1. Industrial Manufacturing

Measuring and certifying of the safety of autonomous vehicle by RSS[1]
[Summary] ● Some companies are already contributing to the safety standards of autonomous vehicles. ● Company A has developed a Responsibility-Sensitive Safety (RSS) model, that can measure and prove the safety of autonomous vehicles, using a tested mathematical formula to mimic human driver behavior. RSS provides autonomous vehicle manufacturers with a transparent safety model to test and prove the safety of their vehicles, and defines a 'safe state' for human responsibility and caution needed to prevent accidents.
Providing connected car hardware[2]
[Summary] ● Some companies, in partnership with telecom companies, already provide connected car hardware. ● Through connected car Wi-Fi hotspots which are embedded in vehicles, enabling travelers to stream entertainment or work on-the-go. ● Activating one hotspot can get multiple connections and eliminating the need for individual data plans or routing devices ● The car Wi-Fi can also be connected to from outside vehicles, making it a viable connectivity solution when working from home. ● Beyond in-vehicle infotainment, automotive players started to offer other connected services such as, predictive maintenance, real-time emergency response, concierge services, and even in-vehicle e-commerce services.
Implementation of autonomous driving

[1] 「2030 日本デジタル改革」P48
[2] "Japan Digital Agenda 2030" P49

- Company B has nearly 50 deep learning models, trained from millions of images, running at once on the car's onboard computer to predict what the auto-pilot should do in reaction to traffic signals, pedestrians, or other objects.
- In addition to such deep learning models are high-performance, low-power consumption system on a chip that offer high reliability and scalability to allow for over-the-air updates. Such Application-specific integrated circuit (ASIC) or Graphical Processing Unit (GPU) chips are embedded into autonomous vehicles to allow for on-board edge processing, reducing the volume of data that needs to be transmitted outside the vehicle.

Machine learning enabled drug discovery optimization

- By leveraging machine learning on multiple data sources, Company C was able to quickly and accurately predict biomarkers of therapeutic response and inform target selection for drug discovery.
- Artificial intelligence raised a hypothesis that the comapany's existing medicine, medicine A, to treat rheumatoid arthritis could be used to treat COVID-19, The Food and Drug Administrative issued an Emergency Use Authorization to allow use of medicine A as a part of combination therapy to treat hospitalized COVID-19 patients, marking an example of where artificial intelligence supported identification of an alternative indication for an existing drug.

[Future Barriers (1.Industrial Manufacturing)]

- Software talent and AI expertise – engineers need to reskill and learn the how/what of data labeling, model development/training and deployment. Providing training on software development and machine learning to existing engineers are necessary.
- Limited availability of labelled datasets hinders development of ML models – revamping internal policies on collecting and labelling images that are usable for AI in the future including making sure data is in an integrated and interoperable format. It is hoped that practices to gather and label unstructured data for machine learning purposes will be established.

- Legacy IT policies and fragmented infrastructure impede data-driven use cases – integrated databases or ‘single sources of truth’ are needed. Launching agile digital divisions to operate unencumbered in a ‘test and learn’ environment with latitude from legacy organization is also needed.
- Top management reluctant to invest in bold digital transformations. Perception that automation threatens workforce stability – C-level need to drive resource reallocation into software, analytics, AI.
- It is desirable to create initiatives to incentivize industrial manufacturing companies to adopt digital through public-private collaboration.

2. Retail

Deep learning driven demand prediction[3]
[Summary] ● Traditionally, demand prediction involved old-school statistics to analyze datasets such as historical sales reports and competitor product catalogues. There is, however, a wealth of information available that traditional techniques cannot easily capture, such as, for apparel: comments on fashion blogs; popular styles and colors as seen on social media posts; customer style and color searches on online stores. ● Machine learning, and deep learning – including image and text recognition – can unlock new realms of customer data that can provide insight into what is popular and selling now, and in the future. Such insights can be valuable for retailers during the process of designing and predicting demand for products. ● An example of a company playing in this space is that, Company D launched a partnership with a search engine company as a part of their Project in 2018, to use machine learning, and deep learning for image recognition, to evaluate product trends and predict demand. By analyzing images and other data, the partnership will enable the company to predict colors, shapes and styles likely to be in vogue and design products accordingly.
[Expected impacts] ● Improved sales prediction accuracy, shortened times between design and production.
Deep learning driven demand prediction[4]
● By eliminating time spent waiting in line and paying, Company E has streamlined the customer journey and enhanced the customer experience, while reducing human error at checkout. Another hidden benefit of the company is the ability to collect valuable data on customer behavior and preferences. Physical grocery

[3] "Japan Digital Agenda 2030" P58
[4] "Japan Digital Agenda 2030" P57

stores have no way of tracking anything beyond final purchases. The company, by contrast, uses customer scrolls, views and clicks to obtain additional insights, e.g. the number of times a product was picked up but replaced on shelves without a final purchase. This trove of data can inform assortment decisions and store layout.

[Future Barriers (2. Retail)] [5]

- Prevalence of legacy systems increases modernization costs.
- Capability gaps and limited data availability hinder rollout of turnkey e-commerce solutions for small stores.
- Size of workforce poses challenges for staff retraining and change management.
- Store-based incentive structure discourages shifting to e-commerce and omnichannel.
- Non-standardized product and customer IDs hinder supply / demand, and customer analytics
- Following countermeasures need to be taken:
  - Leverage secure cloud data platforms to process high frequency and volume of retail customer data to enhance operations and customer centricity.
  - As retail is an industry that frequently connects with large population groups, the availability of rich, granular and high frequency customer datasets, with often fewer sensitivities around data collection and usage (compared to patient health records) allows players to perform fully functional advanced analytics. In order to fully leverage this data enterprises need to move away from legacy systems to cloud-based digital platforms that support data integration and building of scalable digital applications.

[5] "Japan Digital Agenda 2030" P61

3. Education

Enrichment of online education (EdTech players) [6]
[Summary] ● Several EdTech players aim to simplify the provision of online teaching when in-person education is not possible, and also reduce the amount of time spent by teachers and students assigning, completing, and grading homework. ● Some OS vendors, for example, have each built on their workplace productivity suites to offer education-focused products: teachers can use them to deliver lessons remotely, share materials, and distribute and collect assignments. ● Additional cloud solutions can also be integrated by schools to foster creativity and teamwork. Such a solution allows teachers to design interactive projects where students can collaborate to practice multimedia storytelling, using accessible, browser-based tools.
Enrichment of online education (High Education) [7]
[Summary] ● In Japan, institutions such as the University of Tokyo have made lecture recordings and courseware available online, and many have temporarily adopted online learning. For universities, hybrid or fully remote instruction presents several opportunities. ● It lowers operating costs from lecture halls and accommodation facilities, makes it possible for more students to attend courses, and allows for more flexible academic calendars. Moreover, the use of cloud and other technologies allows educators to leverage resources from multiple new sources, such as other universities or education programs. In order for these models to be successful, however, universities need to carefully design programs that allow for academic mentorship and feedback, social interactions, and equitable access.
[Future Barriers (3. Education) [8]]
● GIGA program promotes cloud adoption to a certain extent, but has no clear

[6] 「2030 日本デジタル改革」P38
[7] “Japan Digital Agenda 2030” P38
[8] “Japan Digital Agenda 2030” P40-P41

mandate for actually adopting the cloud. And due to security concerns, there are cases where faculty's devices for school affairs are not permitted to connect to the Internet, which becomes a barrier to collect and utilize the study data of students.

- In addition, personal information protection ordinances of local governments have been a barrier: While driven by the desire to protect individuals' privacy, the complexity and multiplicity of such provisions may present a major impediment, particularly in implementing remote-based education at scale.
- A harmonized privacy regulatory framework would facilitate the deployment of cloud-based learning solutions countrywide. Government should support the academic institutions based on the updates of the revised Education Information Security Policy Guideline and should continue to revise future guidelines balancing security and cloud/internet access. In addition, expanding IT literacy training opportunities for faculty members will be the key to enhance optimized learning opportunities for each and every student.

4. Government Services

Data sharing across public and private sector (Estonia, United Kingdom, United States)[9]
[Summary] ● In a digital world, making data accessible is critical to development. The digital world is less about data integration – which requires moving data from one location to another - and more about sharing data sets or making data accessible through Application Program Interfaces (APIs). Businesses have solved this problem by creating data-lakes with data sets that can be accessed across an organization, or by developing layers with APIs to enable builder teams to access select data. Building a data exchange layer can achieve significant benefits for customers without requiring major IT overhauls. ● Estonia is a marquee example of deploying a data sharing layer that has improved customer experience with significant efficiency gains, saving the government 1,407 working years in 2018. ● The UK's Government Digital Service (GDS) shares ~20,000 datasets enabling data scientists and software specialists to develop new applications. ● Many US cities also excel at data sharing. For example the city of Chicago makes thousands of datasets available, which citizen data scientists and developers have used to build apps, a notable example being identifying safe areas to run or ride a bike in. The city of Boston similarly shares thousands of data sets; an innovative example involved an app that used a phone's accelerometer while driving to detect where there could be potholes in the road that needed to be repaired. A final example is the city of San Francisco which also makes many datasets available, for example to track energy usage across buildings.

[9] "Japan Digital Agenda 2030" P90

Digital citizen and business journey portal/apps (United Kingdom, Singapore, Estonia, Japan, Norway) [10]

[Summary]

- The UK's Government Digital Service (GDS) developed 'Gov.UK' in 2012, a one-stop-shop to access e-services, which replaced ~1,700 different government websites and provides access to ~300 agencies. This has been estimated to save taxpayers £70m per year in service delivery costs.
- The UK, as a part of its consolidated government e-services website, allows citizens to create online childcare accounts which can then be used to obtain childcare support programs, such as yearly free childcare with approved childcare providers.
- In terms of purpose-specific apps, the Singapore government created an app called 'Moments of Life (Families)', to proactively support families of children aged 6 and below: it provides necessary information to parents and caregivers (including birth registration, preschools, immunization records) and is designed to improve with feedback.
- Estonia, often touted as the top eGovernment executed a plan to consistently roll out new digital products. In 2000 it rolled out e-Taxes, in 2002 ID-card to access e-services, in 2005 i-voting, in 2007 Mobile-ID; a mobile version of the original ID card. Later in 2011 it launched Reporting 3.0 to help entrepreneurs accelerate the submission of data, and in 2014 it launched e-Residency. Estonia has further identified 10 focus areas to keep pace with digital revolutions and emerging technologies by moving basic services to a full digital model, with the goal of having at least 7 new services functioning in 2020.
- In Japan, obtaining residence certification (known as juminhyou) is an essential prerequisite for various other activities such as opening a bank account or

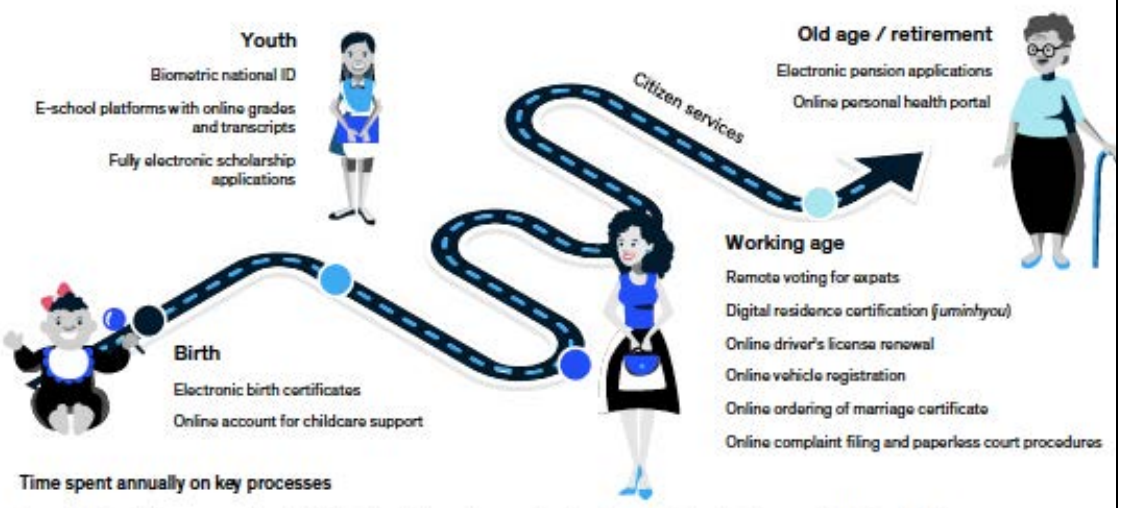
[10] "Japan Digital Agenda 2030" P86, P87, P88

starting a new job; It is now possible to use one's My Number card to issue and print a juminhyou at any of approximately 55,000 convenience stores spread across the country – and serving 740 municipalities that represent over 80% of the national population – in a process that takes just a few minutes at a self-operated kiosk. Moreover, certain municipalities such as Shibuya in Tokyo have rolled out chatbots, that can be used to apply for and electronically pay for juminhyou copies and other documents such as tax certificates through one's smartphone, via the popular LINE messaging app. After requesting and paying via LINE, citizens have to wait to receive physical copies of the documents which are mailed to their registered residential addresses. Although the kiosks and chatbots mark considerable improvements from a process based on physical visits, they still involve receiving paper copies of the juminhyou.

- An example is Norway, where pension applications can be made entirely online using the Norwegian Labor and Welfare Administration's portal, and citizens can apply electronically and receive a response within minutes. Citizens may also use the portal to get an overview of their pension earnings, calculate future pension amounts, and compare options to see how withdrawal dates and rates can affect the size of one's pension – all without having to deal with multiple slips of paper.

Exhibit 16:

Digital citizen journey and time spent annually on key citizen processes



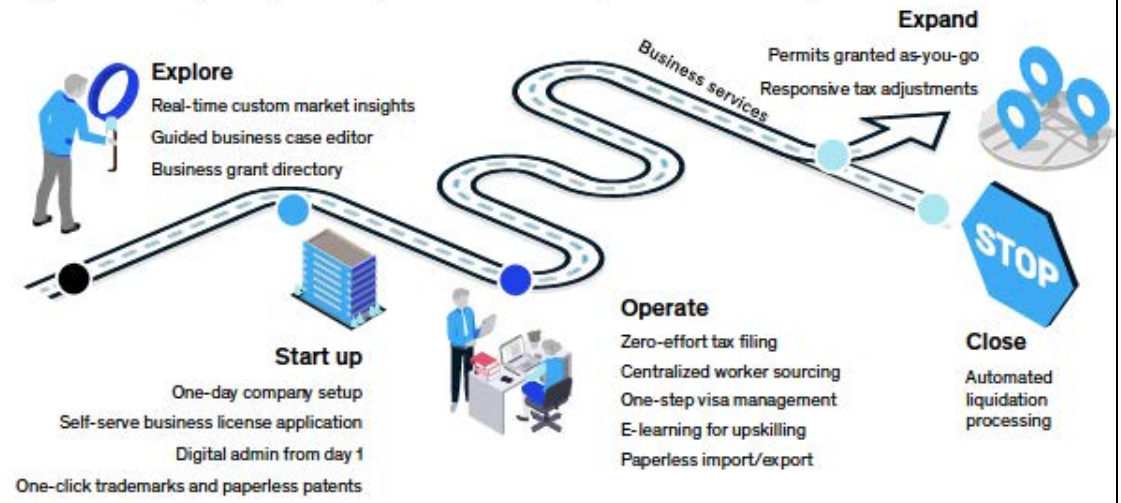
Time spent annually on key processes

Renewing driver's license	Certification to register residency	Receiving medical certificate	Marriage & divorce
~50 million hours	~6 million hours	~1.3 million hours	~1.1 million hours

Source: McKinsey

Exhibit 17:

Digital business journey and key business services processed annually



Volume of tasks processed annually

Company registration	Business license approval	Corporate tax processing	Working visa review
~116,000	~5.2 million	~2.7 million	~245,000

Source: McKinsey

Online portal to enable one-day company setup (New Zealand)

- Starting a company requires deciding on a business structure, obtaining approval for a company name, securing the necessary capital, appointing key staff, and establishing a legal address.

● Streamlined this process, New Zealand reached the top of the World Bank's global DB (Doing Business) ranking for ease of starting a business. On the Companies Office website, registering a business is a one-step procedure completed in under a day.
[Expected impacts] ● Quicker setup of company, reduction in processing time for government workers.
Online paperless platform for import and export of goods and services (Singapore)[11]
[Summary] ● A truly interesting innovation is Singapore's online platform for trade, the NTP (Networked Trade Platform), which has won several international awards. More than an online marketplace, it allows any Singaporean business to log in with a single business ID, connect with domestic and international players across the value chain, set up paperless contracts and customs declarations, organize freight shipments, monitor trade activity and integrate with third-party systems.
[Expected Impacts] ● Increased volume and expedited process of trade, reduced disruptions to production schedules due to a streamlined and diversified supply chain.
Central management of public procurement (South Korea, Sweden)
● Korea ON-line Eo-Procurement System (KONEPS) was created as a central portal for public procurement, The launch of KONEPS reduced bid processing time from 30 hours to <2 hours, and is one of the largest e-commerce marketplaces in the world with a total transaction volume of around U$60B. ● Sweden is another example, with a common eProcurement platform that was launched as long ago as 2007.
[Future Barriers (4. Government Services)] [12]

[11] "Japan Digital Agenda 2030" P89
[12] "Japan Digital Agenda 2030" P91

- Data standards vary across agencies - data is not always machine-readable or allows for joint analysis. Different legal frameworks between agencies, national and local governments create complexities regarding what data can be digitized or shared. Need to establish standards for data format and data quality across sources, deploy “data dictionaries”, implement APIs and use cloud-based single sources for each data type.
- Interoperability of systems across government agencies - adopting common protocols or data types, reducing interoperability overhead.