (MEP) which seeks to leverage the private sector to facilitate cross-border online business (see Box 8).

137. VOX EU (2015), "With a little help from my bank: Japanese SMEs' export decision". Available at: https://voxeu.org/article/little-help-my-bank-japanese-smes-export-decision
138. VOX EU (2015), "With a little help from my bank: Japanese SMEs' export decision". Available at: https://voxeu.org/article/little-help-my-bank-japanese-smes-export-decision
139. Nippon.com (2019), "Japan's English proficiency drops among non-English-speaking countries". Available at: https://www.nippon.com/en/japan-data/h00594/japan%E2%80%99s-english-proficiency-drops-among-non-english-speaking-countries.html#:~:text=A%20survey%20has%20revealed%20that,both%20South%20Korea%20and%20China
140. The economic value of digital exports refers to the value of export of virtual goods (e.g., applications, digital content) and of physical products enabled by digital technologies (e.g., e-commerce). Hinrich Foundation and AlphaBeta (2017), The Data Revolution: Capturing the digital trade opportunity at home and abroad. Available at: https://research.hinrichfoundation.com/hubfs/Digital%20Trade%20Project/main-digital-trade-project%20hinrich%20foundation.pdf?__hsfp=563081268&__hssc=251652889.3.1609216777749&__hstc=251652889.046b2d9e630915fe65dfdee8862dd175.1606466357061.1606819026368.1609216777749.3

Box 8.
Singapore's "Multichannel E-commerce Platform" (MEP) program to support SMEs in exporting products overseas digitally

As part of the "Grow Digital" joint initiative by Enterprise Singapore and Infocomm Media Development Authority (IMDA), the Singapore Government launched partnerships with business-to-business (B2B) platforms and business-to-consumer (B2C) platforms that cover major markets with growing e-commerce presence such as Hong Kong, China and India. The "Multichannel E-commerce Platform" (MEP) program aims to support the onboarding of SMEs, with little resources to invest in building a physical presence in foreign markets, on these platforms and maximize their reach and networks across multiple countries and seize new business opportunities.[141]

Under the MEP program, SMEs receive end-to-end support, including enterprise resource planning (ERP) and a network of ecosystem partners for custom clearance and bonded warehouses, provided by appointed MEP providers to gain rapid entry to new markets via multiple overseas e-marketplaces. In addition, SMEs can also list their offerings under dedicated "Singapore Pavilions" that showcase home-grown brands to foreign buyers. For instance, a "Singapore Pavilion" on WeChat e-marketplace promotes products and services from Singapore to the 1.2 billion WeChat customer base worldwide. In partnership with the Singapore Institute of Retail Studies, SMEs can also receive relevant training programs to operate an e-commerce business such as digital marketing support to increase brand value and drive traffic on e-commerce platforms. Since the launch of the MEP program, more than 500 SMEs have gained access to new overseas markets digitally and sales by Singaporean companies to overseas buyers on these platforms have grown by at least ten percent monthly in 2020.

141. Infocomm Media Development Authority (2020), "More than 500 SMEs access new overseas markets with Grow Digital". Available at: https://www.imda.gov.sg/news-and-events/Media-Room/Media-Releases/2020/More-Than-500-Smes-Access-New-Overseas-Markets--With-Grow-Digital

- **Participate in digital trade agreements to promote digital trade in the region.** With an OECD report highlighting that a ten percent rise in "bilateral digital connectivity" could improve trade in goods and services by about two and three percent respectively, cross-border data flows are critical for enabling digital exports.[142] While Japan has forged a bilateral agreement with the US through the "US-Japan Digital Trade Agreement" and taken on digital rules in the "Comprehensive and Progressive Agreement for Trans-Pacific Partnership" (CPTPP), the country could play a leading role in advancing digital trade rules and connectivity in the region. Japan can adopt a more proactive approach in forging digital agreements to promote the seamless flow of cross-border digital trade.[143] An example of such a recently signed agreement is the "Digital Economy Partnership Agreement" (DEPA) signed between Singapore, New Zealand and Chile, which seeks to promote digital trade and help MSMEs overcome the challenges of scale and distance.[144] This would provide companies with a competitive edge to engage in cross-border digital trade, including through:

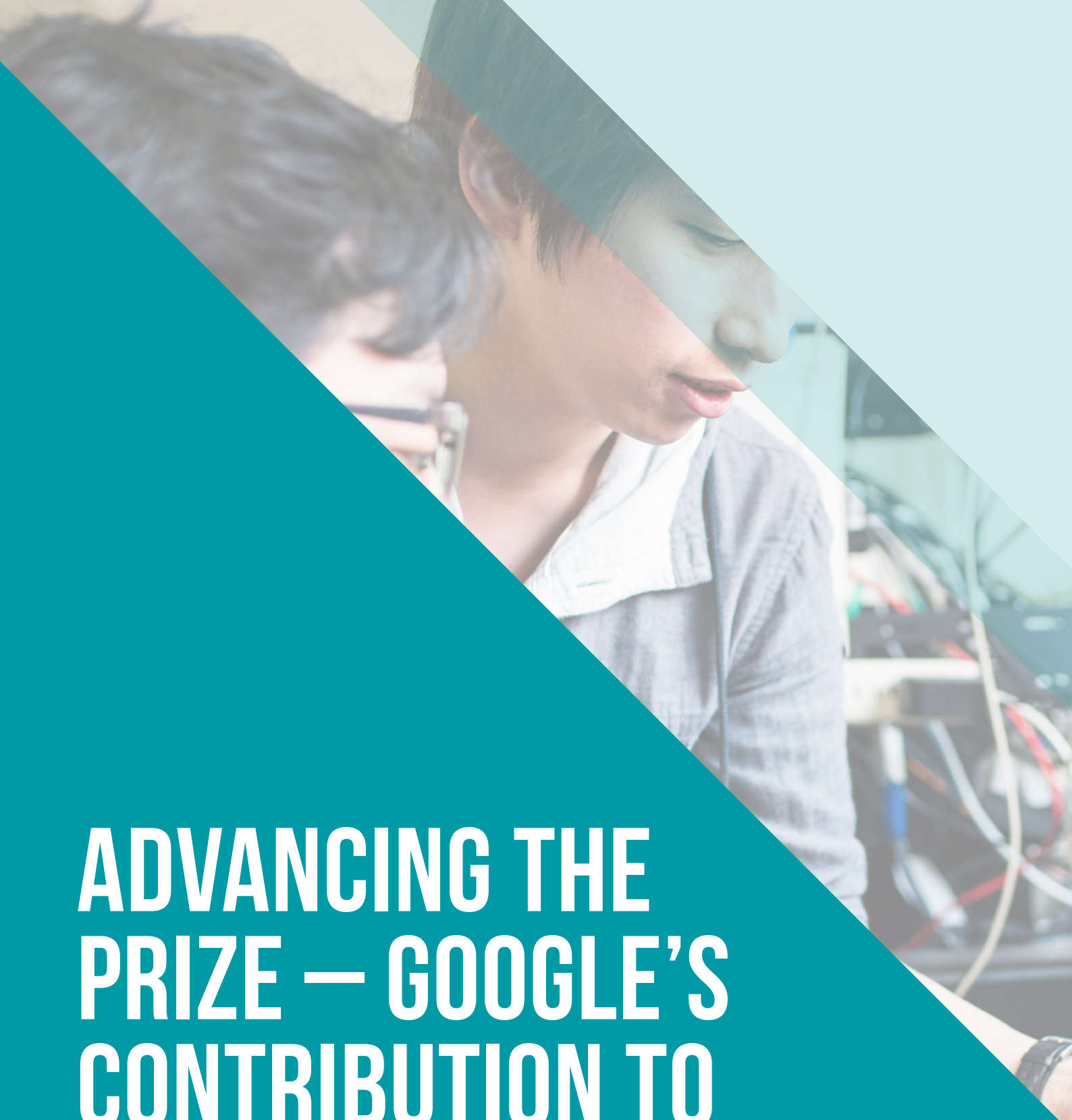
  - ***Streamlined trading procedures.*** For instance, e-certificates for animal products exchanged through the agreement's "International Connectivity System" will reduce the time for document transit and cargo clearance, resulting in lower operating costs for exporters.

  - ***Open cross-border data flows with the necessary data safeguards.*** There is a considerable opportunity to improve transparency on data management requirements across the Asia Pacific (APAC) region and to identify areas to enhance performance. Through the DEPA, businesses operating in the three signatory countries are able to transfer information seamlessly across borders, with the assurance that the data is protected by the relevant security mechanisms and requisite regulations. This provides a conducive environment for data-driven business models, such as software-as-a-service, and with businesses increasingly reliant on electronic transactions and digital solutions to serve customers regardless of where they are located. In addition, SMEs looking to better understand foreign markets can now access and use open government data to discover new business opportunities and innovate new products and services.[145]

  - ***Enhanced trust in cross-border digital systems.*** As digital systems for the exchange of digital goods and services span borders and need to be interoperable across countries, it is important that governments build trust in such systems so that enterprises may confidently enter export markets. This includes aligning laws and regulations with international frameworks through agreements such as the DEPA to protect consumers against fraudulent, misleading, or deceptive conduct when engaging in online commercial activities and adopting ethical AI governance frameworks to harness AI in a responsible manner.[146]

Given the importance of traditional sectors benefiting from digitization and considering the digital divide between regions, it is especially important to focus on resolving the challenges faced by these sectors and regions in the implementation of digital adoption policies.

142. OECD (2019), Trade in the digital era. Available at: https://www.oecd.org/going-digital/trade-in-the-digital-era.pdf
143. Ministry of Trade and Industry Singapore (2020), "The Comprehensive and Progressive Agreement for Trans-Pacific Partnership (CPTPP)". Available at: https://www.mti.gov.sg/Improving-Trade/Free-Trade-Agreements/CPTPP
144. Beehive.gov.nz (2020), "NZ concludes digital economy trade talks with Singapore and Chile." Available at: https://www.beehive.govt.nz/release/nz-concludes-digital-economy-trade-talks-singapore-and-chile
145. Ministry of Trade and Industry Singapore (2020), "Digital Economy Partnership Agreement." Available at: https://www.mti.gov.sg/Improving-Trade/Digital-Economy-Agreements/The-Digital-Economy-Partnership-Agreement
146. Ministry of Trade and Industry Singapore (2020), Singapore substantially concludes negotiations for Digital Economy Partnership Agreement with Chile and New Zealand. Available at: https://www.mti.gov.sg/-/media/MTI/Newsroom/Press-Releases/2020/01/Joint-press-release---Conclusion-of-Digital-Economy-Partnership-Agreement---21-Jan.pdf

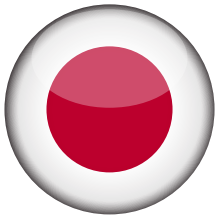


ADVANCING THE PRIZE — GOOGLE'S CONTRIBUTION TO ADVANCING THE DIGITAL OPPORTUNITY IN JAPAN

An important player spearheading digital transformation in Japan, Google has made significant contributions in each of the three pillars for digital transformation in Japan that were outlined in Chapter 2. Through the Google for Startups: Accelerator program and digital tools such as Google Cloud, Google has been supporting local tech start-ups. Through digital skills programs like Grow with Google, Google is equipping business owners with digital tools and supporting the development of a digitally skilled workforce. Google has also enabled companies in Japan to access digital export opportunities through digital marketing and e-commerce programs which provide guidance on how to export goods and services to overseas markets.

In addition, Google's products create various economic benefits for businesses, consumers and the broader society in Japan. Businesses and consumers in the country are estimated to derive total economic benefits from Google's products worth JPY3.2 trillion (USD30.1 billion) and JPY4.4 trillion (USD40.7 billion), respectively. These products include Google Search, Google Ads, AdSense, Google Play, Google Maps, Google Drive, and Google Docs, Sheets and Photos. For businesses, use of these products reaps economic benefits in the form of increased revenue through increased customer outreach and access to new markets, as well as improved productivity through time savings. It is estimated that over 109,000 jobs are supported in the economy, including traditional sectors such as consumer, retail and hospitality, and infrastructure, through the use of Google Ads and AdSense. These sectors were also one of the most severely COVID-19 affected sectors in Japan - in

"ADVANCING THE PRIZE"
GOOGLE'S CONTRIBUTION TO JAPAN'S DIGITAL TRANSFORMATION JOURNEY



1. Promote an innovation-oriented environment
2. Enhance digital skills training and education
3. Secure digital export opportunities

Examples of initiatives by Google

- **Google Cloud** increases operational efficiency in traditional sectors and provides a platform to build innovative applications in growing sectors
- Google offers support by providing free digital skilling training through Grow with Google, and by providing **Chromebooks/Google Workspace for Education**
- Japanese businesses leverage **Google Play and YouTube** to export mobile apps and digital content

Google also delivers wider benefits to businesses, consumers and society in Japan

BUSINESSES

Through significant boosts to productivity and customer outreach, Google is estimated to support **JPY3.2 trillion (USD30.1 billion)** worth of annual benefits to businesses in Japan[1]

CONSUMERS

By helping consumers save time and generating value through their products, Google is estimated to support **JPY4.4 trillion (USD40.7 billion)** worth of annual benefits to consumers in Japan[2]

SOCIETY

Google supports non-profits assisting underserved SMEs with a USD2.5 million grant funding and promotes arts and culture in Japan by collaborating with government agencies

1. Business benefits refer to the estimated economic impact from the following products: Google Search; Google Ads; AdSense; Google Play.
2. Consumer benefits refer to the estimated economic impact from the following products: Google Search; Google Maps; Google Drive; Docs, Sheets and Photos; Google Play.

Note: All data is based on AlphaBeta analysis using a range of original and third-party sources. See Appendix in report for detailed methodology. Figures are estimated based on the latest available annual data as at time of research in 2020.

2020, the restaurant industry witnessed the largest number of pandemic-related bankruptcies, followed by the construction and hospitality industries. These jobs are created through the use of Google products that enable businesses to expand their customer base and increase revenue, thereby leading to increased hiring demand. In addition, the Android operating system supports more than 540,000 jobs in Japan's economy. Consumers, on the other hand, experience benefits such as greater convenience, more opportunities to access information, and more avenues for learning and skills development. Beyond its economic contributions to businesses and individuals, Google delivers benefits to the broader society by supporting the country's non-profit sector and promoting local culture.

3.1 GOOGLE CONTRIBUTES TO EACH OF THE THREE PILLARS OF DIGITAL TRANSFORMATION IN JAPAN THROUGH ITS PRODUCTS AND INITIATIVES

Across the three pillars of action, Google has made significant contributions in Japan through its programs, products and services. In addition, Google has also embarked on a range of initiatives to support communities amidst the spread of COVID-19.

To **promote an innovation-oriented environment**, Google has done the following:

- **Support growth of local start-ups and digital adoption by small businesses.** Through the Google for Startups: Accelerator program launched in 2019, start-ups with high growth potential undergo an intensive three-month program. In this program, Google staff, external mentors, and product experts provide support to budding entrepreneurs in machine learning, leadership best practices, and growth strategies, to innovate and grow.[147] Besides supporting local start-ups in innovation, Google Ads provides a cost-effective digital advertising tool for small local businesses to promote their business (see Box 9).

147. Google for Startups. Available at: https://www.campus.co/intl/ja_jp/tokyo/

Box 9.
Yamaya Corporation: Supporting businesses in adopting digital advertising tools such as Google Ads to promote their business

Founded in 1921, Yamaya is a boutique knitwear shop from Koryo-cho, Nara Prefecture, which prides itself on crafting socks using organic, environmentally sustainable cotton.[148] When mass production led to a flood of cheap socks in the domestic market, the intense price competition forced the business to redefine its brand and differentiate it from other producers through fine craftsmanship and using high-quality materials.

In 2020, when the COVID-19 infection rates soared in Japan, shop owner Yasutaka Nomura made a hard decision to close the shop and factories for about two months to safeguard the health and safety of his employees.[149] As a result, the company relied solely on its e-commerce website to continue selling socks. To boost online sales, Nomura increased its advertising on Google Ads to channel higher traffic to its website. In addition, the shop distributed “mill ends”, a by-product of the sock manufacturing process, as a gift for every online purchase, which received positive feedback from customers as these could be used to make string ties for cloth masks.

Nomura was very impressed with the effectiveness of its digital marketing campaign and remarked, “Running Google Ads on our website since 2019 allowed me to understand the cost-effectiveness of online marketing, which enabled me to increase my advertising spend during this time without much hesitation. Even during these trying times, we have managed to increase sales by utilizing our online store and Google Ads, which I am very grateful for and proud of.”

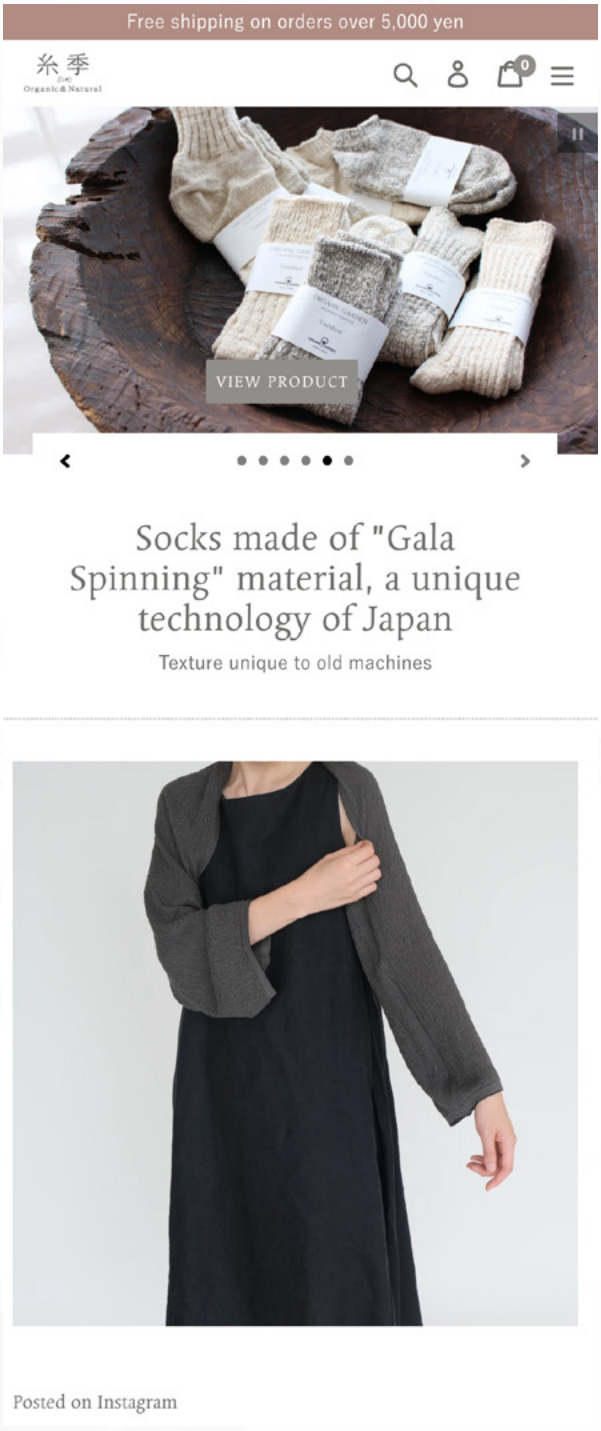


Photo Source: https://siki-naramachi.com/

148. Siki Naramachi (2020), Available at: https://siki-naramachi.com/
149. Google Advertising Official (2020), "Google Advertising Case Study (Increased Awareness: Yamaya Co., Ltd.)". Please visit: https://www.youtube.com/watch?v=t9vClPlQV5s

- **Facilitate the growth of new business models.** Google's products and services have also promoted the growth of Japan's digital economy by supporting the development of new technology-driven business models in traditional sectors, such as agriculture and food. Where small businesses struggle to source for capital, Google Cloud democratizes access to specialized technologies such as AI and machine learning. Businesses can access not only TensorFlow, an open-source machine learning library, but also sophisticated software for image and language recognition, translation, and other analytic tools that unlock the value of their data, reduce cost and provide world-leading products and services to customers globally. Box 10 shows examples of how Google Cloud has benefitted both traditional and emerging sectors such as e-sports in Japan. By using Google Cloud to develop their own AI solutions, local businesses experienced an improvement in both operational efficiency and performance of their existing products and services.

- **Investments in network infrastructure.** In response to the growing demand from businesses in Japan to build and scale their operations on Google Cloud, in 2020, Google invested in a second cloud region and the company's third undersea cable system in Japan, connecting the country to Guam and Australia. These cloud regions enable greater efficiency in the operation of Google's applications for nearby organizations and improve the availability of Google Cloud services. With multiple undersea cable systems in place, businesses can benefit from improved business continuity planning by relying on the distributed, secure infrastructure during disaster recovery.[150] Box 11 provides further details on the impact of Google's network infrastructure investments on Businesses in Japan.

- **Partnered with local institutions and industry players to tackle humanitarian challenges using AI.** For instance, in collaboration with a research team from the Department of Health Care Policy and Management at Keio University led by Professor Hiroaki Miyata, Google has developed a prediction model that can be used as one of the public health indicators during a pandemic. The model is provided to medical institutions, public institutions, and other organizations affected by COVID-19 for use as reference information in considering and preparing more appropriate measures for the future. This COVID-19 Public Forecasts projects the daily number of positive cases, deaths, and hospitalization/recuperation patients for the next 28 days.[151]

- **In another collaboration with Kyoto University, Google Cloud signed a strategic agreement with the Graduate School of Medicine to combine the school's medical knowledge with Google Cloud's smart data analytics solutions and AI.** Through the partnership, Google promotes digital transformation in medical science and contributes to the improvement of medical care in Japan.[152] In addition, Google collaborated with Apple, a multinational technology company, to provide a Bluetooth-based system to curb the spread of COVID-19 in the community, and support the Ministry of Health, Welfare and Labour in their efforts to provide the public with an app running on this system. By informing individuals who may have had close contact with infected individuals, the application supports public health authorities in safeguarding the health and safety of the people in Japan.[153]

To **enhance digital skills training and education** for the current workforce and future talent, Google has launched the following efforts in Japan:

150. Google Cloud (2020), "Google Cloud launches new Osaka region to support growing customer base in Japan".
Available at: https://cloud.google.com/blog/products/infrastructure/google-cloud-launches-new-osaka-region-to-support-growing-customer-base-in-japan

151. Google Cloud (2020), "Google Cloud, Harvard Global Health Institute release improved COVID-19 Public Forecasts, share lessons learned".
Available at: https://cloud.google.com/blog/products/ai-machine-learning/google-and-harvard-improve-covid-19-forecasts

152. Google Cloud (2021), "Google Cloud が 京都大学大学院医学研究科及び医学部附属病院の DX パートナーに".
Available at: https://cloud.google.com/blog/ja/products/gcp/becomes-dx-partner-for-kyoto-university

153. Google in Japan (2020), "AppleとGoogle、新型コロナウイルス対策として、濃厚接触の可能性を検出する技術で協力".
Available at: https://japan.googleblog.com/2020/04/apple-and-google-partner-covid-19-contact-tracing-technology.html

Box 10.
Local businesses develop innovative solutions with Google Cloud

JAPANESE CUCUMBER FAMILY FARM: INCREASING THE EFFICIENCY OF CUCUMBER SORTING USING TENSORFLOW

When Makoto Koike, a former system designer, started helping out at his parents' cucumber farm, he was amazed by the amount of work it took to sort cucumbers by size, shape, color and other attributes. Sometimes, his 64-year-old mother could spend eight hours manually sorting them.[154] Makoto realized that he needed to find a way to alleviate their workload and automate the tedious sorting tasks.

He was inspired to utilize machine learning for sorting cucumbers after learning about Google's AlphaGo – an AI-enabled computer program that plays the board game "Go". Makoto set out to see whether he could leverage deep learning technology for sorting using Google's open-source machine learning library, TensorFlow, on the Google Cloud Platform. After multiple iterations of his AI-enabled cucumber sorting machine, his latest generation contraption could sort up to ten cucumbers at a go, at 70 percent accuracy. His family farm's yield has since improved by 140 percent.[155]

Photo Source: https://www.engadget.com/2016-08-31-google-ai-helps-cucumber-farm.html

154. Sources include "The Future Created by AI - Connecting Agriculture to the Next Generation. One farmer's challenge" Available at: https://www.youtube.com/watch?v=XkKxSAb4EAw; CNA (2019), "Killing bugs and sorting cucumbers: How artificial intelligence is already changing the way we live our lives". Available at: https://www.channelnewsasia.com/news/singapore/artificial-intelligence-robots-changing-lives-japanese-cucumbers-11752608

155. CNA (2019), "Killing bugs and sorting cucumbers: How artificial intelligence is already changing the way we live our lives". Available at: https://www.channelnewsasia.com/news/singapore/artificial-intelligence-robots-changing-lives-japanese-cucumbers-11752608

ZOZO: UTILIZING TENSORFLOW MODELS TO IMPROVE CUSTOMER E-COMMERCE SHOPPING EXPERIENCE

Popular Japanese fashion retailer Zozo built its own e-commerce website, ZOZOTOWN, powered by machine learning. To provide the best search experience for its customers, the business had to speed up the training and optimization of its machine learning models. After working with TensorFlow models on Google Cloud, Zozo was able to run its machine learning models 55 times faster, effectively reducing training duration from one week to under three hours.[156] The Vice President of Engineering at Zozo said, "Running TensorFlow on Google Cloud using Cloud TPU has helped us consistently test, improve, and serve better models that delight our users".

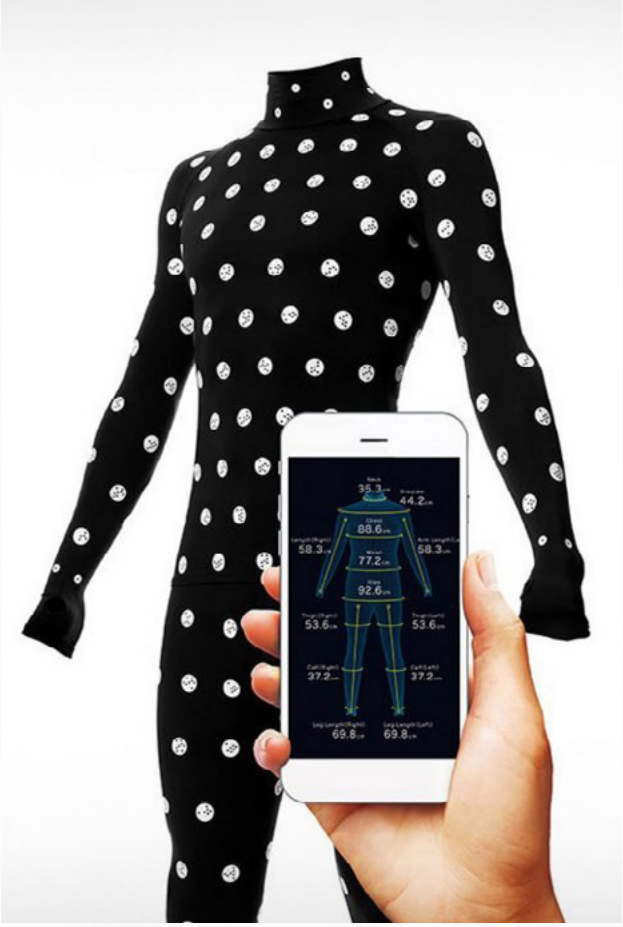


Photo Source: https://www.theceomagazine.com/business/innovation-technology/the-zozosuit-fashion-forward-or-so-last-year/

DENA: HOSTING AI-DRIVEN RECOMMENDATION SERVICE ON GOOGLE CLOUD TO CREATE AN APPEALING GAMING EXPERIENCE

DeNa, a popular mobile-based Internet service company in Japan, uses AI and machine learning to improve the new player onboarding experience for its game – Gyakuten Othellonia. By working on the Google Cloud Platform, the company was able to leverage Google's expertise in building and serving different components of the game. The Director of the AI Department at DeNA remarked, "We are able to leverage Google Cloud's open and serverless technologies to host our AI models without worrying about the scalability of infrastructure or portability of code." Gyakuten's gaming algorithm provides new players with recommendations for in-game strategies, and creates scenarios for new players to practice and gain experience before challenging skilled players. This new gaming experience greatly appealed to players, and the win rate of beginners grew by five percentage points. After implementing the new service, the lifetime value (LTV) of players – which refers to the average profit DeNA earns from each player throughout their lifetime – has increased significantly.[157]

Photo Source: https://www.pocketgamer.com/articles/069195/big-in-japan-an-old-game-makes-a-modern-return-in-gyakuten-othellonia/

156. Google Cloud (2019), "Reaching for the sky: Japanese businesses embrace Google Cloud for digital transformation".
Available at: https://cloud.google.com/blog/topics/inside-google-cloud/japanese-businesses-embrace-google-cloud-for-digital-transformation
157. Google Cloud (2019), "Reaching for the sky: Japanese businesses embrace Google Cloud for digital transformation".
Available at: https://cloud.google.com/blog/topics/inside-google-cloud/japanese-businesses-embrace-google-cloud-for-digital-transformation

Box 11.
Google's network infrastructure investments in Japan

By improving the capacity of network services, investments in network infrastructure such as edge infrastructure allow local Internet service providers to better manage higher Internet traffic and enable faster data transfers. These in turn allow them to deliver innovative services, such as cloud services, video conferencing and gaming. Google's infrastructure investments in the APAC region have contributed to higher download speeds in Japan, which are now more than four times that of less well-connected economies.[158] A recent study found that by allowing for increased business activity through higher rates of Internet use, Google's investments in network, submarine cables and edge infrastructure in APAC collectively contributed USD269 billion to Japan's GDP cumulatively from 2010 to 2019, and are expected to contribute an additional USD202 billion from 2020 to 2024. The study also found that Google's network infrastructure investment spurred job creation through two channels: direct job creation in the construction and telecommunications sectors, and indirect job creation facilitated by the improvement of broadband connectivity (especially in the IT, financial services and manufacturing sectors). The same study estimated that a total of 419,000 jobs were created in Japan as a result of Google's network investments in APAC in 2019.

158. Analysys Mason (2020), Economic impact of Google's APAC network infrastructure – Focus on Japan.
Available at: https://www.analysysmason.com/contentassets/b8e0ea70205243c6ad4084a6d81a8aa8/japan-country-chapter.pdf

- **Develop digital adoption tools and skill programs for businesses during the COVID-19 pandemic.** In light of the COVID-19 pandemic, Google has unveiled several initiatives to support businesses with the tools and technologies to remain resilient and maintain business continuity. When the country declared a nationwide state of emergency during the pandemic, business operations, particularly those in the retail and tourism industries, were disrupted and many businesses shifted online. As one of Google's cornerstone community initiatives, the Grow with Google program seeks to equip business owners with digital skills and support the adoption of digital tools such as Google My Business.[159] Through a series of digital skilling courses under the program, business owners were taught how to create a free Business Profile on Google My Business to receive orders from customers online and inform customers about the latest changes to operating hours. To help small businesses leverage e-commerce, Google also curated online courses under its Google Digital Workshops in collaboration with Salesforce, Shopify, SMEA, and Impulse (part of the Central Federation of Societies of Commerce and Industry).[160] With a target to train ten million people in digital skills by 2022, the Grow with Google program has partnered with more than 140 local partners, including private companies, local governments and non-governmental organizations to administer training for over 7.5 million people in 47 prefectures across Japan since 2019.[161] A survey conducted on the participants of Japan's Grow with Google program conducted between April 2019 and March 2020 found that 88 percent of respondents said they were able to learn some new skills for themselves or their business, and 74 percent said they felt they could use what they learned in their daily lives.[162]

- **Create digital skills education programs to nurture future talent.** Through the Google AI for Japan initiative, Google aims to advance AI research, increase AI deployment in businesses, increase AI education and talent, and support AI-driven entrepreneurship in Japan. In 2019, Google provided USD300,000 worth of funding to support six researchers conducting AI-related research.[163] Furthermore, to prepare the future workforce in coping with the evolving demands of the digital economy, Google provided a local education-focused non-profit organization in Japan, Code for Everyone, with grant funding to provide computer programming training for both teachers and students.[164] Besides introducing students to computer science, the program also provides resources and trains teachers in conducting programming education in primary schools. Since 2018, Google.org has provided grant support to Code for Everyone to deliver training to 2,000 "master teachers" – which are individuals tasked to transfer this know-how to other fellow teachers at their schools – and another 80,000 teachers in Japan. Through the Google.org grant, Google also supported Code for Everyone to expand the program to make these training available to middle schools, with the goal of reaching one million middle school students by 2025 and training 5,000 teachers in computer science by 2022. Finally, through the Grow with Google program, Google will provide university students and working adults with basic knowledge of AI and training to apply it to business.[165]

- **Introduce digital technologies to facilitate learning opportunities during the COVID-19 pandemic.** With mandatory lockdowns and temporary school closures, schools were faced with the urgent need to build the environment for remote

159. Grow with Google (2020), "Preparing for Japan's Changing Economy". Available at: https://japan.googleblog.com/2020/08/japan-economic-recovery.html
160. Google The Keyword (2020), "Japan prepares for a changing economy". Available at: https://blog.google/around-the-globe/google-asia/japan-prepares-changing-economy/
161. The Nikkei (2021), Google, "Digital Technology Education, Used by 7.5 Million People in Japan," World Digital Summit 2021] Source: https://www.nikkei.com/article/DGXZQOUC07AJ20X00C21A6000000/
162. Kantar (2020), Japan Economic Impact. Available at: https://www.kantar.com.au/Google/Google_Economic_Impact.pdf
163. Google in Japan Blog (2019), "Google AI for Japan: Aiming to develop AI human resources and promote technology utilization". Available at: https://japan.googleblog.com/2019/07/googleaiforjapan.html
164. Minna no Code (2020), "'Programming Teacher Training School' Collaborative: Google.org," Source: https://code.or.jp/yoseijuku/
165. Udemy (2020). Available at: https://www.udemy.com/course/google-jp-ai/

learning. Google supports MEXT in promoting the "Global Innovation Gateway for All (GIGA)" school plan, which provides public elementary and junior high schools with Chromebook laptops and Google Workspace for Education teachers with free training (Kickstart Program) (see Box 12).[166]

- **Extend digital skilling opportunities to bridge the digital gender divide in the workforce.** A 2019 survey found that Japan has the lowest hourly labor productivity in the G7 group of countries.[167] According to the Cabinet Office's survey on work-life balance, while 36.9 percent of full-time female employees want to prioritize their families, only 15.2 percent are actually able to do so.[168] Such an unproductive and inflexible work environment has serious implications for women, in particular working mothers struggling to balance family and work. In 2014, Google launched a project in Japan called Women Will to support women's advancement in society through more flexible work styles using technology in order to close the gender gap in technology use and increase the percentage of female workers. Box 13 introduces the various initiatives that Women Will has undertaken since its launch, aiming to create a society where everyone can play an active role, regardless of age or gender.

Google has also been supporting businesses in Japan in securing digital export opportunities **through the following initiatives**:

- **Support tourism businesses in improving their international appeal through digital platforms.** Google offered a course on "Digitalizing Tourism Right Now" as part of the Grow with Google program to help promote the appeal of various regions of Japan to the world through the power of technology. This course guides tourism businesses on ways to attract domestic and foreign travelers by leveraging tools such as Google My Business, uploading information about their business on Google Maps, and using Google Translate to enable real time conversation in a foreign language with their clients.[169] So far, 300,000 individuals have been trained online. Box 14 introduces examples of how digital technologies could be utilized in tourism marketing efforts, indirectly promoting the country's tourism sector, and spreading awareness of Japanese culture and attractions.

166. Google in Japan (2020), "Supporting the future of each student with the Google GIGA School Package". Available at: https://japan.googleblog.com/2020/03/google-for-education-google-giga-school.html

167. Japan Productivity Center "International Comparison of Labor Productivity" https://www.jpc-net.jp/research/list/comparison.html

168. Survey Report on Work-Life Balance in Companies, etc., "Results of Individual Questionnaire Survey" (March, 1991) Source: http://wwwa.cao.go.jp/wlb/research.html

169. Sources include: Udemy (2020). Available at: https://www.udemy.com/course/google-jp-tourism/; Grow with Google (2020), Available at: https://grow.google/intl/ALL_jp/program/personal-growth/#?modal_active=none

Box 12.
Google supports the government-led "GIGA School Plan" to integrate digital technology in education curriculums

In 2019, MEXT launched the "GIGA School Plan" which aims to leverage the ICT environment to realize optimal individualized learning and collaborative learning across all students through the provision of computers, tablets and rental mobile routers to students, and the implementation of online learning systems in schools.[170] To achieve this, the Japanese Government has set aside an investment of around JPY481.9 billion to implement the necessary infrastructure and facilitate the use of digital technology in the education sector.[171]

In addition to providing Chromebook laptops and Google Workspace for Education licenses, Google provides programs such as Grow with Google and Kickstart Program as well as training to promote teachers' understanding and use of Google Chromebooks. Google Chromebooks are subsidized by the government (JPY45,000 per device) and meet the specifications required for students to use them for learning. During the COVID-19 pandemic, millions of teachers and students benefited from accessing Google Workspace for Education tools, such as Google Meet and Google Classroom, to facilitate their transition to distance learning.[172] The Kickstart Program also provides training for educators at no cost. Teachers are taught how to use applications under Google Workspace for Education and set up Chromebook laptops for students.

CASE STUDY OF MACHIDA 5TH ELEMENTARY SCHOOL

At Machida 5th Elementary School in Tokyo, fifth and sixth grade students were each provided a Chromebook laptop with a Google Workspace for Education license. This license allows students and teachers to access Google's cloud-based tools, such as Google Sheets and Google Slides, which enable them to collaborate and create slides online together. The commenting feature also allows students to view and react to comments from their classmates which builds confidence and collaboration, while also deepening their understanding of the subject.[173]

On the other hand, productivity tools from Google Workspace for Education have also been instrumental in improving the productivity of teachers at work. With Google Slides, the cloud-based tool captures every student's work in real-time which minimizes the need for teachers to retype them or print them on physical copies. Instead of having to prepare teaching materials on their own, Google Sheets allows teachers to collaborate with one another and spurs creativity. Teachers are also able to administer tests through Google Forms and students can receive immediate feedback upon submitting the answers without having to wait for the teacher's review. As a result, teachers were able to complete their work and leave the school about an hour earlier than before.[174]

170, Channel News Asia (2020), "Commentary: Japan's two-month-long school closure is not a pretty sight". Available at: https://www.channelnewsasia.com/news/commentary/japan-close-schools-coronavirus-covid-19-online-learning-laptops-12683174

171. Ministry of Education, Culture, Sports, Science and Technology (2020), "Ministry of Education, Culture, Sports, Science and Technology FY2020 Budget Highlights". Available at: https://www.mext.go.jp/en/unesco/mext_00002.html

172. Business Insider (2020), "The reason why Google focused on 'free' in the 'GIGA School Package' for Japan." Available at: https://www.businessinsider.jp/post-209662

173. YouTube (2019), "Machida 5th Elementary School". Available at: g.co/edu/machidavideo2

174. YouTube (2020), "Workstyle Transformation". Available at: https://www.youtube.com/watch?v=gLeGeU_2Gg0

Box 13.
Toward a more diverse, equitable, and inclusive society, across all ages and genders

To urge the reform of flexible and efficient work styles using technology, Women Will has worked with more than 1,000 supporting companies and organizations to come up with measures for reforming work styles that can be adopted by organizations and individuals, and conduct empirical research. However, in order to create an environment that allows everyone to play an active role, multilateral changes are necessary, not only in the use of technology, but also in individual awareness, organizational culture, and social systems. With this in mind, in 2020, Women Will offered the Women Will Leadership Program, a training program for both management and individuals aspiring to become leaders, to create more inclusive organizations and promote women in management positions. Approximately 50 companies and organizations have participated in the program. 2021 will see the launch of the Women Will Diversity & Inclusion Program, a program designed to eliminate unconscious bias in companies and organizations, promote a more inclusive corporate culture, and create an environment and society where everyone can play an equal role. With the aim of creating a more diverse, equitable and inclusive society, Google aims to provide this program to 100,000 people by March 2022.

Box 14.
Grow with Google program encourages the use of digital technology to promote Japan's growth as a tourist destination

As part of the Grow with Google program, Google launched a course for the tourism industry to boost tourism, the key to regional development. This course aims to train tourism-related businesses and government officials in the use of digital tools to improve their service offerings. In particular, online training is targeted at tourism-related businesses located in rural and suburban areas. After achieving initial success in its online campaigns with Google Ads, the tourism office of Yoron Island (Kagoshima Prefecture) created and streamed 8K-definition videos using drone technology which received praise at Japan's World Tourism Film Festival, raising greater awareness of the region as an attractive tourist destination. Their high-quality marketing video also left a deep impression on viewers, with 270 percent more viewers remembering the video when asked during a survey, and a 61 percent increase in inclination to visit the location after watching the video.

GOOGLE'S ECONOMIC IMPACT IN JAPAN

BUSINESS BENEFITS

Google supports **JPY3.2 TRILLION (USD30.1 BILLION)** in annual benefits to businesses in Japan[1]

Google Search saves the average Japanese employee about **2.4 DAYS PER YEAR** through almost instantaneous access to information online

CONSUMER BENEFITS

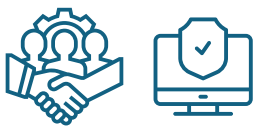
Google supports about **JPY4.4 TRILLION (USD40.7 BILLION)** in annual benefits to consumers in Japan[2]

The average Japanese **Google Search** user saves **5.4 DAYS A YEAR** looking for answers, as compared to traditional offline methods

Android enables consumers to choose from over **3.5 MILLION** apps available on the Android ecosystem[3]

Google Maps reduces driving time by over **7 HOURS,** and also shaves off over **4 HOURS** of commute time on public buses and trains per year

SOCIETAL BENEFITS



In 2020, Google.org supported Youth Business International with **USD2.5 MILLION** towards their **"Rapid Response and Recovery Program"**; this amount includes providing online training to help small businesses recover from the COVID-19 pandemic

1. Business benefits refer to the estimated economic impact from the following products: Google Search; Google Ads; AdSense; Google Play.
2. Consumer benefits refer to the estimated economic impact from the following products: Google Search; Google Maps; Google Drive; Docs, Sheets and Photos; Google Play.
3. App Annie (2017), "Top Predictions for the App Economy in 2018".
Available at: https://www.appannie.com/en/insights/market-data/predictions-app-economy-2018/

Note: All data is based on AlphaBeta analysis using a range of original and third-party sources. See Appendix in report for detailed methodology. Figures are estimated based on the latest available annual data as at time of research in 2020.

3.2 BENEFITS OF GOOGLE SEARCH, GOOGLE MAPS AND OTHER TECHNOLOGIES TO BUSINESSES, CONSUMERS AND SOCIETY

Google's applications and services, such as Google Search, Google Ads and Google Maps, bring about various economic benefits in Japan. This study finds that the annual economic value presented by Google's applications and platforms is JPY3.2 trillion (USD30.1 billion) for businesses, and JPY4.4 trillion (USD40.7 billion) for consumers.[175] An overview of the assessed economic benefits of Google products to businesses and consumers in Japan is provided in Exhibit 7. It is important to note that these benefits relate to direct economic benefits received, and do not include the flow-on economic effects generated (see Box 15 for further details). In addition, Google brings intangible benefits to the broader society by supporting the non-profit organizations delivering support to businesses during the COVID-19 pandemic and promoting local culture.

175. The products included in these estimations include Google Search, Google Ads, AdSense, Google Play, Google Maps, Google Drive, and Google Docs, Sheets and Photos. Figures are estimated based on the latest available annual data as at time of research in 2020.

Exhibit 7:

Overview of annual benefits supported by Google in Japan

TYPE OF BENEFIT	EASE OF ACCESS TO INFORMATION	ENTERTAINMENT AND ENRICHMENT
RELEVANT PRODUCT/S	**Google Search**	**Google Play & Android**
BUSINESS BENEFITS	• By allowing almost instantaneous access to online information, Google Search saves the average employee about **2.4 days** per year in Japan	• App developers in Japan earn about **JPY1.1 trillion (USD10.2 billion)** in revenue annually from both domestic and international markets through the Google Play platform per year • Android enables app developers to save up to **25%** of development time and target more than **1 billion** users worldwide[1]
CONSUMER BENEFITS	• Google Search saves consumers about **5.4 days** seeking information online per year • The total annual consumer benefits derived from Google Search are estimated at **JPY1.4 trillion (USD13 billion)**	• Consumers can choose from over **3.5 million** apps available on the Android ecosystem[1] • By gaining access to a range of digital entertainment options through Google Play, the consumer surplus benefits of this platform to consumers in Japan are estimated at **JPY964 billion (USD8.9 billion)** annually

1. App Annie (2017), "Top Predictions for the App Economy in 2018". Available at: https://www.appannie.com/en/insights/market-data/predictions-app-economy-2018/

2. Net advertising benefits refer to additional revenue earned from advertising less the advertising cost.

Note: Figures are estimated based on the latest available annual data as at time of research in 2020.

SOURCE: AlphaBeta analysis

	INCREASED PRODUCTIVITY AND CONVENIENCE	ADVERTISING BENEFITS	TOTAL BENEFITS:
	Google Maps, Drive, Photos, Docs & Sheets	**Google Ads & AdSense**	
	• The Google My Business (GMB) function in Google Maps allows customers to discover local businesses. Globally, the additional revenue earned by small and medium-sized businesses as a result of GMB has been estimated to be between **USD212-250** per year	• Google Search and Ads bring about **JPY2 trillion (USD18.5 billion)** in net advertising benefits to businesses in Japan annually[2] • Web publishers earn about **JPY110 billion (USD1 billion)** in revenue from AdSense annually • Advertisers in Japan gain **JPY31.8 billion (USD295 million)** in net advertising benefits annually through displaying advertisements on websites using AdSense[2]	**JPY3.2 TRILLION (USD30.1 BILLION)**
	• Google Maps helps consumers save over **4 hours** on public transport trips per year • Drivers spend **7 hours** less on the roads per year by using Google Maps to optimize their driving journeys • The total annual consumer benefits derived from productivity-enhancing tools of Google Maps, Drive, Photos, Docs, and Sheets are estimated at **JPY2 trillion (USD18.8 billion)**	Nil	**JPY4.4 TRILLION (USD40.7 BILLION)**

Box 15.
Measuring the benefits of Google's products to businesses and consumers

The benefits of Google's products to businesses and consumers estimated in this research focus on the direct economic impact received by them. Because of the different nature of the benefits experienced from the products, different approaches were utilized for businesses and consumers. The business benefits supported by Google include the gross revenue, income or savings generated by businesses using Google products. It is important to note that these benefits do not include the flow-on economic effects generated, such as further purchases from their suppliers, or the economic activity generated by the employees of these businesses who spend their wages in the broader economy (indirect or induced spend). This is because of the intention to gauge the direct impacts that business users of Google's products receive. On the other hand, for benefits to consumers, it is important to note that these are challenging to measure and calculate because individuals typically do not pay for the services. In the absence of price indicators, the economic "willingness to pay" principle was used to estimate the value of consumer benefits by asking individuals how much they value specific products. Time savings accrued to consumers from their use of Google Maps (which optimizes their driving and public transport journeys) and Google Search (which increases the efficiency of information gathering) were also measured to derive a measure of the convenience these products bring to them. Appendix B shows a detailed methodological explanation of how the benefit of each product was sized.

Benefits to businesses

Google helps businesses boost their revenues

Google applications broaden the reach of businesses in Japan to new customers and markets. Online advertising platforms, such as **Google Ads** and **YouTube**, allow businesses to conduct targeted advertising, bringing their products and services to the right audiences and growing their customer base. **Google Ads** is estimated to generate JPY2 trillion (USD18.5 billion) annually in the form of net returns to businesses in Japan from advertising on Google Search results of relevant keywords.[176] Beyond search advertising, businesses in Japan also benefit from displaying advertisements on Google's network of publisher sites such as websites, blogs, and forums through **AdSense**. These net returns are estimated at JPY31.8 billion (USD295 million) annually. Meanwhile, by leveraging the various formats of advertisements enabled by **YouTube**, businesses in Japan are able to generate awareness of their brand and offerings to large audiences, including outside of Japan.

Box 16 illustrates how local SMEs were able to expand their customer outreach and increase revenue through Google Ads during the pandemic, while Box 17 shows the extensive support made by Google to support the country during this crisis.

In addition, Google provides new sources of income for content creators in Japan. By allowing content creators such as online journalists, media sites, bloggers and writers to earn income by hosting advertisements on their sites, **AdSense** is estimated to have helped content creators in Japan monetize space on their websites, and generate a total annual income of JPY110 billion (USD1 billion). **YouTube** also benefits video content creators in Japan who earn revenue through placing advertisements on their videos.

Google's digital product distribution system, **Google Play**, as well as its operating system (OS), **Android**, have resulted in a variety of benefits to app developers in Japan. App developers in Japan are estimated to earn an annual return of JPY1.1 trillion (USD10.2 billion) from both the domestic and international markets through Google Play. Further, through the Android operating system, app developers in Japan can readily reach more than one billion users globally.[177] It was additionally found that Android app developers can save up to 25 percent in development time from not having to port their apps across different operating systems.[178]

Exhibit 8 summarizes the estimated business benefits in the form of revenue gains experienced by businesses in Japan from Google Search and Ads, AdSense and Google Play.

176. This refers to the increase in revenues and sales that can be directly attributed to advertising minus the related advertising expenditure.
177. AlphaBeta (2018), "AlphaBeta research brief: The estimated economic impact from Android across five Asian markets". Available at: https://www.alphabeta.com/wp-content/uploads/2017/08/180820-Android-Economic-Impact.pdf
178. AlphaBeta (2018), "AlphaBeta research brief: The estimated economic impact from Android across five Asian markets". Available at: https://www.alphabeta.com/wp-content/uploads/2017/08/180820-Android-Economic-Impact.pdf

Box 16.
Google Ads helped local SMEs gain new customers online and boost revenue during the COVID-19 pandemic

CHITOSE INDUSTRIAL CO., LTD.

Founded in 1962, Chitose is a metal manufacturer located in the Osaka prefecture. The company's key business activities include press working, brazing, assembly, designing and producing wireless electronic equipment. For three years, the business faced difficulties in selling its in-house temperature and humidity meter – Logbee. With little confidence, the director decided to advertise the product on Google Ads and reached out to potential clients online who were seeking niche technologies. After placing advertisements online, the number of inquiries received by the company increased ten-fold while sales increased by 580 percent year-on-year. Despite the low advertising budget, the business was able to sell its products to customers in both the domestic and international markets.[179]

SAIHARA SCHOOL

At the height of the COVID-19 pandemic in April 2020, Goro Saihara started a private school, also known as cram school, in Yokohama City, Kanagawa prefecture, to offer supplementary classes for students preparing for entrance exams. Due to school closures, Saihara faced difficulties in attracting students. Moreover, the private school was situated near the ocean, far away from the city, and did not have a brand presence. He resorted to using Google Ads to advertise the school online and started to receive new inquiries from students about the school's programs after viewing his advertisements online. Saihara hopes to establish the most trusted cram school in the area.[180]

179. YouTube (2020), "Google Ads Case Study (Capturing new customers: Chitose Industrial Co., Ltd.)". Available at: https://www.youtube.com/watch?v=9hsh_FybC0c&feature=emb_logo

180. YouTube (2020),"Google Ads Case Study (Gaining recognition : Individual cram school Saihara)". Available at: https://www.youtube.com/watch?v=JlY64ZDnBB8

Box 17.
Google's contributions to businesses and students during the COVID-19 pandemic

ENABLING REMOTE WORKING ARRANGEMENTS DURING THE PANDEMIC

While companies in Japan have traditionally required workers to be in the office full-time, during the nationwide state of emergency, many employees in Japan had to work from home – including almost half of all workers in the Kanto and Kansai regions.[181] As more businesses adjust to work-from-home arrangements during the COVID-19 pandemic, the Google Meet video-conferencing app was made available free of charge to everyone all over the world including Japan. This allowed companies to work remotely at all times from anywhere on the globe.

SUPPORTING BUSINESS CONTINUITY

When the nationwide state of emergency was declared, many businesses saw a fall in in-store revenues as most people stayed at home. In this situation, Google My Business was instrumental in creating a digital storefront for businesses to sell online and expand their outreach to gain new customers. By creating a Google My Business profile, potential customers would be able to search for local businesses on Google Search and Google Maps, and find out more about the products and services offered. In addition, small and medium-sized businesses are now able to use free tools to upload the latest business information, connect with their customers digitally and to continue selling their products and services at no cost. One example is Kurakata Dolls, a 180-year-old business located in Tokorozawa City, Saitama Prefecture, specializing in the production of traditional Hina dolls. Unlike the previous years, the business saw revenues decrease by 30 percent in April 2020 compared to the average of previous years during its summer sale season. To provide assurance for customers hoping to visit the store, shop owner Kentaro Kurakata updated their Business Profile on Google My Business with

181. Google The Keyword (2020), "Japan prepares for a changing economy".
Available at: https://blog.google/around-the-globe/google-asia/japan-prepares-changing-economy/

Box 17 (cont'd).
Google's contributions to businesses and students during the COVID-19 pandemic

coronavirus prevention measures and launched a social media campaign to boost online sales during "Children's Day".[182]

Besides its free Business Profile, Google also added new features to facilitate businesses in capturing new sources of revenue that emerged during the COVID-19 pandemic. With increasing consumer demand for food delivery and takeout, businesses which created Business Profiles on Google My Business have the option of adding dining service attributes such as "takeout" and "delivery" on their profile.[183] This greatly enhanced the ease with which customers could order food while minimizing physical contact. At the same time, businesses are now able to continue operating while abiding by social distancing measures.

HELPING STUDENTS LEARN AT HOME

For a few months from the end of March 2020, schools across the nation were forced to close temporarily and 13 million students and teachers were affected.[184] To help students learn from home under lockdown, Google launched a Distance Learning Support Program which included lending thousands of Chromebooks to teachers and students in schools who wanted one to provide learning continuity.[185] Additionally, Google hosted regular webinars introducing tools available and how to use them effectively for teachers teaching remotely.

182. Kurakata Dolls (2020), Available at: https://shop.k-doll.co.jp/products/list?category_id=2
183. Google for Small Business (2020), "Helping your business through COVID-19."
Available at: https://smallbusiness.withgoogle.com/intl/en_nz/news/resources-for-smbs-impacted-by-coronavirus/#!/
184. NHK (2020) "Prime Minister to request temporary closure of elementary, junior high and high schools across Japan from 2nd of next month until spring break" Source：https://www3.nhk.or.jp/news/html/20200227/k10012304751000.html
185. Google Workspace for Education (2020), Available at: https://edu.google.com/distance-learning/

Exhibit 8:

Google is estimated to bring about JPY3.2 trillion (USD30.1 billion) worth of annual benefits to businesses in Japan

Product	Description of benefits	Estimated annual benefits
Google Search & Ads	Net advertising benefits for businesses[1]	JPY2 trillion (USD18.5 billion)
AdSense	Net advertising benefits for businesses[1]	JPY31.8 billion (USD295 million)
	Income generated by website publishers through AdSense	JPY110 billion (USD1 billion)
Google Play	Income generated by app developers in Japan from both the domestic and international markets through Google Play	JPY1.1 trillion (USD10.2 billion)
	TOTAL ANNUAL BUSINESS BENEFITS IN JAPAN:	**JPY3.2 TRILLION (USD30.1 BILLION)**

1. Net advertising benefits refer to additional revenue earned from advertising less the advertising cost.
Note: Figures are estimated based on the latest available annual data as at time of research in 2020.
SOURCE: AlphaBeta analysis

At the same time, Android has contributed significantly to the broader digital ecosystem in Japan. By being able to use Android source code directly rather than having to develop bottom-up operating systems, several Japanese device manufacturers have leveraged the Android OS to drastically reduce one-off development costs. It was estimated that free-to-use open-source operating systems such as Android have enabled Japanese device manufacturers to save about 100,000 software development days each.[186] Box 18 highlights examples of how Android's free-to-use open-source operating system has supported Japanese original equipment manufacturers (OEMs) in innovating new products and increasing their competitiveness.

Google helps businesses increase productivity and save time

Google helps businesses save time by enhancing employees' productivity through improving the speed and ease of access to information and research. In particular, **Google Search** minimizes the time for businesses to acquire information by arranging and simplifying the vast array of content on the Internet. The ability to rapidly find relevant data and information provides tremendous productivity benefits for employees, with each employee saving on average about 2.4 days annually.[187]

Google supports jobs in Japan

At a broader level, Google has facilitated job creation in the economy through its products. Through Google Ads and AdSense, Google supports the creation of over 109,000 jobs in Japan across all sectors, including traditional sectors such as consumer, retail and hospitality, and infrastructure.[188] These sectors were some of the most severely COVID-19 affected sectors in Japan - in 2020, the restaurant industry witnessed the largest number of pandemic-related bankruptcies, followed by the construction and hospitality industries.[189] These jobs are created through the use of Google products that lead to businesses expanding

186. AlphaBeta (2018), "AlphaBeta research brief: The estimated economic impact from Android across five Asian markets". Available at: https://www.alphabeta.com/wp-content/uploads/2017/08/180820-Android-Economic-Impact.pdf
187. Report on the economic impact of Google/AlphaBeta, sample size = 750.
188. Refers to jobs supported by Google Ads and AdSense. The job estimate excludes revenue gained by website publishers who use AdSense as it may comprise freelancers and individuals who publish websites recreationally, and thus do not fall under any formal industry sector.
189. The Asahi Shimbun (2021), "1,000 companies go bankrupt as virus continues to rage in Japan". Available at: http://www.asahi.com/ajw/articles/14159624

Box 18.
Japanese OEMs leverage the Android OS to improve services and increase market share

SHARP

Founded in 1912, Sharp manufactures a wide range of electronic products such as Android OS smartphones (e.g., SH-M03 and the Aquos Chrystal) and smart TVs (i.e., Aquos) using the Android TV platform. According to a Sharp representative, the company has significantly benefited from the variety of features and apps available through Android. "Android constantly incorporates new features and functions at ever higher speeds, this pushes the smartphone industry to further innovate. Network connected applications and functions that utilize connectivity between devices as well as the user experience using touch panels has been improved due to Android in our products." The Android OS has also enhanced Sharp's app development - "In the past, Sharp used to develop a lot of applications (for basic functionality) by ourselves, but since the rise of Android, we make more use of third-party applications and focus our innovation efforts on developing apps that are truly unique."[190]

190. Interview with Sharp conducted by AlphaBeta.

Photo Source: https://www.gsmarena.com/sonys_2021_bravia_tvs_come_with_hdmi_21_google_tv_and_cognitive_processor_xr-news-47112.php

SONY

Another Japanese OEM which has benefitted from the Android OS is Sony Visual Products (SVP). SVP manufactures and retails a series of television models from smart TVs using Android TV platforms (e.g., Sony Bravia TV range) to traditional TV sets (e.g., R300E series). According to an SVP representative, Android has improved competition in the device manufacturing market in Japan and has improved the product experience of SVP's devices for its customers.[191] One of the key advantages of Android that SVP sees is that it helps attract Over-The-Top (OTT) service providers[192] to offer their apps and services on its televisions. "Previously, while SVP used a proprietary operating system, we were too small to attract all the OTTs. OTTs have to adjust their services for different operating systems, and smaller players cannot support SVP because they have to prioritize their services by market share, and across devices - not just televisions."[193]

FREETEL

Android not only benefits established multinational enterprises such as Sharp Corporation and SVP, but it also provides the environment for smaller firms in Japan to level the playing field and compete with local and international smart device players. For instance, Freetel, a manufacturer of devices established in 2012, is branching out to over 20 countries.[194] Freetel has adopted Android as its main operating system since 2012 and has managed to make its mark in both the Japanese and international smartphone markets despite it being a small and new player in the industry. According to Freetel's personnel, "Some companies, maybe even Freetel, could not start their businesses without a working operating system (e.g., Android).[195] When asked whether the brand name of Android has helped Freetel compete and enter new markets, the company replied "Yes, the familiarity with Android means using Android is a strong brand image that helps expansion both abroad and in Japan. Many consumers think about Non-Android versus Android first and the OEM second."[196]

191. Interview with Sony Visual Products conducted by AlphaBeta.
192. OTTs refer to over-the-top services that provide products over the internet and bypass traditional distribution. Examples include subscription video on-demand services like Netflix and ESPN. Information obtained from techopedia, 2017 - https://www.techopedia.com/definition/29145/over-the-top-application-ott
193. Interview with Sony Visual Products conducted by AlphaBeta.
194. Information obtained from Freetel Japan, 2017 – https://www.freetel-japan.com/about.html
195. Interview with Freetel conducted by AlphaBeta.
196. Interview with Freetel conducted by AlphaBeta.

their customer bases and increasing revenue.[197] For instance, businesses that expand their reach to new markets through advertising via Google Ads and AdSense would require increased resources to meet this additional demand.

Through the Android OS, It was estimated that over 540,000 Japanese were employed in jobs that were linked to Android in 2020.[198] This includes more than an estimated 180,000 Japanese who are employed directly in Android app development jobs. In addition to this direct employment, Android generates employment through indirect jobs (non-tech-related jobs within the app economy), as well as spillover jobs (jobs created outside of the app industry, such as firms supplying app developers with products and services).

Benefits to consumers

Consumers experience total annual benefits worth JPY4.4 trillion (USD40.7 billion) from Google's services

The consumer benefits supported by Google are challenging to measure and calculate because individuals typically do not pay for the services. In the absence of price indicators, the economic "willingness to pay" principle was adopted to estimate the value of consumer benefits by asking individuals how much they value specific products (see Box 15). Taken together, the total value placed by consumers on these products – which takes into account their perceived functionality and ease of using these products – is estimated at JPY4.4 trillion (USD40.7 billion) annually. This value includes three main categories of benefits provided by Google applications: ease of access to information (Google Search), entertainment and enrichment (Google Play), and enhanced productivity and convenience (Google Maps, Drive, Photos, Docs and Sheets). Exhibit 9 shows the breakdown of consumer surplus by category.[199]

Google enables consumers better access to information

Google provides benefits to consumers in Japan by allowing them to instantly access a vast array of information online. The total annual consumer surplus brought about by **Google Search** are estimated at JPY1.4 trillion (USD13 billion) (Exhibit 9). Based on an international study showing that a search for a piece of information that takes 21 minutes in the library takes only 7 minutes online, it is estimated that Google Search saves consumers in Japan an average of 5.4 days per year (Exhibit 10).[200]

Google's services improve productivity and convenience for consumers

Google Maps brings about productivity in the public transport and driving journeys of consumers in Japan through the service's wayfinding and navigation feature, which optimizes these trips using real-time data such as public transport arrival times and road traffic conditions. Commuters who use Google Maps to optimize their public transport journeys are estimated to save over 4 hours per year on buses and trains (Exhibit 10).

In addition, by allowing digital data to be stored and accessed through multiple devices including laptops, tablets and smartphones, Google's cloud-based services such as **Google Drive, Photos, Docs, and Sheets** provide great convenience to consumers in Japan. These services enable them to manage files, folders, music and photos on the fly – without having to retrieve the information from a piece of hardware.

197. Jobs supported refer to new jobs that may have been created through a business' use of Google's platforms, as well as ongoing employment of jobs that previously existed.

198. Based on AlphaBeta estimates. See Appendix B for details on methodology.

199. Because individuals typically do not pay for services, it is difficult to measure and calculate the benefit consumers receive from Google support. In the absence of a price index, Google applied the economic "willingness-to-pay" principle to estimate the value of consumer benefits by asking individuals how highly they would rate a particular product. This is also known as consumer surplus.

200. Yan Chen, Grace Young Joo Jeon and Yong-Mi Kim (2014), A day without a search engine: an experimental study of online and offline search. Experimental Economics. Available at: https://link.springer.com/article/10.1007/st10683-013-9381-9

Exhibit 9:

Google is estimated to support a total JPY4.4 trillion (USD40.7 billion) worth of annual consumer surplus in Japan

Estimated annual consumer surplus of Google products in Japan
Consumer surplus (JPY)

TYPE OF BENEFITS	PRODUCT	ANNUAL CONSUMER SURPLUS
Ease of access to information	Google Search	JPY1.4 trillion (USD13 billion)
Entertainment and enrichment	Google Play	JPY964 billion (USD8.9 billion)
Enhanced productivity and convenience	Google Maps	JPY2 trillion (USD18.8 billion)
	Google Drive, Photos, Docs and Sheets	
	TOTAL ANNUAL CONSUMER SURPLUS:	**JPY4.4 TRILLION (USD40.7 BILLION)**

Note: Figures are estimated based on the latest available annual data as at time of research in 2020.
SOURCE: AlphaBeta analysis

Exhibit 10:

Google's applications like Google Search and Google Maps bring about time savings to consumers

Estimated annual time savings provided by Google Search and Google Maps to consumers in Japan
Amount of time saved per year

PRODUCT	TIME SAVED PER USER
Google Search	5.4 days per year[1]
Google Maps	7.1 hours per year (driving)
	4.3 hours per year (public transport)

1. These time savings differ from those estimated in the business benefits section, as these relate to savings gained on non-work activities (e.g., using Google Search to find information for leisure purposes).
SOURCE: AlphaBeta analysis

The total consumer benefits derived from productivity-enhancing tools of Google Maps, Drive, Photos, Docs, and Sheets are estimated at JPY2 trillion (USD18.8 billion) annually.

Google provides various options for entertainment and enrichment

YouTube has presented substantial benefits to consumers as a source of free entertainment as well as a channel for consumers to learn new skills (e.g., online "how-to" videos) or gain new knowledge (e.g., online documentaries). During the COVID-19 pandemic when time spent at home increased dramatically, the number of people using online video services has increased. In particular, 74 percent of YouTube users reported an increase in their platform usage since the start of the pandemic.[201] The average views on home exercise videos have grown by over 450 percent since March 2020 while cooking videos have earned over five billion views in Japan in 2020.[202]

Google Play and **Android** have also brought a variety of benefits to consumers in Japan. For example, Android enables consumers to choose from over 3.5 million apps available on the Android ecosystem.[203] Meanwhile, **Google Play** is a convenient platform for consumers to access a range of smartphone applications, as well as digital books, music and films. According to AlphaBeta research, Google Play brings consumers in Japan an estimated annual consumer surplus of JPY964 billion (USD8.9 billion).[204]

Benefits to wider society

Google supports non-profit organizations through grants

With typically tight margins, SMEs are particularly vulnerable to the current economic downturn brought about by the COVID-19 pandemic. Google's philanthropic arm, Google.org, provided the Youth Business International (UK) with a USD2.5 million grant to support the launch of the "Rapid Response and Recovery Program". The program aims to provide a holistic package of emergency support for over 200,000 underserved SMEs across 32 countries during the COVID-19 crisis. To implement this project in Japan, ETIC has joined YBI as a delivery partner to provide emergency assistance packages to companies in distressed areas.[205]

Google promotes Japanese arts and culture

In collaboration with government agencies, Google Arts and Culture collaborated with the Tottori Prefectural Government, Takasaki City, and other organizations in a partnership themed "Made in Japan: Japanese Craftsmanship" to introduce various artisan products that Japan prides itself on, and with the Ministry of Agriculture, Forestry, and Fisheries to introduce the history and background of Japanese food, as well as the thoughts of the producers, under the theme "Let's Enjoy Japan's Deep Food Culture".

During the COVID-19 pandemic when museums had to close, Google Arts and Culture became a key portal for home-bound travelers to explore artworks digitally and roam freely in the galleries through 360-degree views. For example, visitors can go on a virtual exhibition tour in Tokyo National Museum's Honkan galleries and the Gallery of Horyuji Treasures through Google Street View, which creates indoor directories mapped based on building floor plans.[206]

201. YouTube (2020), "YouTube Japan Trends 2020". Available at: https://www.youtube.com/watch?v=wKkCA3hwyWM&feature=youtu.be
202. YouTube (2020), "YouTube Japan Trends 2020". Available at: https://www.youtube.com/watch?v=wKkCA3hwyWM&feature=youtu.be
203. App Annie (2017), "Top Predictions for the App Economy in 2018". Available at: https://www.appannie.com/en/insights/market-data/predictions-app-economy-2018/
204. Google/AlphaBeta Economic Impact Report survey, n = 750. The total consumer surplus represents the economic benefits to consumers in Japan from using Google Play. See more details in Appendix B of the methodology.
205. Youth Business International (2020), "COVID-19 Rapid Response and Recovery Programme supported by Google.org". Available at: https://www.youthbusiness.org/initiative/covid-19-rapid-response-and-recovery-programme
206. Tokyo National Museum (3030), "Masterpieces from the Tokyo National Museum now viewable on Google Arts & Culture". Available at: https://www.tnm.jp/modules/r_free_page/index.php?id=1859&lang=en

APPENDIX: METHODOLOGY

A: SIZING THE ECONOMIC VALUE OF DIGITAL TECHNOLOGIES

This document provides the detailed methodology, assumptions and sources of information to quantify the potential economic impact of digital technologies for Japan in 2030.

Appendix A1: Overall approach

A four-step methodology was used to understand the potential economic impact created by digital technologies in 2030 (Exhibit A1).

Step 1: Identify digital technologies

Several existing research reports on current and emerging digital technologies were reviewed to identify the most relevant technologies to focus on for this analysis in terms of their potential economic impact. There is a large body of research by academics, development practitioners, non-for-profits as well as the private and public sector on the interaction between technologies and economic development. In 2013, McKinsey Global Institute identified 12 disruptive trends that would transform life, business and the global economy.[207] Of these trends, seven were considered digital in nature: mobile Internet; automation of knowledge; IoT which was often combined with geospatial and satellite technology (e.g., remote sensing); cloud technology; advanced robotics; autonomous and near autonomous vehicles; and additive manufacturing (more commonly known as 3D printing).

Since 2013, several technologies have been added to this list due to potentially transformational economic and social impact. For example, the UK-based international development network, Bond, noted rapid changes in the technologies shaping international development between 2016 and 2019. Emerging technologies included big data, financial technology (FinTech), machine learning and even blockchain. These technologies were in no way mutually exclusive and the line between what constituted a different technology versus an application of a technology could be blurred. For example, AI utilized big data which often relied on cloud computing technology to provide the storage and computational horsepower to run machine learning algorithms and other analytics. Similarly, autonomous vehicles contained a multitude of sensors, many of which were Internet-enabled i.e., IoT. Exhibit 1 in Chapter 1 provides an overview of eight key digital technologies with significant implications for economic development.

Step 2: Align on focus sectors

To understand the current and potential economic output of these digital technologies, a set of focus sectors have been identified. These sectors were selected based on two steps:

- Clustering industries, at the ISIC 1 digit level, into broader sectors for convenient analysis.[208] This was guided by the individual industry's relevance for digital technologies (based on past research

207. McKinsey Global Institute (2013), Disruptive technologies: Advances that will transform life, business, and the global economy. Available at: https://www.mckinsey.com/business-functions/digital-mckinsey/our-insights/disruptive-technologies

208. These sectors uniquely match to the relevant International Standard Industrial Classification of All Economic Activities (ISIC) with the exception of "Consumer, retail & hospitality", combining ISIC Sector G: Wholesale and retail trade; repair of motor vehicles and motorcycles and Sector I: Accommodation and food service activities; "Infrastructure", which combines ISIC Sectors F: Construction and L: Real estate activities; and "Resources", combining the ISIC Sector B: Mining and quarrying; Sector D: Electricity; gas, steam and air conditioning supply and Sector E: Water supply, sewerage, waste management and remediation activities.

quantifying the potential industry benefits of these digital technologies).[209]

- Prioritizing the sectors based on their importance for GDP, proxied by the sector's share of national GDP. Each selected sector must represent more than 1.5 percent of the national GDP.

The Information and Communication Technology (ICT) industry classification was excluded due to its value-added to the economy being almost entirely driven by technology and most of the value from digital technologies in this sector would have been captured in other sectors as an input to production.

Based on these steps, ten sectors were selected.[210] These sectors consisted of Agriculture and food (including food manufacturing); Consumer, retail and hospitality services; Education and training; Financial services; Government; Health; Infrastructure (including utilities such as energy and water); Manufacturing; Resources (including mining and oil & gas); Transport services.

Step 3: Identify relevant technology applications in focus sectors

Relevant technology applications in the focus sectors and their sources of value (e.g., reduced wastage in production, enhanced consumer offerings) were identified based on a detailed review of the academic literature for each of the eight focus technologies. These technology applications included tangible drivers of business value, such as the use of

Exhibit A1:

A four-step methodology was used to understand how digital technologies could transform economic development

	STEP 1 Identify digital technologies	STEP 2 Align on focus sectors	STEP 3 Identify relevant technology applications in focus sectors	STEP 4 Size the value in 2030
Activities	Identify key digital technologies that academic literature has shown to be important for driving business and consumer value	Identify key sectors of the economy, based on relevance of those technologies and their importance for overall jobs and GDP	Understand relevant technology applications in focus sectors, including sources of value	Estimate the value (in local currency terms) of these technology applications in each sector in 2030 based on full adoption scenario
Methodology	Industry reports – e.g., McKinsey Global Institute, World Economic Forum	Technology reports to identify sector-impact of technologies; local country data for importance of sectors to GDP and jobs	Review of sector-level technology reports	Case studies, with top-down "sanity check" based on comparison to other research reports on overall value of technologies

209. This was based on a range of reports. See for example, McKinsey Global Institute (2014), Southeast Asia at the crossroads: Three paths to prosperity (Available at: https://www.mckinsey.com/~/media/McKinsey/Featured%20Insights/Asia%20Pacific/Three%20paths%20to%20sustained%20economic%20growth%20in%20Southeast%20Asia/McKinsey Global Institute%20SE%20Asia_Executive%20summary_November%202014.ashx); and McKinsey Global Institute (2014), India's tech opportunity: Transforming work, empowering people (Available at: https://www.mckinsey.com/industries/high-tech/our-insights/indias-tech-opportunity-transforming-work-empowering-people).

210. In Japan, all ten sectors have fulfilled the criterion in Step 2 except for the agriculture and food sector which account for less than 1.5 percent of the national GDP.

remote patient monitoring to enable hospital-level care in homes using advanced sensors, smart medical devices, and robotics. A list of these technology applications, categorized by sector and key digital technology, is shown in Exhibit 2 in Chapter 1. Several emerging digital technologies such as blockchain were considered but not analyzed as they were still in the nascent stages and economic impact estimates were difficult to obtain.

Step 4: Size the value in 2030

The value (in local currency terms) of these technology applications in each sector was then quantified in 2030 (based on assessed potential linked to benchmarks). The "Full adoption" scenario was analyzed. In this scenario, the country was assumed to achieve full digital adoption (10 percent) in the 40 digital technology applications across ten sectors. This scenario was modeled to frame the maximum achievable opportunity. A series of international and country-specific case studies were used for each technology application in the sizing. A “sanity check” of the results was then done by comparing the overall sector and economy-wide estimates with other research reports. **These estimates do not represent GDP or market size (revenue), but rather economic impact such as productivity gains, increased revenues and cost savings.**

Appendix A2: Specific approaches, assumptions and sources

Table 1 summarizes the key metrics and sources used commonly across the sizing of the economic opportunities of digital technology applications.

The specific assumptions and sources of information used to size each digital technology application in each sector are shown below. These assumptions were used to estimate the “Full adoption” scenario in 2030.

Table 1: Key metrics and sources for sizing economic opportunities

METRICS	SOURCE
GDP / GDP per capita	• World Bank GDP statistics • International Monetary Fund (IMF) Real GDP growth estimates • Japan Statistics Bureau
Population	• United Nations Department of Economic and Social Affairs Population datasets
Labour Force	• International Labour Organization (ILO) • World Bank Labor Force statistics • Japan Statistics Bureau
Wage	• Japan Statistics Bureau
Exchange rates	• OFX

AGRICULTURE AND FOOD

DESCRIPTION	SIZING ASSUMPTIONS	SOURCE
1. PRECISION FARMING TECHNOLOGIES		**PRODUCTIVITY GAINS/COST SAVINGS**
Data-driven optimization of crop and meat production	Sized based on the productivity gains from increased yield, as well as cost savings from the use of fewer resources in farming. Cambridge University Press (2017) published an article which states that harvest efficiency increased by 30 percent after implementing smart agricultural machinery systems. Country-level estimate was derived based on the effectiveness of the technology within the context of the country's agricultural landscape and its agricultural sector GDP.	• Cambridge University Press (2017)[211] • World Bank[212]
2. IOT-ENABLED SUPPLY CHAIN MANAGEMENT		**INCREASED REVENUES**
IoT technology to help reduce food waste in supply chain	Sized based on the additional revenues from reduced food losses that occur in the supply chain. McKinsey Global Institute (2014) estimated that ten percent to 15 percent of all food waste throughout the supply chain were recoverable from technology-enabled supply chain management. Country-level estimate was derived based on annual food waste from the supply chain which was assumed to grow at constant rates.	• McKinsey Global Institute (2014)[213] • Food and Land Use Coalition[214]
3. FOOD SAFETY TECHNOLOGIES		**COST SAVINGS**
Using sensors, data monitoring and analysis techniques to ensure the biosecurity of food products and predict when concerns may arise	Sized based on cost savings from reduced food contamination losses. Fast Company (2017) reported that improving food traceability via sensing, tracking and data monitoring technologies could improve the percentage of food arriving at the retailers' premises with target freshness, from 30 percent to 90 percent. Pricewaterhouse Coopers (2015) estimated the global cost of food fraud, proxied by lost sales due to adverse health consequences, to be between USD30 billion to USD40 billion a year. Growth in cost of food fraud was derived based on FAO's estimate of global food demand growth. Country-level estimate of food contamination losses was derived based on the relative share of global GDP.	• Fast Company (2017)[215] • PricewaterhouseCoopers (2015)[216] • Food and Agriculture Organisation of the United Nations[217]

211. Cambridge University Press (2017), "Design of Smart Agriculture Japan Model". Available at: https://www.cambridge.org/core/journals/advances-in-animal-biosciences/article/design-of-smart-agriculture-japan-model/58BDA3722DEA08EB3DC3D32825B62949

212. World Bank (2018). Available at: https://blogs.worldbank.org/opendata/new-country-classifications

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CONSUMER, RETAIL AND HOSPITALITY

DESCRIPTION	SIZING ASSUMPTIONS	SOURCE
1. DIGITAL RETAIL SALES AND MARKETING CHANNELS	**PRODUCTIVITY GAINS**	
Productivity gains from delivering retail goods through digital channel, reducing labor, inventory, and real estate costs	Sized based on productivity gains from delivering goods digitally. McKinsey Global Institute (2013) estimated that productivity gains from selling goods through digital channels ranged from six percent to 15 percent, based on reduced labor requirements, inventory efficiencies and lower real estate costs. Country-level estimate was derived based on domestic e-commerce retail sales and operating costs (assuming constant growth rates).	• McKinsey Global Institute (2013)[218]
2. IOT-ENABLED INVENTORY MANAGEMENT	**INCREASED REVENUES**	
Use of IoT to reduce stock outs	Sized based on increase in revenues from capturing sales potentially lost due to stock outs. McKinsey Global Institute (2013) estimated that four percent of retail sales were lost due to stock outs, and that 35 percent to 40 percent of this value may be recaptured using IoT. Country-level estimate was derived based on domestic retail sales.	• McKinsey Global Institute (2013)[219]
3. AUTOMATION AND AI CUSTOMER SERVICE IN HOTELS	**INCREASED REVENUES**	
Use of AI and automated services for remote check-ins at hotels	Sized based on increased revenues from higher efficiency in hotel verification procedures. Colliers International (2019) estimates that hotel revenues could increase by ten percent through AI. The Vulcan Post reported that each hotel verification procedure typically took ten minutes. The Singapore Tourism Board estimated that the E-visitor Authentication system could eliminate manual processes and reduce check-in time by up to 70 percent. Country-level estimate was derived based on hotel revenue.	• Colliers International (2018)[220] • The Vulcan Post (2018)[221] • Singapore Tourism Board (2019)[222]
4. DATA ANALYTICS ON TRAVEL PATTERNS	**INCREASED REVENUES**	
Use of big data analytics in predicting consumer behavior	Sized based on increased revenues from better targeted promotions to tourists. Boston Consulting Group (2020) estimated that brands experienced a revenue uplift of six to ten percent from integrating proprietary data to create personalized experiences. Country-level estimate was derived based on tourism revenue.	• Boston Consulting Group (2020)[223]

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CONSUMER, RETAIL AND HOSPITALITY (CONT'D)

DESCRIPTION	SIZING ASSUMPTIONS	SOURCE
5. ONLINE F&B DELIVERY SERVICES		**INCREASED REVENUES**
Use of online delivery service	Sized based on increase in revenues from capturing F&B orders placed online. The Straits Times (2017) reported that restaurants have seen revenues rise by 15 percent after partnering food delivery firms. Country-level estimate was derived based on domestic hospitality revenue.	• The Straits Times (2017)[224]

EDUCATION AND TRAINING

DESCRIPTION	SIZING ASSUMPTIONS	SOURCE
1. E-CAREER CENTERS AND DIGITAL JOBS PLATFORMS		**GDP INCREMENTS**
Use of online job listing platforms and matching of candidate profiles to available jobs based on algorithms	Sized based on GDP contributions from higher employment. McKinsey Global Institute (2015) estimated the impact on employment rates on different countries, stating that these were different for each country, depending on its labor market characteristics, education and income levels and demographic trends. Country-level estimate was derived based on national employment rate, labor force and GDP per capita.	• McKinsey Global Institute (2015)[225]
2. PERSONALIZED LEARNING		**GDP INCREMENTS**
Use of digital technologies to provide personalized and remote learning opportunities for students	Sized based on increase in GDP from higher employment. McKinsey Global Institute (2018) estimated that personalized learning would increase employment rate by 0.5 percent in high-income countries, and 0.9 percent in other countries. Classification of the country's income level was based on the World Bank's definition. Country-level estimate was derived based on national employment rate, labor force and GDP per capita.	• McKinsey Global Institute (2018)[226] • World Bank[227]
3. ONLINE RETRAINING PROGRAMS		**GDP INCREMENTS**
Lifelong learning opportunities delivered in digital format helped individuals gain new skills	Lifelong learning opportunities delivered in digital format helped individuals gain new skills Sized based on increase in GDP from higher employment. McKinsey Global Institute (2018) estimated that online retraining programs would increase employment rate by 0.1 percent in "high income" countries, and 0.3 percent in "middle-income" countries. Country-level estimate was derived based on national employment rate, labor force and GDP per capita.	• McKinsey Global Institute (2018)[228] • World Bank[229]

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FINANCIAL SERVICES

DESCRIPTION	SIZING ASSUMPTIONS	SOURCE
1. BIG DATA ANALYTICS		**INCREASED REVENUES**
Increased lending to SMEs at higher margins due to big data	Sized based on additional revenue generated from increased lending to SMEs at higher margins. McKinsey Global Institute (2014) estimated that lending to SMEs would increase by 16 percent to 33 percent due to big data analytics, with increased margins between 1.4 percent to 1.8 percent. Country-level estimate was derived based on annual total lending to SMEs.	• McKinsey Global Institute (2014)[230]
2. DIGITAL BANKING SERVICES		**COST SAVINGS**
Use of Internet and mobile technologies to reduce operational and risk costs, and improve service delivery	Sized based on the cost savings from digitization such as the electronic onboarding of clients, leveraging machine learning and robotics to create operational improvements and the use of public cloud infrastructure to reduce processing capacity. McKinsey Global Institute (2017) estimated that the potential savings from retail banking operational costs and risk costs ranged from 20 percent to 30 percent and ten percent to 30 percent, respectively. Country-level cost savings was derived based on domestic banking sector operating costs.	• McKinsey Global Institute (2017)[231]
3. REG TECH		**COST SAVINGS**
Use of AI and machine learning to automate document review, risk analysis and other repetitive compliance tasks	Sized based on the cost savings in compliance expenditure due to improvement in efficiency brought about by these technologies. Juniper Research (2017) estimated that up to 50 percent of compliance expenditure could be eliminated from adopting these technologies. KPMG (2013) indicated that compliance expenditure contributed to ten percent of banks' operating costs on average. Country-level estimate of efficiency savings was derived based on domestic banking sector costs.	• Juniper Research (2017)[232] • KPMG (2013)[233]

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GOVERNMENT

DESCRIPTION	SIZING ASSUMPTIONS	SOURCE
1. CLOUD COMPUTING		**COST SAVINGS**
Use of cloud-based software to reduce costs	Sized based on the estimated savings from cloud computing, specifically in the reduction in hardware costs. InfoWorld (2019) reported that companies experienced between 25 percent to 55 percent cost savings after migrating to the cloud. Country-level estimate was derived based on government ICT expenditure and hardware costs.	• InfoWorld (2019)[234]
2. E-SERVICES		**COST SAVINGS**
Reduction in operating expenditure from using e-services	Sized based on the reduction in operating expenditure from moving services online, pre-filing of tax forms, data availability and performance dashboards. McKinsey Global Institute (2011) estimated that between 15 percent to 20 percent of operating expenditure was eliminated in Europe after moving to e-services. The study also reported that the addressable base for such a reduction was about 20 percent to 25 percent of government expenditure. Country-level estimate was derived based on government operating expenditure.	• McKinsey Global Institute (2011)[235]
3. E-PROCUREMENT		**COST SAVINGS**
Cost savings from using e-procurement channels	Sized based on the reduction in transaction costs from shifting to e-procurement for government projects. In South Korea, the Public Procurement Service estimated that the government saved USD8 billion in transaction costs annually through reduced labor costs, reduced lead-time and a more streamlined process. Country-level estimate was derived based on public procurement volumes.	• Public Procurement Service[236]
4. GEOGRAPHIC INFORMATION SYSTEM ENABLED TAX COLLECTION		**INCREASED TAX COLLECTION**
Use of big data and location-based information to improve tax collection	Sized based on the increase in tax collected from using big data and GIS-enabled services. In Brazil, the government managed to raise its Federal Tax collection by about 13 percent through adopting big data in audit corporate tax declaration. Country-level estimate was derived based on the country's tax evasion rate as a percentage of GDP relative to Brazil's.	• Bill & Melinda Gates Foundation and AlphaBeta (2018)[237]

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GOVERNMENT (CONT'D)

DESCRIPTION	SIZING ASSUMPTIONS	SOURCE
5. DATA ANALYTICS FOR GOVERNMENT TRANSFER PAYMENTS		**COST SAVINGS**
Use of data analytics in government transfer payments	Sized based on reduction in costs from using data analytics in determining eligible recipients of government transfer payments. McKinsey & Company estimated that five to ten percent of government transfer payments globally are improper payments that could be addressed by adopting data analytics. Country-level estimate was derived based on the country's GDP.	• McKinsey & Company (2017)[238]

HEALTH

DESCRIPTION	SIZING ASSUMPTIONS	SOURCE
1. REMOTE PATIENT MONITORING		**COST SAVINGS**
Application of remote monitoring systems to improve patient care	Sized based on cost savings to the healthcare system through reduced hospital visits, length of patients' stays and medical procedures. McKinsey Global Institute (2013) estimated that such systems would reduce hospital visits, length of patients' stays and the number of procedures required to treat chronic diseases, resulting in ten to 20 percent savings for the healthcare system. Country-level estimate was derived from the World Bank's estimate of total healthcare spend and the country's share of spending on chronic diseases.	• McKinsey Global Institute (2013)[239] • World Bank[240]
2. TELEHEALTH APPLICATIONS		**COST SAVINGS**
Use of Internet and mobile technologies for medical consultations	Sized based on cost savings to the healthcare system through reduced doctor visits. Goldman Sachs (2015) estimated that the US healthcare system could save USD100 billion by adopting telehealth. Country-level estimate was derived based on relative national healthcare expenditure.	• Goldman Sachs (2015)[241]

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HEALTH (CONT'D)

DESCRIPTION	SIZING ASSUMPTIONS	SOURCE
3. DATA-BASED PUBLIC HEALTH INTERVENTIONS		**GDP INCREMENTS**
Use of analytics to direct highly targeted health interventions for at-risk populations	Sized based on the economic value of reduced disability-adjusted life years (DALYs) due to timely public health interventions. McKinsey Global Institute (2018) indicated that the most significant and measurable impacts were on maternal and child health, as well as public sanitation and hygiene. It estimated a 0.4 percent reduction in DALYs for "high-income" countries, and 1.5 percent for other countries. Income of countries classified based on the World Bank's definition. Economic value was taken to be this multiplied by GDP per capita, and was estimated based on the proportion of the population suffering from chronic diseases. Country-level estimate was derived based on national population sizes and GDP per capita.	• McKinsey Global Institute (2018)[242] • UN Population Division (2018)[243] • World Bank[244]
4. DETECTION OF COUNTERFEIT PHARMACEUTICAL DRUGS		**COST SAVINGS**
Use of IoT and advanced analytics to detect counterfeit drugs	Sized based on cost savings from reduced counterfeit pharmaceutical drugs in the country due to higher detection rates. EU IPO (2016) estimated that the annual cost of counterfeit pharmaceutical drugs to Europe's pharmaceutical industry was EUR10 billion. McKinsey Global Institute (2013) assessed that 30 percent to 50 percent of all drugs sold were addressable by this technology, and that its success rate was between 80 percent and 100 percent. Country-level estimate on the national cost of counterfeit drugs was derived based on the country's relative healthcare expenditure.	• EU Intellectual Property Office (2016)[245] • McKinsey Global Institute (2013)[246]
5. SMART MEDICAL DEVICES AND WEARABLES		**GDP INCREMENTS**
Analyzing data across connected implants, smart medical devices and wearables in personalized and predictive care	Sized based on the economic value of reduced disability-adjusted life years (DALYs) due to health improvement measures prompted by data from such devices. McKinsey Global Institute (2018) estimated that smart medical devices reduced DALYs by one percent reduction in high-income countries, and 0.6 percent in other countries. The economic value was taken to be this multiplied by GDP per capita. Classification of the country's income level was based on the World Bank's definition. Country-level estimate was derived based on national population sizes and GDP per capita, and was estimated based on the proportion of the population suffering from chronic diseases.	• McKinsey Global Institute (2018)[247] • UN Population Division (2018)[248] • World Bank[249]

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HEALTH (CONT'D)

DESCRIPTION	SIZING ASSUMPTIONS	SOURCE
6. ELECTRONIC MEDICAL RECORDS		**COST SAVINGS**
Use of cloud-based electronic medical record systems	Sized based on the cumulative savings (such as saving of physician and nursing time) from adopting electronic health records (EHR). McKinsey Global Institute (2014) estimated that widespread adoption of electronic medical records could increase India's annual economic value by USD3 billion. The global economic impact of EHR was estimated based on India's share of the global healthcare expenditure. Country-level estimate was derived based on its relative national healthcare expenditure according to World Bank data and the global EHR market growth rates.	• McKinsey Global Institute (2014)[250] • World Bank[251] • Transparency Market Research[252]

INFRASTRUCTURE

DESCRIPTION	SIZING ASSUMPTIONS	SOURCE
1. SMART GRIDS		**COST SAVINGS**
Use of digital communications technology in detecting and optimizing electricity networks	Sized based on cost savings from energy savings due to lower consumption and efficiency improvements. The New York Times (2011) reported that engineers estimated five to ten percent energy could be saved from using smart grids. Country-level estimate was derived based on total electricity consumption. Business and Sustainable Development Commission (2017) estimated that the global average wholesale price of electricity was USD100/Mwh.	• The New York Times (2011)[253] • World Bank[254] • Business and Sustainable Development Commission (2017)[255]
2. 5D BIM AND PROJECT MANAGEMENT TECHNOLOGIES		**COST SAVINGS**
Use of integrated modeling platforms to simulate construction cost and timeline impacts of decisions in project planning, design, construction, operations, and maintenance	Sized based on cost reductions from improved coordination between different development parameters, as well as the continuous insight provided on project costs. McKinsey Global Institute (2013) estimated that streamlining project delivery could bring about 15 percent savings to infrastructure cost, with 15 percent to 25 percent of these savings coming from 5D BIM technologies. Country-level estimate was derived based on domestic construction sector costs.	• McKinsey Global Institute (2013)[256] • Global infrastructure Outlook[257]

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INFRASTRUCTURE (CONT'D)

DESCRIPTION	SIZING ASSUMPTIONS	SOURCE
3. PREDICTIVE MAINTENANCE TECHNOLOGIES		**COST SAVINGS**
Using data from sensors to ensure prompt and predictive maintenance, minimizing downtime	Sized based on the economic value of benefits from sizeable applications including the predictive maintenance of public transit systems and water leakage detection and control. McKinsey Global Institute (2018) estimated a 2.3 percent reduction in average commuting time from predictive transit for "high-income" countries, and 1.4 percent for other countries. On water leakage detection and control, McKinsey Global Institute (2018) estimated a 1.4 percent reduction in water consumption for "high-income" countries, and country-level estimates were used in other countries. Classification of the country's income level was based on the World Bank's definition. The Business and Sustainable Development Commission (2017) estimated that the global average price of water was USD0.90/m3. Country-level estimate was derived based on the country's average commuting time, population, GDP per capita and domestic water consumption.	• McKinsey Global Institute (2018)[258] • World Bank[259] • UNESCO-IHE (2011)[260] • Business and Sustainable Development Commission (2017)[261]
4. SMART BUILDINGS		**COST SAVINGS**
Use of physical sensor networks, energy storage and data analytics to improve resource efficiency of buildings and reduce energy and water consumption, as well as carbon emissions	Sized based on the economic value of the reduction in greenhouse gas emissions (GHG) and water consumption by building automation systems. McKinsey Global Institute (2018) estimated a 2.9 percent reduction in GHG emissions and a 1.7 percent reduction in water consumption for "high-income" countries. The corresponding figures for other countries were 1.4 percent and 1.1 percent. Classification of the country's income level was based on the World Bank's definition. Country-level estimate was derived based on its greenhouse gas emissions and water consumption from buildings. Business and Sustainable Development Commission (2017) estimated that the global average price of water was USD0.90/m3 and GHG price was valued at USD50/ton (a global proxy price equating roughly to the financial incentives needed to achieve carbon emissions consistent with a 2-degree pathway).	• McKinsey Global Institute (2018)[262] • IPCC[263] • World Bank[264] • Business and Sustainable Development Commission (2017)[265]

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MANUFACTURING

DESCRIPTION	SIZING ASSUMPTIONS	SOURCE
1. BIG DATA ANALYTICS		**INCREASED REVENUES**
Use of big data analytics in demand forecasting and supply planning	Sized based on increase in revenue from more accurate demand-supply matching leading to higher sales. McKinsey Global Institute (2011) estimated a 2.5 percent to three percent increase in profit margin from big data analytics in manufacturing. Country-level estimate was derived based on domestic manufacturing sector GDP.	• McKinsey Global Institute (2011)[266]
2. ADDITIVE MANUFACTURING		**PRODUCTIVITY GAINS/COST SAVINGS**
Use of dynamic, resource efficient 3D printing and related technologies to enable 'on-time' manufacturing & rapid manufacturing	Sized based on the incremental economic value of faster time-to-market due to quicker prototyping and design adjustments, reduced production time, higher material productivity as well as more efficient sales process due to product customization. McKinsey & Company (2017) estimated that the global economic value of this technology could reach between USD100 billion and USD250 billion by 2025. Current economic value was calculated based on today's global manufacturing sector GDP, and assuming a constant growth rate for the 2030 forecast. Country-level estimate was derived based on the domestic manufacturing sector GDP as a share of the global figure.	• McKinsey & Company (2017)[267]
3. IOT-ENABLED SUPPLY CHAIN MANAGEMENT		**COST SAVINGS**
Savings in operating costs from IoT-enabled supply chain management and distribution network management	Sized based on reduction in operating costs from adopting IoT-enabled supply chain management and distribution network management. McKinsey Global Institute (2011) estimated a 2.5 percent to five percent savings in distribution and supply chain operating costs could amount to two percent to six percent of manufacturing sales. Country-level estimate was derived based on domestic manufacturing sector operating costs.	• McKinsey Global Institute (2011)[268]
4. AUTOMATION AND ROBOTICS		**PRODUCTIVITY GAINS**
Productivity boost from automating mundane and repetitive production tasks	Sized based on productivity boost to manufacturing processes from robots performing mundane and repetitive tasks. McKinsey & Company (2017) estimated that automation and robotics could improve productivity ranging from 0.8 to 1.4 percent of global GDP annually from 2015 to 2065. Country-level estimate was derived based on domestic manufacturing sales.	• McKinsey & Company (2017)[269]

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269. McKinsey & Company (2017), A future that works: Automation, employment, and productivity. Available at: https://www.mckinsey.com/~/media/mckinsey/featured%20insights/digital%20disruption/harnessing%20automation%20for%20a%20future%20that%20works/a-future-that-works-executive-summary-mgi-january-2017.ashx

RESOURCES

DESCRIPTION	SIZING ASSUMPTIONS	SOURCE
1. SMART EXPLORATION AND AUTOMATION IN MINING OPERATIONS		**PRODUCTIVITY GAINS/COST SAVINGS**
Use of big data to analyze geoscience and drilling data to locate probable deposits proactively and efficiently, and automate extraction and transport	Sized based on the potential global economic value of such technologies in mining. McKinsey & Company (2015) estimated big data to generate USD250 billion in economic value, based on an 80 percent adoption rate scenario. Country-level estimate was derived based on the country's relative share of global mining sector GDP, proxied by the country's share of global mineral rents.	• McKinsey & Company (2015)[270]
2. PREDICTIVE SAFETY TECHNOLOGIES		**PRODUCTIVITY GAINS/COST SAVINGS**
Technologies that improve productivity and safety such as wearables with in-built sensors that monitor fatigue, location, atmosphere and vitals, and augmented reality interfaces that improve human-machine interaction	Sized based on the potential global economic value of such technologies in mining. McKinsey & Company (2015) estimated the economic value to be USD15 billion, based on a 100 percent adoption rate scenario. Country-level estimate was derived based on the country's relative share of global mining sector GDP, proxied by the country's share of global mineral rents.	• McKinsey & Company (2015)[271]
3. PREDICTIVE MAINTENANCE TECHNOLOGIES		**PRODUCTIVITY GAINS/COST SAVINGS**
Use of remote operations centers and data-collecting sensors on mining equipment to improve failure anticipation, reduce unscheduled breakdowns and increase equipment life	Sized based on the potential global economic value of such technologies in mining. McKinsey & Company (2015) estimated the economic value to be USD105 billion, based on a 100 percent adoption rate scenario. Country-level estimate was derived based on the relative share of global mining sector GDP, proxied by the country's share of global mineral rents.	• McKinsey & Company (2015)[272]

270. McKinsey & Company (2015), How digital innovation can improve mining productivity.
Available at: https://www.mckinsey.com/industries/metals-and-mining/our-insights/how-digital-innovation-can-improve-mining-productivity
271. McKinsey & Company (2015), How digital innovation can improve mining productivity.
Available at: https://www.mckinsey.com/industries/metals-and-mining/our-insights/how-digital-innovation-can-improve-mining-productivity
272. McKinsey & Company (2015), How digital innovation can improve mining productivity.
Available at: https://www.mckinsey.com/industries/metals-and-mining/our-insights/how-digital-innovation-can-improve-mining-productivity

TRANSPORT SERVICES

DESCRIPTION	SIZING ASSUMPTIONS	SOURCE
1. SMART ROADS		**TIME SAVINGS**
Use of real-time public transit information, intelligent traffic signals and real-time road navigation to reduce commuting time	Sized based on the economic value of real-time public transit information, intelligent traffic signals and real-time road navigation. McKinsey Global Institute (2018) estimated a 2.2 percent reduction in average commuting time for "high-income" countries, and 5.5 percent for other countries. Classification of the country's income level was based on the World Bank's definition. Country-level estimate was derived based on the average commuting time, population and GDP per capita.	• McKinsey Global Institute (2018)[273] • World Bank[274]
2. SMART PORTS		**COST SAVINGS**
Use of IoT to enhance port efficiency	Sized based on cost savings from reduced logistics costs due to IoT-enabled data collection and monitoring, as well as intelligent decision-making capabilities. Accenture and SIPG (2016) estimated 3.6 percent savings in logistics costs from building smart ports. Country-level estimate was derived based on logistics sector costs (based on indicated percentages of the country's GDP).	• Accenture and SIPG (2016)[275] • Council of Supply Chain Management Professionals (2013)[276] • World Bank (2016)[277]
3. AUTONOMOUS VEHICLES		**COST SAVINGS**
Use of AI and sensors to increase fuel efficiency	Sized based on the projected gains in fuel efficiency, compared to conventional vehicles. McKinsey Global Institute (2013) estimated that autonomous cars could travel more closely together, reducing air resistance and improving fuel efficiency by 15 percent to 20 percent. Country-level estimate was derived based on the number of cars, projected number of autonomous vehicles, annual fuel requirement, and cost of fuel.	• McKinsey Global Institute (2013)[278]
4. GEOSPATIAL SERVICES		**PRODUCTIVITY GAINS/COST SAVINGS**
Productivity impact of using location-based information	Sized based on estimated productivity impact geospatial services in the transport sector (land, sea and air). AlphaBeta (2017) estimated that geospatial services could improve productivity of land, sea and air transport by 2.5 percent to five percent. These benefits include reduced logistics costs, improved network design and management. Country-level estimate was derived based on the size of the land, sea and air transport sector.	• AlphaBeta (2017)[279]

273. McKinsey Global Institute (2018), Smart cities: Digital solutions for a more liveable future.
Available at: https://www.mckinsey.com/industries/capital-projects-and-infrastructure/our-insights/smart-cities-digital-solutions-for-a-more-livable-future

274. World Bank (2018). Available at: https://blogs.worldbank.org/opendata/new-country-classifications

275. Accenture and Shanghai International Port Group (2016), Connected ports: Driving future trade.
Available at: https://www.accenture.com/t20161012T003018Z__w__/us-en/_acnmedia/PDF-29/accenture-connected-ports-driving-future-trade.pdf

276. Council of Supply Chain Management Professionals (2013), State of logistics report.
Available at: http://www.scdigest.com/assets/newsviews/13-06-20-2.php?cid=7168&ctype=content

277. World Bank (2016), Logistics performance index: Ranking by countries. Available at: https://lpi.worldbank.org/international/global

278. McKinsey Global Institute (2013), Disruptive technologies: Advances that will transform life, business and the global economy.
Available at: https://www.mckinsey.com/~/media/McKinsey/Business%20Functions/McKinsey%20Digital/Our%20Insights/Disruptive%20technologies/McKinsey Global Institute_Disruptive_technologies_Full_report_May2013.ashx

279. AlphaBeta (2017), The Economic Impact of Geospatial Services: How Consumers, Businesses And Society Benefit from Location-Based Information.
Available at: https://www.alphabeta.com/wp-content/uploads/2017/09/GeoSpatial-Report_Sept-2017.pdf

Appendix A3: Economic impact of COVID-19 relevant technology applications

To estimate the economic value of technology applications that could help businesses and organizations manage the economic impact of COVID-19, all the technology applications were assessed for their relevance to COVID-19 and the value from those relevant to COVID-19 was estimated.

Of the 40 technology applications, 22 were assessed to have the potential to manage the economic impacts of the pandemic in Japan's context, through three channels. These are:

- Facilitate customer interactions, transactions and marketing through digital platforms;
- Enable the continuity of business operations amid remote working arrangements; and
- Reduce logistical bottlenecks amidst global and regional supply chain disruptions induced by the pandemic.

Exhibit A2 shows the list of these 22 COVID-19 relevant technology applications, grouped by their respective sectors and the specific channel through which they deliver COVID-19 relevant impact.

Exhibit A2:

Of the 40 applications, 22 have the potential to allow businesses to thrive despite the COVID-19 pandemic through three key channels

Channel	Sector	COVID-19 relevant technology application/s
Facilitate customer interactions, transactions and marketing through digital platforms	Consumer, retail and hospitality	1. Digital retail sales and marketing channels 2. Online F&B delivery services
	Education and training	3. E-career centers and digital jobs platforms 4. Online retraining programs
	Financial services	5. Digital banking services
	Health	6. Telehealth applications
Enable the continuity of business operations amid remote working arrangements	Agriculture & food	7. Precision farming technologies
	Consumer, retail and hospitality	8. IoT-enabled inventory management 9. Automation and AI customer service in hotels
	Government	10. Government e-services 11. E-procurement
	Health	12. Remote patient monitoring 13. Smart medical devices and wearables
	Infrastructure	14. Smart grids 15. 5D BIM and project management technologies 16. Predictive maintenance technologies
	Manufacturing	17. Big data analytics 18. Robotics and automation
	Resources	19. Smart exploration and automation in mining operations
Reduce logistical bottlenecks amidst global and regional supply chain disruptions induced by the pandemic	Agriculture & food	20. IoT-enabled supply chain management (food)
	Manufacturing	21. IoT-enabled supply chain management (manufacturing)
	Transport services	22. Smart ports

SOURCE: AlphaBeta analysis

Appendix A4: Breakdown of Japan's digital opportunity by region

Regional splits of the economic opportunity presented by digital technologies in Japan were determined based on two metrics. The first metric refers to the breakdown of the number of businesses by sector and prefecture, while the second refers to the breakdown of GDP contribution by sector and prefecture. Regional splits of the total digital opportunity were derived based on the average of the two metrics by region. The official administrative and jurisdictional set of eight regions and their corresponding 47 prefectures were used, and are as follows:

1. **Hokkaido region:** Hokkaido
2. **Tohoku region:** Aomori, Iwate, Miyagi, Akita, Yamagata, Fukushima
3. **Kanto region:** Ibaraki, Tochigi, Gunma, Saitama, Chiba, Tokyo, Kanagawa
4. **Chubu region:** Niigata, Toyama, Ishikawa, Fukui, Yamanashi, Nagano, Gifu, Shizuoka, Aichi
5. **Kansai region:** Mie, Shiga, Kyoto, Osaka, Hyogo, Nara, Wakayama
6. **Chugoku region:** Tottori, Shimane, Okayama, Hiroshima, Yamaguchi
7. **Shikoku region:** Tokushima, Kagawa, Ehime, Kochi
8. **Kyushu region:** Fukuoka, Miyazaki, Nagasaki, Kumamoto, Kagoshima, Saga, Oita, Okinawa

Table 2 shows the inputs and sources used for calculating the breakdown of digital opportunity by sector and prefecture.

Table 2: Inputs and sources for calculating the breakdown of digital opportunity by sector and prefecture

METRIC	SOURCE
Share of businesses by sector in each prefecture	• Statistics of Japan (2015)[280]
Share of GDP by sector for each prefecture	• Statistics of Japan (2015)[281]

280. Statistics of Japan (2015), "Number of businesses by industry and prefecture". Available at: https://www.e-stat.go.jp/en
281. Statistics of Japan (2015), "Prefectural GDP contribution by industry". Available at: https://www.e-stat.go.jp/en

B: SIZING GOOGLE'S ECONOMIC IMPACT IN JAPAN

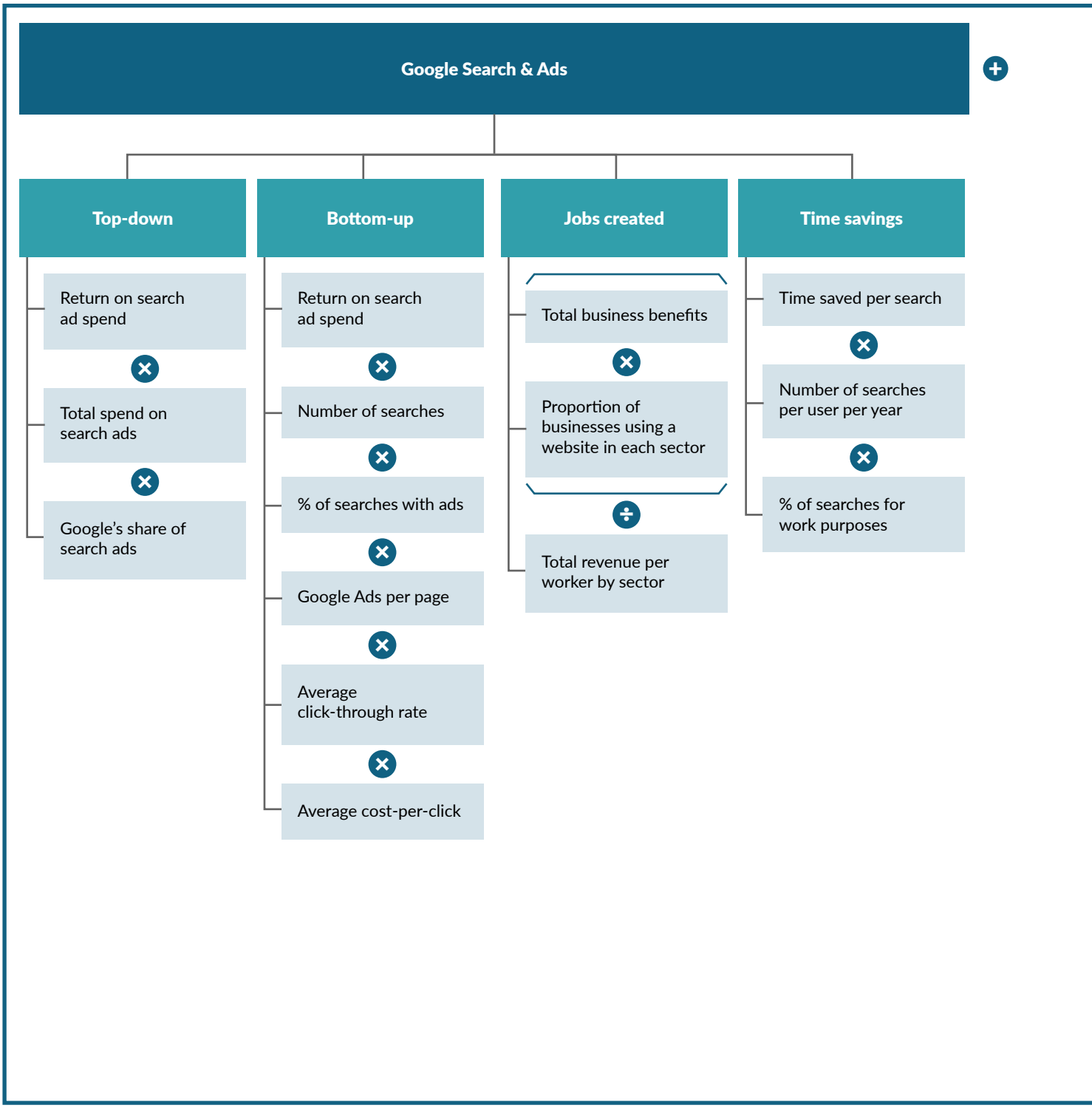
To estimate the **business benefits**, the economic value generated by businesses that used Google's products was calculated. These are in the form of increased revenue (through increased customer outreach and access to new markets), as well as improved productivity (through time savings). The Google products included in this analysis of business benefits include Google Search, Google Ads, AdSense, and Google Play.

Estimating the **consumer benefits** supported by Google is a challenging task. This is because individuals typically do not have to pay for the Google products that they use. There are several established methodologies for estimating the benefits of free services, including consumer surplus based on the consumer's willingness to pay (how much an individual values a Google product). Primary data used in the analysis was collected from a consumer survey of 750 Internet users in Japan. This sample size is statistically significant based on Japan's online population, at a 95 percent confidence level (the level typically adopted by researchers). The survey was conducted online, which was deemed suitable given the intention to survey Internet users. The sample was also checked for its representativeness of Japan's Internet population based on demographic variables including age, income level, and the geographical location of respondents. In addition to the consumer survey, this research also leveraged big data gathering methods such as that used to determine the amount of time saved by using Google Maps for driving and public transport, as well as third-party sources. The Google products included in this analysis of consumer benefits include Google Search, Google Maps, Google Play, Google Drive, Photos, Docs, and Sheets.

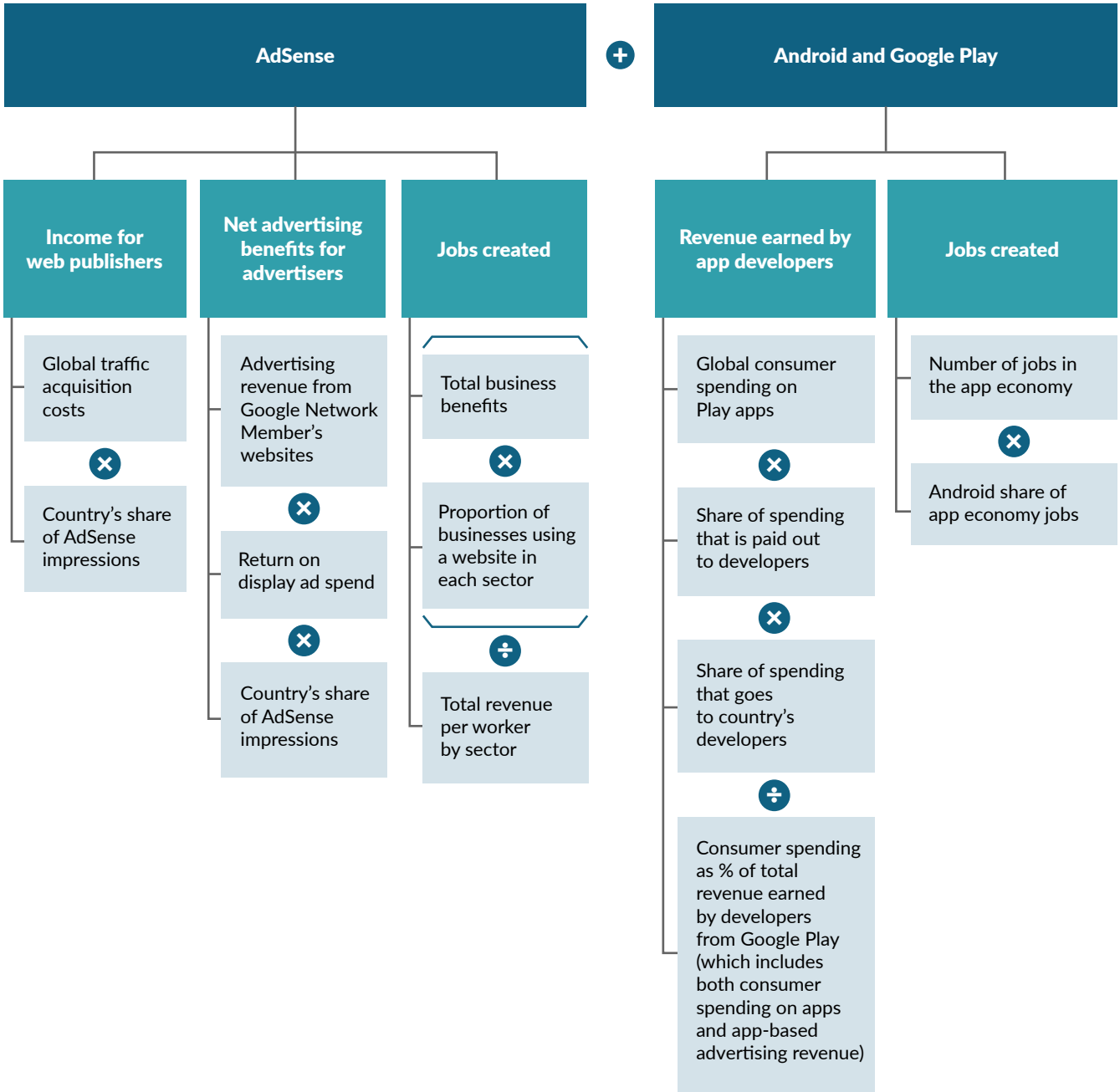
Business benefits

The business benefits supported by Google include the gross revenue, income or savings generated by businesses using Google products. These benefits do not include the flow-on economic effects generated, such as further purchases from their suppliers or the economic activity generated by the employees of these businesses who spend their wages in the broader economy. These benefits also do not account for activity that may have been displaced by Google, nor attempt to estimate the incremental impact of Google on the Japanese economy beyond what would be the case if Google did not exist but other companies like it did. Exhibit B1 summarizes the methodology used for sizing the business benefits of Google's products.

Exhibit B1:
Methodology for sizing business benefits from Google



Note: This report's methodology for measuring Google's economic impact is consistent with the methodology used in the Google Economic and Social Impact South Korea 2021 report.
SOURCE: AlphaBeta analysis


AdSense
+
Android and Google Play
Income for web publishers
Net advertising benefits for advertisers
Jobs created
Revenue earned by app developers
Jobs created
Global traffic acquisition costs
×
Country's share of AdSense impressions
Advertising revenue from Google Network Member's websites
×
Return on display ad spend
×
Country's share of AdSense impressions
Total business benefits
×
Proportion of businesses using a website in each sector
÷
Total revenue per worker by sector
Global consumer spending on Play apps
×
Share of spending that is paid out to developers
×
Share of spending that goes to country's developers
÷
Consumer spending as % of total revenue earned by developers from Google Play (which includes both consumer spending on apps and app-based advertising revenue)
Number of jobs in the app economy
×
Android share of app economy jobs

Google Search and Ads

The business benefits of Google Search and Ads were estimated using two methods – a top-down approach and a bottom-up approach. The top-down approach estimated the total size of the search advertising segment in Japan and the proportion of this space that Google represents. The bottom-up approach estimated the number of Google searches conducted in the country, the proportion of searches with advertisements, the number of advertisements per search, the average click-through rate (CTR), and the average cost-per-click (CPC).

To estimate the income generated by businesses paying for online advertising through Google a return on investment (ROI) ratio range of 3.4 – 8 was applied, and both estimates were reported.[282] This ROI ratio was developed from a few assumptions:

- Using a large sample of proprietary data, Hal Varian, Google's Chief Economist, estimated that businesses received USD2 in revenue for every USD1 spent on advertising. This finding was published in the American Economic Review in 2009.

- Businesses also receive free clicks because of unpaid Google Search. Using research published in the International Journal of Internet Marketing and Advertising in 2009 by Jansen and Spink, the Google US Economic Impact Study assumed that businesses receive five clicks for every click on a paid advertisement.

- Unpaid clicks are not considered as commercially valuable, so the US Economic Impact Study assumed their value at 70 percent of paid clicks.

- Because of these assumptions, an ROI ratio of 8 was estimated. This ROI ratio was taken as an upper bound. To derive a lower bound, we built on the academic findings detailed in the Google UK Economic Impact Study to set a lower bound of 3.4.

Table 3 shows the inputs and sources used for estimating the business benefits of Google Search and Ads.

AdSense

The direct business benefits from AdSense were estimated as the net advertising benefits generated by businesses placing advertisements on publisher sites such as websites, blogs, and forums.[283] We estimated this figure using Google's published global advertising revenue from Google network's websites and multiplied this by the country's share of global AdSense impressions.[284] In addition, we applied an ROI ratio that advertisers earn using display advertising, derived from academic literature.

The benefits of AdSense to content creators were also estimated as the total income that they earn from placing advertisements sourced through Ads next to content on their website. The total income earned by the country's content creators was estimated from Google's global payments to website publishers, also known as their traffic acquisition costs, and applying the country's share of AdSense impressions to estimate the payments specific to the country.

Table 4 shows the inputs and sources used for estimating the business benefits of AdSense.

Google Play

We estimated the revenue earned by the country's app developers from consumer spending on Google Play based on global consumer spending on Google Play, the share of the spending that was paid out to app developers, and the share of the spending that went to the country's app developers. The revenue from consumer spending earned by the country's app developers was scaled up to include advertising revenue to arrive at the total revenue supported by Google Play in the country, using estimates for the distribution of revenue across consumer spending and ads.

Table 5 shows the inputs and sources used for estimating the business benefits of Google Play.

282. ROI reflects the net advertising benefits that businesses receive from online advertising (i.e., total revenue minus online advertising cost).
283. This refers to the increase in revenues and sales that can be directly attributed to advertising minus the related advertising expenditure.
284. This methodology does not account for price differences across countries due to the lack of availability of reliable data on cost per impression by country.

Table 3: Inputs and sources for calculating business benefits of Google Search and Ads

APPROACH	METRIC	SOURCE
Top-down approach	Total online search advertising market size	• Statista (2020)[285]
	Search's market share	• StatCounter (2019)[286]
Bottom-up approach	Search traffic data	• AlphaBeta Consumer Survey (2019)
	% of pages that display advertisements	• Varian (2009)[287], Jansen & Spink (2009)[288] • Deloitte (2015)[289]
	Advertisements per page on average	• Varian (2009)[290], Jansen & Spink (2009)[291] • Deloitte (2015)[292]
	Average CTR for Search (Estimate)	• Word Stream (2019)[293] • BannerTag (2019)[294]
	Average CPC for Search (Estimate)	• Word Stream (2018)[295] • Adstage (2019)[296]
Both Methods	ROI ratio Lower and Upper Bound	• Varian (2009)[297], Jansen & Spink (2009)[298] • Deloitte (2015)[299]

285. Statista (2020), "Search advertising – Japan". Available at: https://www.statista.com/outlook/219/121/search-advertising/japan
286. StatCounter (2020), "Search engine market share Japan". Available at: https://gs.statcounter.com/search-engine-market-share/all/japan
287. Varian, H. R. (2009), "Online Ad Auctions". The American Economic Review, Vol. 99, No. 2, pp. 430-434. Available at: https://www.aeaweb.org/articles?id=10.1257/aer.99.2.430
288. Jansen, B. J., & Spink, A. (2009), "Investigating customer click through behaviour with integrated sponsored and non-sponsored results." International Journal of Internet Marketing and Advertising, Vol. 5, No. 1-2, pp. 74-94.
289. Deloitte (2015), Google's Economic Impact United Kingdom. Available at: https://drive.google.com/file/d/0B9xmjQ1MUCjpNXBJZExHY1NqQlU/view
290. Varian, H. R. (2009), "Online Ad Auctions". The American Economic Review, Vol. 99, No. 2, pp. 430-434. Available at: https://www.aeaweb.org/articles?id=10.1257/aer.99.2.430
291. Jansen, B. J., & Spink, A. (2009), "Investigating customer click through behaviour with integrated sponsored and non-sponsored results." International Journal of Internet Marketing and Advertising, Vol. 5, No. 1-2, pp. 74-94.
292. Deloitte (2015), Google's Economic Impact United Kingdom. Available at: https://drive.google.com/file/d/0B9xmjQ1MUCjpNXBJZExHY1NqQlU/view
293. Laubenstein, C. (2019), "What's a Good Click-Through Rate (CTR) for Google Ads?". Word Stream. Available at: https://www.wordstream.com/blog/ws/2010/04/26/good-click-through-rate
294. Karlštrems, A. (2019), "Google AdSense CPM Rates 2019". BannerTag. Available at: https://www.bannertag.com/google-adsense-cpm-rates/
295. Irvine, M. (2018), "Average Cost per Click by Country: Where in the World Are the Highest CPCs?" Word Stream. Available at: http://www.wordstream.com/blog/ws/2015/07/06/average-cost-per-click
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297. Varian, H. R. (2009), "Online Ad Auctions". The American Economic Review, Vol. 99, No. 2, pp. 430-434. Available at: https://www.aeaweb.org/articles?id=10.1257/aer.99.2.430
298. Jansen, B. J., & Spink, A. (2009), "Investigating customer click through behaviour with integrated sponsored and non-sponsored results." International Journal of Internet Marketing and Advertising, Vol. 5, No. 1-2, pp. 74-94. Available at: https://pennstate.pure.elsevier.com/en/publications/investigating-customer-click-through-behaviour-with-integrated-sp
299. Deloitte (2015), Google's Economic Impact United Kingdom. Available at: https://drive.google.com/file/d/0B9xmjQ1MUCjpNXBJZExHY1NqQlU/view

Table 4: Inputs and sources for calculating business benefits of AdSense

ESTIMATION	METRIC	SOURCE
Net advertising benefits for advertisers	Advertising revenue from Google Network Member's websites	• Alphabet (2019)[300]
	ROI ratio	• Gupta et al. (2015)[301]
Revenue to content creators	Global traffic acquisition costs related to AdSense	• Alphabet (2019)[302]
Both estimates	Country share of global impressions on AdSense (Estimate)	• DoubleClick (2012)[303] • Internet World Stats (2019)[304]

Table 5: Inputs and sources for calculating business benefits of Google Play

METRIC	SOURCE
Global consumer spending on Google Play	• Sensor Tower (2020)[305]
Share of the spending that is paid out to app developers	• Google (2020)[306]
Share of the spending that goes to the country's app developers	• Caribou Digital (2016)[307]
Consumer spending as % of total revenue earned by developers from Google Play (which includes both consumer spending on apps and app-based advertising revenue)	• Appota/ AdSota (2017)[308]

300. Alphabet (2019). Form 10-K for fiscal year ended December 31, 2019 - Submission to US SEC.
Available at: https://www.sec.gov/Archives/edgar/data/1652044/000165204420000008/goog10-k2019.htm

301. Gupta, S., Pauwels, K., & Kireyev, P. (2015), Do display ads influence search? Attribution and dynamics in online advertising. International Journal of Research in Marketing.
Available at: https://www.sciencedirect.com/science/article/abs/pii/S0167811615001159

302. Alphabet (2019). Form 10-K for fiscal year ended December 31, 2019 - Submission to US SEC.
Available at: https://www.sec.gov/Archives/edgar/data/1652044/000165204420000008/goog10-k2019.htm

303. Google DoubleClick (2012). What's trending in display for publishers?.
Available at: https://www.slideshare.net/RFONNIER/display-business-trends-publisher-edition-google-2012

304. Internet World Stats (2019). Available at: https://www.internetworldstats.com/stats6.htm

305. Sensor Tower (2020), "Consumer Spending in Mobile Apps Grew 17% in 2019 to Exceed NZ$83 Billion Globally".
Available at: https://sensortower.com/blog/app-revenue-and-downloads-2019

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307. Caribou Digital (2016), Winners and Losers in the Global App Economy.
Available at: https://www.cariboudigital.net/wp-content/uploads/2016/02/Caribou-Digital-Winners-and-Losers-in-the-Global-App-Economy-2016.pdf

308. AdSota (2017), Vietnam Mobile App Advertising and Monetization Report (Q2-2017).
Available at: https://www.slideshare.net/AdsotaAds/vietnam-mobile-app-advertising-monetization-report?qid=3ab11c21-44c9-4fbb-9cb4-41b57d471f3c&v=&b=&from_search=7

Time savings benefits of Google Search

We estimated the time saving benefits that businesses gained from using Google Search based on the amount of time saved per search, the number of searches conducted per worker, and the share of searches that were conducted for work purposes.

Table 6 shows the inputs and sources used for estimating the time savings benefits of Google Search.

Employment impact from Google Ads and Adsense

We estimated the number of jobs that are supported by Google's business benefits (i.e., increased revenue through Google Ads and AdSense) based on the breakdown of business benefits by sector and the revenue per worker in each sector. The breakdown of business benefits by sector was calculated based on the average of the following two metrics: 1) share of businesses using websites (to proxy for the use of Google products) by sector; and 2) revenues of businesses in each sector. This average share is then divided by the respective revenue per worker figures for each sector to obtain the number of jobs created.

Employment impact from Android ecosystem

Our estimate of employment supported by Android is based on the methodology developed by Mandel (2017). Their approach employs data on job postings from indeed.com to size employment in the app economy (see reference for details). The methodology distinguishes between direct, indirect and spillover jobs within the app economy, each accounting for one-third of total jobs in the app economy.

- **Direct jobs:** These are "tech-related" jobs dedicated to building and maintaining apps, (e.g. app developers)
- **Indirect jobs:** These are "non-tech-related" jobs such as HR, marketing, and sales within app companies
- **Spillover jobs:** These are jobs created outside of the app industry due to spillover effects such as app companies' suppliers

The number of jobs in Japan's app economy is estimated based on the country's app intensity multiplied by the total number of employed workers in the country. Table 8 shows the inputs and sources used for estimating the number of jobs created through the Android ecosystem.

Table 6: Inputs and sources for calculating time saving benefits of Google Search

METRIC	SOURCE
Time saved per search	• Varian (2014)[309] • Chen et al. (2014)[310]
Average daily searches per worker	• AlphaBeta Consumer Survey (2019)
% of searches for work purposes	• AlphaBeta Consumer Survey (2019)

Table 7: Inputs and sources for calculating job impact

APPROACH	METRIC	SOURCE
Revenue per worker by sector	Number of employees in Japan by sector	• Ministry of Internal Affairs and Communications (2021)[311]
	Total revenue by sector	• Ministry of Internal Affairs and Communications (2021)[312]
Breakdown of business benefits for Google Search and Ads, as well as AdSense	Businesses using a website from each sector as % of total	• Organisation for Economic Co-operation and Development (2019)[313]

Table 8: Inputs and sources for calculating Android's impact on employment

ESTIMATION	METRIC	SOURCE
App employment supported by Android	Number of jobs in the app economy	• Mandel (2018)[314] • Ministry of Internal Affairs and Communications (2021)[315]
	Ratio of direct to indirect and spillover jobs	• Mandel (2017)[316]
	Android share of app economy jobs	• Mandel (2018)[317]

309. Hal Varian (2014), "Economic value of Google" (Presentation).
Available at: http://cdn.oreillystatic.com/en/assets/1/event/57/The%20Economic%20Impact%20of%20Google%20Presentation.pdf

310. Chen, Y., YoungJoo Jeon, G., & Kim, Y.-M. (2014), "A day without a search engine: an experimental study of online and offline searches". Experimental Economics, Vol 17, Issue 4, pp 512-536. Available at: https://link.springer.com/article/10.1007/s10683-013-9381-9

311. Ministry of Internal Affairs and Communications (2021), "2021 Yearbook of Information Society Statistics".
Available at: https://www.stat.go.jp/english/data/nenkan/70nenkan/index.html

312. Ministry of Internal Affairs and Communications (2021), "2021 Yearbook of Information Society Statistics".
Available at: https://www.stat.go.jp/english/data/nenkan/70nenkan/index.html

313. Organisation for Economic Co-operation and Development (2019), "ICT Access and Usage by Businesses".
Available at: https://stats.oecd.org/Index.aspx?DataSetCode=ICT_BUS

314. Mandel (2018), Korea's App Economy. Available at: https://www.progressivepolicy.org/wp-content/uploads/2018/05/PPI_KoreanAppEconomy_2018.pdf

315. Ministry of Internal Affairs and Communications (2021), "2021 Yearbook of Information Society Statistics".
Available at: https://www.stat.go.jp/english/data/nenkan/70nenkan/index.html

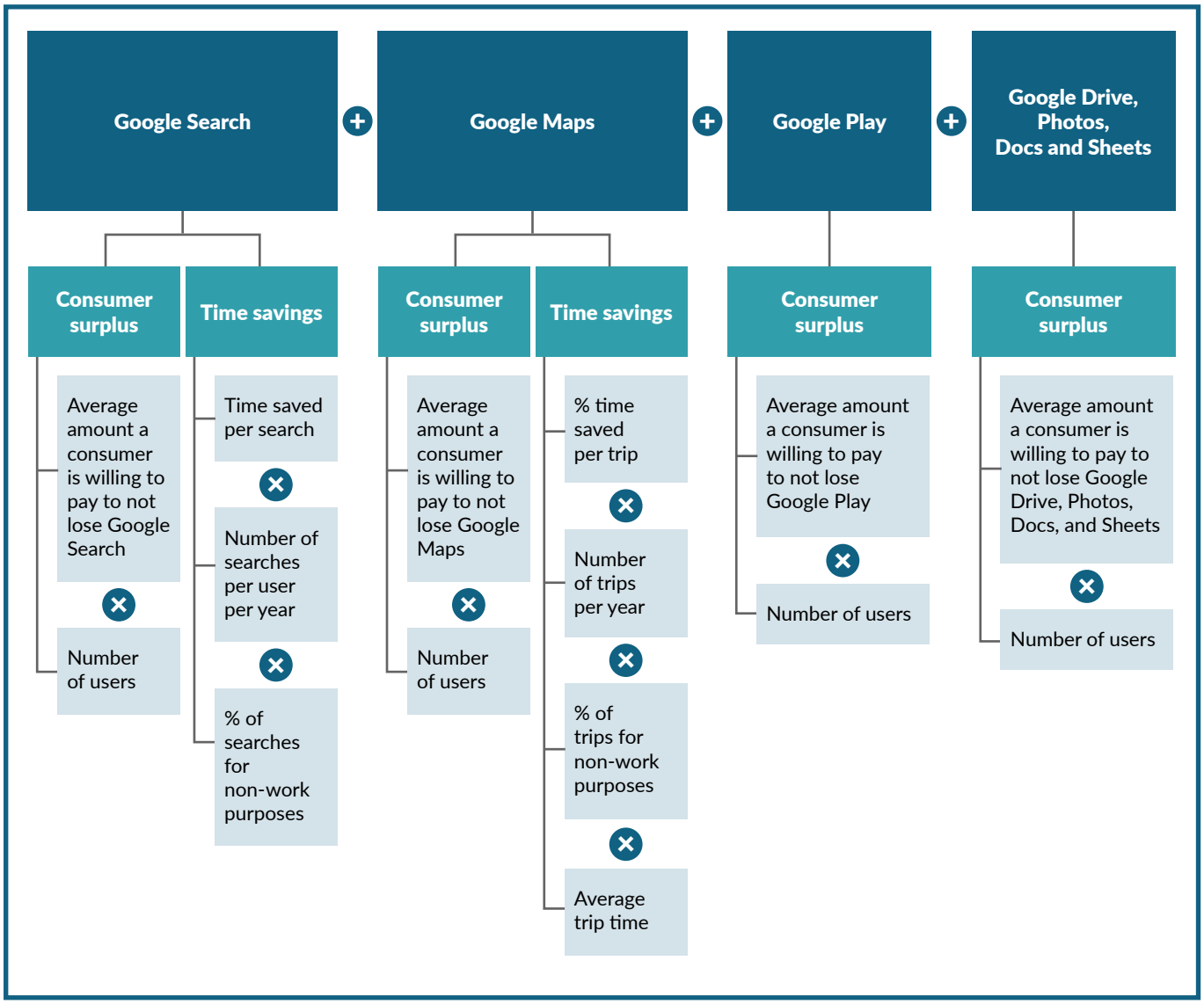
316. Mandel (2017), US App Economy. Available at: https://www.progressivepolicy.org/wp-content/uploads/2017/05/PPI_USAppEconomy.pdf

317. Mandel (2018), Korea's App Economy. Available at: https://www.progressivepolicy.org/wp-content/uploads/2018/05/PPI_KoreanAppEconomy_2018.pdf

Consumer benefits

The consumer benefits supported by Google are challenging to measure and calculate because individuals typically do not pay for the services. In the absence of price indicators, we adopted the economic "willingness to pay" principle to estimate the value of consumer benefits by asking individuals how much they value specific products – also known as consumer surplus. We also calculated the time savings accrued to consumers from their use of Google Maps (which optimizes their driving and public transport journeys) and Google Search (which increases the efficiency of information gathering). Exhibit B2 summarizes the methodology used for sizing consumer surplus and time savings of relevant products.

Exhibit B2:
Methodology for sizing consumer benefits from Google



Note: This report's methodology for measuring Google's economic impact is consistent with the methodology used in the Google Economic and Social Impact South Korea 2021 report.
SOURCE: AlphaBeta analysis

Google Search

We estimated the benefits of Google Search to consumers using two metrics: consumer surplus and time savings.

To calculate the consumer surplus for Google Search, we multiplied the number of Google Search users with the average willingness to pay obtained from the consumer survey.

To calculate time savings, we applied time saving estimates from an experiment that measured the time taken to conduct a search online versus a search at the library.[318] This study found that a search that takes 21 minutes in the library takes 7 minutes online. After accounting for the fact that people now ask more questions due to the ease of online search, we estimated the time saved across Japan by using Google Search.

The share of Google Search users in the country who have made use of Google Search for self-enrichment purposes such as learning new skills or acquiring knowledge in a new topic was also estimated using the consumer survey.

Table 9 shows the inputs and sources used for calculating the consumer benefits of Google Search.

Google Maps

We sized the benefits of Google Maps to consumers using willingness to pay, where consumers were asked to value their favorite online maps service. We also estimated the time saved by using Google Maps for driving and public transport trips.

To calculate the consumer surplus for Google Maps, we multiplied the number of Google Maps users with the average willingness to pay obtained from the consumer survey.

The time saved per user by using Google Maps was estimated using the amount of time saved per trip, the average trip time, and the number of trips conducted for non-work purposes per user. The time saving per trip was obtained from AlphaBeta's traffic crawler analysis of driving and public transport trips in Japan in 2016.

Table 10 shows the inputs and sources used for calculating the consumer benefits of Google Maps.

Google Play

We calculated the benefits of Google Play to consumers using willingness to pay, where consumers were asked to value their favorite online distribution platform for digital products. Results from the survey of Japan's online population were used.

318. Chen, Y., YoungJoo Jeon, G., & Kim, Y.-M. (2014), "A day without a search engine: an experimental study of online and offline searches". Experimental Economics, Vol 17, Issue 4, pp 512-536. Available at: https://link.springer.com/article/10.1007/s10683-013-9381-9

Table 11 shows the inputs and sources used for calculating the consumer benefits of Google Play.

Google Drive, Photos, Docs, and Sheets

We calculated the benefits of Google Drive, Photos, Docs, and Sheets to consumers using willingness to pay, where consumers were asked to value their favorite online cloud-based file storage and document collaboration service. Results from the survey of Japan's online population were used.

Table 12 shows the inputs and sources used for calculating the consumer benefits of Google Drive, Photos, Docs, and Sheets.

Table 9: Inputs and sources for calculating consumer benefits of Google Search

ESTIMATION	METRIC	SOURCE
Consumer surplus	Amount that consumers value product per year (WTP)	• AlphaBeta Consumer Survey (2019)
	Online Population (OP)	• Statista (2019)[319]
	Search users as % of OP	• AlphaBeta Consumer Survey (2019)
Time saved per user	Time saved per search	• Varian (2014)[320] • Chen et al. (2014)[321]
	Average daily searches per user	• AlphaBeta Consumer Survey (2019)
	% of searches for non-work purposes	• AlphaBeta Consumer Survey (2019)
Share of Search users who have made use of Search for self-enrichment purposes	% of Search users in country who made use of Search for self-enrichment purposes	• AlphaBeta Consumer Survey (2019)

319. Statista (2019), "Number of internet users in Japan from 2017 to 2023". Available at: https://www.statista.com/statistics/266376/internet-users-japan/

320. Hal Varian (2014), "Economic value of Google" (Presentation).
Available at: http://cdn.oreillystatic.com/en/assets/1/event/57/The%20Economic%20Impact%20of%20Google%20Presentation.pdf

321. Chen, Y., YoungJoo Jeon, G., & Kim, Y.-M. (2014), "A day without a search engine: an experimental study of online and offline searches". Experimental Economics, Vol 17, Issue 4, pp 512-536. Available at: https://link.springer.com/article/10.1007/s10683-013-9381-9

Table 10: Inputs and sources for calculating consumer benefits of Google Maps

ESTIMATION	METRIC	SOURCE
Consumer surplus	Amount that consumers value product per year (WTP)	• AlphaBeta Consumer Survey (2019)
	Online Population (OP)	• Statista (2019)[322]
	Maps users as % of OP	• AlphaBeta Consumer Survey (2019)
Time saved per user by using Google Maps for public transport	% of time saved per trip on average	• AlphaBeta traffic crawler analysis (2016)
	Number of public transport trips using Google Maps per week	• AlphaBeta Consumer Survey (2019)
	% of trips for non-work purposes	• AlphaBeta Consumer Survey (2019)
	Average trip time	• AlphaBeta Consumer Survey (2016)
Time saved per user by using Google Maps for driving	% of time saved per trip on average	• AlphaBeta traffic crawler analysis (2016)
	Number of driving trips using Google Maps per week	• AlphaBeta Consumer Survey (2019)
	% of trips for non-work purposes	• AlphaBeta Consumer Survey (2019)
	Average trip time	• AlphaBeta Consumer Survey (2016)

Table 11: Inputs and sources for calculating consumer benefits of Google Play

ESTIMATION	METRIC	SOURCE
Consumer surplus	Amount that consumers value product per year (WTP)	• AlphaBeta Consumer Survey (2019)
	Online Population (OP)	• Statista (2019)[323]
	Google Play users as % of OP	• AlphaBeta Consumer Survey (2019)

Table 12: Inputs and sources for calculating consumer benefits of Google Drive, Photos, Docs, and Sheets

ESTIMATION	METRIC	SOURCE
Consumer surplus	Amount that consumers value product per year (WTP)	• AlphaBeta Consumer Survey (2019)
	Online Population (OP)	• Statista (2019)[324]
	Users of Drive, Photos, Docs, and Sheets as % of OP	• AlphaBeta Consumer Survey (2020)

322. Statista (2019), "Number of internet users in Japan from 2017 to 2023". Available at: https://www.statista.com/statistics/266376/internet-users-japan/
323. Statista (2019), "Number of internet users in Japan from 2017 to 2023". Available at: https://www.statista.com/statistics/266376/internet-users-japan/
324. Statista (2019), "Number of internet users in Japan from 2017 to 2023". Available at: https://www.statista.com/statistics/266376/internet-users-japan/

Important Notice on Contents – Estimations and Reporting

This report has been prepared by AlphaBeta for Google. All information in this report is derived or estimated by AlphaBeta analysis using both non-Google proprietary and publicly available information. Google has not supplied any additional data, nor does it endorse any estimates made in the report. Where information has been obtained from third party sources and proprietary research, this is clearly referenced in the footnotes.

The amounts in this report are estimated in both Japanese yen (JPY) and US dollars (USD). The conversion is based on the average exchange rate in 2020, sourced from the IMF Country Database, which was USD1 = JPY107.836.

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