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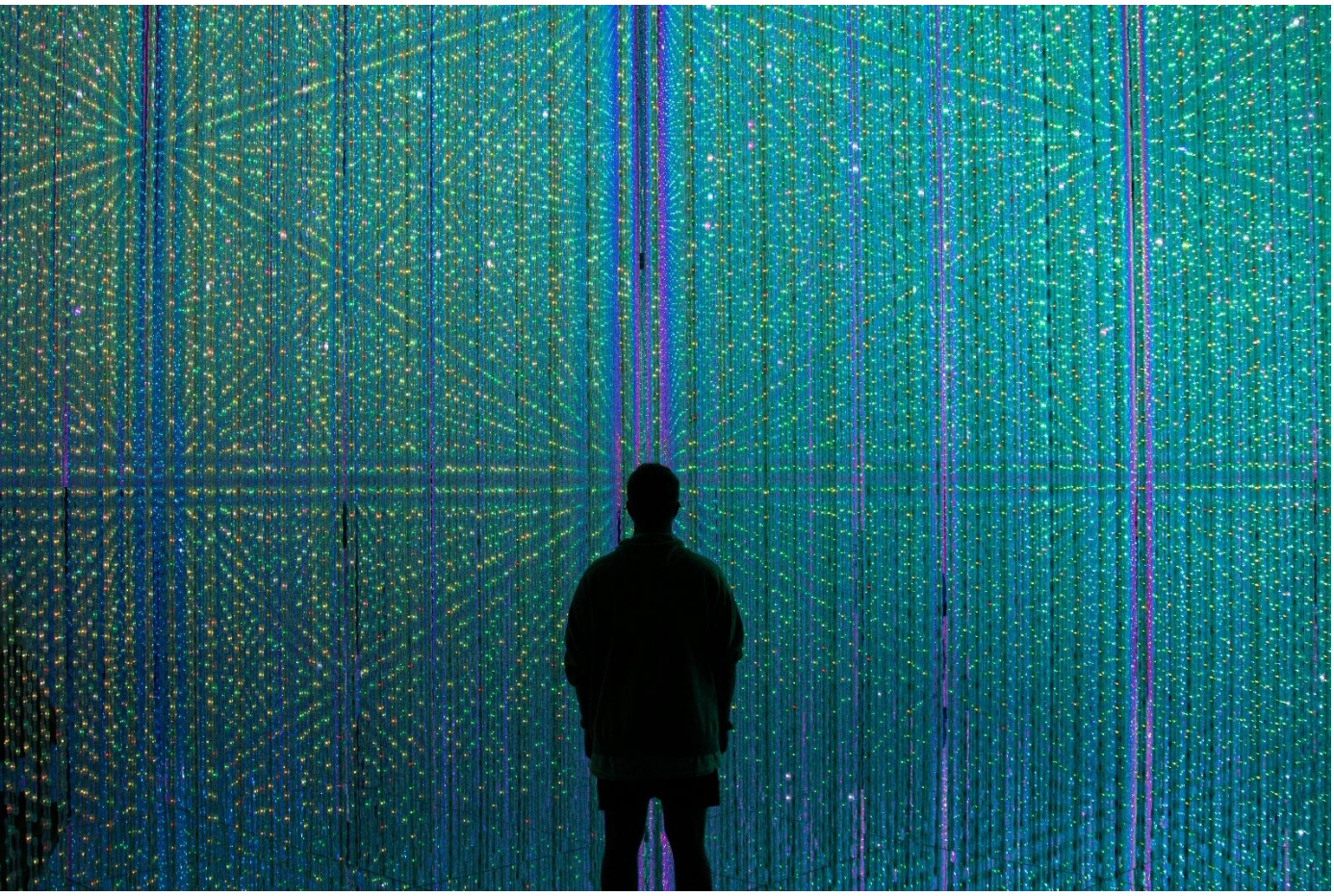

DX: JAPAN'S DIGITAL TRANSFORMATION STRATEGY

Digitalization of state, industry and administration

Dr Gerhard Fasol

Summary

Global interest in Japan is very strong: investors enjoy good returns with the Nikkei 225 Index at an all-time high — substantially higher than at the peak of Japan's bubble economy in December 1989, when the Nikkei 225 peaked at 38,115. Inbound tourism is breaking all records: tourists are fascinated by Japan's safe and clean society, fast and reliable trains, exceptional food, and can enjoy it all at low prices due to the cheap yen. Silicon Valley funds invest in Japan's growing venture eco-system.

On the other side of the coin, Japan's population is decreasing and aging, and while Japan's GDP expressed in US$ grew rapidly until 1995, it has essentially stagnated since then – for 30 years now Japan's economy has not grown, and although it has remained at a high level, it is falling back compared to the growth in most other countries. Japan's government is, of course, putting much thought into the question of why Japan's economy essentially stopped growing 30 years ago, and many steps are being taken to increase Japan's competitive power.

Change has been fast: from mainframe computers with custom made software, to cloud services and Software as a Service (SaaS), to AI. Japan's Industry Ministry, METI, worries that Japan's traditional large companies, which create about 47% of the value added in Japan's GDP, are losing global competitiveness and miss out on value creation because their outdated management practices lead to outdated information technology management. Japan has pioneered many aspects of modern infrastructure. For example, Japan was about 8 years ahead in creating the first mobile internet services with Docomo's I-Mode.

This report looks at Japan's digital transformation (DX) from various perspectives. We introduce several of Japan's outstanding success stories, for example SoftBank – which a Korean immigrant to Japan, Masayoshi Son, with his Midas touch, started in a dormitory room at the University of California Berkeley, and then, mainly from Japan, built into one of the most important internet and IT investment groups globally.

Background and "the big picture"

Japan's economy grew until about 1995, the peak of Japan's bubble economy. 1995 is also the year when the internet started to grow commercially: the search engine AltaVista was founded in 1995, Yahoo was founded in January 1994, and the web browser Mosaic was made available in 1993. The world of 1995 was largely a mechanical one, and Japan dominated many mechanical industries, such as car manufacturing, steel making and ship building.

Could it be that Japan's economy stopped growing because the post-mechanical, information, software and internet-based economy needs different management methods, new ways of thinking, and different talent management, and that Japan was slower than other countries to adapt? This and related questions are studied by METI's Digital Transformation (DX) Committee, and in its "2018 DX Report", METI pushed for changes in Japan's large traditional industries to improve their global competitiveness and their value creation.

Digital transformation (DX) is just one of the questions which can be asked, and of the changes which need to be addressed. Another and bigger question is why Japan (and Europe) have not been able to create globally internet-based companies even remotely comparable in corporate value and impact to the US companies Alphabet/Google, META, Apple, Microsoft, Amazon, NVIDIA, OpenAI, or Palantir.

Japan's island economy – the Galapagos effect

Japan is an island economy, and an island culture. Japan is one of only two countries in East Asia which have never been a colony (the other is Thailand). This is not a result of luck. When Japan's Tokugawa shogunate understood the intentions of the Portuguese and Spanish to convert Japan into colonies, the shoguns closed the country, essentially prohibiting any entry to and exit from Japan, with only a few and very tightly controlled exceptions. The Dutch East India Company were the only Western foreigners allowed to enter Japan, at the very small Dejima Island in Nagasaki, between 1641 and 1858. Japan's "sakoku" (= closed country) period lasted from the early seventeenth century to the mid-nineteenth, and for almost 250 years Japan was essentially closed to and from Western countries.

Closing almost all contacts between Japan and Western countries for over two centuries prevented Japan from becoming a colony, enabled Japan's traditions and culture to develop to a large extent independent from outside influence, and, together with other factors (e.g. the Chinese character writing system), contributed to the development of many aspects of Japan's unique creativity. Many of my Japanese friends tell me that some "Sakoku thinking" still remains today and may contribute to "Japanese people's way of doing things", to finding Japanese solutions different from solutions prevailing in other countries.

As an example, Pikachu is more popular in Japan than Mickey Mouse, and Pokémon is the highest grossing media franchise globally. Japan's creativity has enough power for Pikachu and Pokémon to stand up to Walt Disney Corporation's Mickey Mouse.

- The global total revenue of the Pokémon franchise is estimated at US$ 115 billion (since 1996)
- The global total revenue of the Mickey Mouse & Friends franchise is estimated at US$ 61.2 billion (since 1928), i.e. about half of Pokémon's revenue, and this over a much longer time interval since its creation

However, Japan's island thinking may also have negative aspects. Some very advanced and beautiful technologies and products are created in Japan for Japan's market, are way ahead of their time globally, and yet do not (or have not yet) succeed in global markets. Japan's high-speed train system, the Shinkansen, may be one example, and another example often mentioned in this context is I-Mode, Japan's mobile internet, which was brought to market 8 years earlier than the iPhone, but did not succeed in global markets despite NTT-Docomo's efforts and investments. I-Mode's co-founder and former NTT-Docomo Board Director Takeshi Natsuno created the "Post-Galapagos Study Group" which met once per month over 1-2 years to seek solutions to overcome this Galapagos Effect, and he invited me as the only non-Japanese onto this committee. I reported on this to the American Chamber of Commerce in Japan, ACCJ.[1]

Japan's traditional split IT industry structure may slow down DX: "users" vs "vendors" (System Integrators, SI)

As in so many areas, Japan does things differently for information technology (IT) from most other countries. Japan's IT industry structure on the whole has historically evolved differently and is still differently organized today.

All companies, large and small, whether traditional with a long history or young ventures, either depend on IT for their core business, or data management and IT are that core business. As an example, the core business of banks is to manage accounts, manage loans and their risks, understand

their customers and their financial position and needs, and, in the case of investment banks, understand and work in financial markets, and advise customers on investment management, risk management and M&A. All of this core business is based on software and computer systems: IT.

In Japan to a large extent, large traditional corporations, e.g. banks, procure the creation of IT systems including software and hardware from system integrators (SI). The dominant and traditional pattern is that large Japanese corporations have long-term relationships with SIs (e.g. Fujitsu, Hitachi Data Systems, etc.). When e.g. a bank needs to transition to a new core banking IT system, or needs changes in its existing IT system, the bank issues a request for proposal (RFP) to one or more SIs ("vendors") and enters into a contract with the SI with specifications, pricing and timeline. The SI delivers the new system according to the contract. The IT market is split into "users" and "vendors". This system is established in Japan, but has clear disadvantages, holding back digital transformation (DX), and slowing progress.

These disadvantages include

- The user/vendor and procurement process is tuned to the outdated "waterfall" software development model. It is difficult to adapt this user/vendor model to modern "agile" development models[2] [3].
- "Users'" top management may see software (IT) as a cost factor only, aiming to reduce software costs in procurement negotiations with "vendors", instead of seeing software/IT as a strategic investment driving core business growth – possibly into new directions of value creation. "Vendors" on the other hand may miss strategic opportunities for value creation by focusing on pure cost factors, e.g. billable hours etc.
- The IT system can become a "black box" for the "user company" (e.g. the bank), while the know-how about the inner workings of the software system remains with the SI, and the SI's responsibility is limited.
- The people who create the software and IT systems, and their know-how, are located at the SI/vendor, not at the user. When these people move to new positions or retire, the know-how retires with them, and the user (e.g. the bank) is left with an IT system which is a black box for them, and knowledge of the inner workings can "evaporate".
- Changes in the software system take much longer compared to the use of in-house software engineers, slowed down by cumbersome procurement processes, contract negotiations etc.

The reverse side of this coin is that partnerships with Japan's system integrators (SIs) are one of the essential keys to success in Japan for foreign software companies. As an example, Japan Post - one of the world's largest financial institutions by assets - is one of salesforce.com's most important customers globally, and winning Japan Post as a customer was salesforce.com's key step to success in Japan[4]. To win Japan Post as a customer, salesforce.com worked with Japan Post's system integrator Hitachi Software Engineering KK (today Hitachi Solutions). Foreign IT companies wanting to succeed in Japan focus on building a network of relationships with System Integrators (SIs), respecting and leveraging existing relationships between "users" (e.g. Japan Post) and SIs (e.g. Hitachi Solutions).

Japan's Industry Ministry METI, DX-Reports and the "2025 Digital Cliff"

Japan's industry ministry, METI's, main mission is Japan's economic success and economic growth. METI realized that Japan's overall slow pace of digital transformation (DX) was holding back Japan's economic growth, productivity, and value creation, especially in large, traditional corporations, which

represent about 47% of value added in GDP (medium enterprises represent about 40%, and small enterprises about 13%).

To push for the acceleration of Japan's digital transformation (DX) in large traditional corporations in order to enable increased value creation based on IT, METI produced a series of "DX reports", starting with the "Digital Transformation (DX) report",[5] subtitled "Overcoming the "2025 IT System Cliff" and full scale deployment of Digital Transformation (DX)", published on 7th December 2018, as a result of METI's "Digital transformation study committee".

METI's "2018 DX Report" and the "2025 Cliff" focused Japan's minds on accelerating digital transformation and addressing the underlying issues identified in METI's reports - as intended by the Ministry. Several follow-up reports were published:

- DX Report 2 on 28 December 2020
- DX Report 2.1 on 31 August 2021
- DX Report 2.2 in July 2022

METI created and manages a broad range of programs to accelerate the digital transformation (DX) including

- Digital Governance Code 3.0 (updated on 19 September 2024) which aims to increase corporate value through DX
- A digital transformation (DX) certification system
- In cooperation with the Tokyo Stock Exchange, a system to promote stock market listed companies as "DX Stocks", selected for creating value by transforming their business model through digital transformation
- "DX Selection" program, promoting good examples of DX value creation by mid-sized and small businesses

Here some core findings of METI's "2018 DX Report" issued by the "Digital Transformation Study Committee":

- 80% of businesses have outdated IT systems, and 70% of businesses feel that these outdated systems are preventing DX
- "Black box syndrome" and recurring black box syndrome: IT systems are "black boxes" for companies, no-one knows the inner functioning of IT/software systems, and even after maintenance, IT systems again are black boxes
- "Software and data silos": different departments of a large corporation have totally independent software and data silos, preventing company wide use of data.
- "Vendor/SI know-how silo": outsourcing of IT system creation to system integrators (SI) concentrates all system know-how at the "vendor/SI", and not at the user company. When SI employees change employment or retire, the system knowledge disappears. Systems become black boxes, and the introduction of new services, maintenance etc. become difficult or impossible.
- Use of "development from scratch" ("scratch development") to narrow specifications, even for common standard systems (e.g. HR, accounting etc.), instead of more efficient packaged or cloud services. The danger is that these "scratch developed systems" will become

unserviceable "black boxes", once the developers have retired, or left the SI.

- Lack of focus on creating new value and new business models based on data and IT. While for US companies IT investment is focused on creating new products, new services and new business, in Japan the focus of IT expenditure is on cost reduction. In Japan about 80% of IT expenditure is for "run the business" purpose, and only 20% is for "value up", i.e. investment in IT for value creation and new business models and new products/services. Traditional Japanese companies predominantly see IT expenditure as a cost to be reduced, not as an investment in future value creation and new business development.

- Leaving IT decisions to System Integrators/SI/vendors based on long-term relationships, creating difficulties in the way of ventures bringing innovation to established businesses.

- Difficulties in moving from the traditional "waterfall" software development model to the "agile" development model. It is difficult to change traditional Japanese user/vendor relationships and contracts to "agile" development, slowing progress.

- Lack of software engineers at "user" companies. In Japan software engineers and know-how are predominantly at system integrators (SIs)/vendors:

    - In the US about 65% of software engineers work in the IT departments of "user companies", and about 35% at IT vendors/system integrators,

    - In Japan the relationship is more than inverted: about 28% of software engineers work at "user companies", while 72% work at system integrators/vendors.

METI's "2025 Digital Cliff"

In order to focus minds and to promote change, METI in its 2018 DX report created the slogan "2025 Digital Cliff". METI's "2025 Digital Cliff" estimated that if dramatic acceleration of DX were not implemented in the 7 years between 2018 and 2025, obsolete software systems and other issues listed above were likely to cause a ¥12,000,000,000,000 (= EURO 70 billion) loss to Japan's economy.

Problems contributing to METI's "2025 Digital Cliff" include those mentioned above and particularly the following:

- Data silos: black box syndrome prevents company wide use of data

- Maintenance costs consume the whole of IT budgets, with no money left for strategic IT investments creating new value, new services and new business models

- Lack of software engineers due to the aging society, the allocation of software engineers predominantly at SIs, and the lack of software engineers at user companies

- Legacy software used beyond end of support, eg Windows XP, the end of the PSTN phone network, SAP ERP end of support etc.

The purpose of METI's "2025 Digital Cliff" was to create high level and broad attention to the range of problems outlined above, which are costing Japan's economy real money, and preventing the creation of value. METI is running a range of programs to address these issues, and to accelerate change. The 2025 Digital Cliff concept has also been picked up by the World Economic Forum, investment banks and analysts globally.

The year 2025 is now over. The question of whether METI's prediction of an economic loss of EURO 70 billion in 2025 was borne out is, of course, difficult if not impossible to verify. However, it is certainly true that METI managed to focus minds, and to accelerate changes, leading to accelerated digital transformation at Japan's large traditional companies. Some success stories will be outlined later in this report.

METI's "Legacy Systems Modernization Committee": top management, CEOs need to take direct responsibility for company's IT systems

The main point of the committee's report was that: *with outdated legacy systems, Japanese corporations cannot introduce the latest digital technologies, the gap with other countries will widen further, and Japan's industrial competitiveness will continue to decline.*

METI's "Legacy Systems Modernization Committee" aims to push to overcome legacy IT infrastructure in Japanese corporations. The Committee's conclusions are summarized in the report "Current status of DX and overcoming legacy systems" dated 28 May 2025[6].

In my view the most important point raised in this report is the widespread lack of top management attention to companies' IT systems. Instead of the CEO and Board of Directors taking responsibility, in too many companies responsibility is pushed down to the information systems department, which is seen as a cost factor. The priority is to reduce these information system costs, and top management does not see information systems as strategic investments necessary for the competitive strength and future of the company.

In addition, top management sees the information systems department as low down in the meritocracy, low ranking in status, and does not sufficiently recognize its strategic value for the future competitiveness of the company. Shockingly only 12% of companies have replacement or introduction of large-scale IT systems in their medium-term management plans - 88% of companies do not plan to replace their legacy IT systems, or to introduce large scale new IT systems.

Legacy systems are widespread:

- 61% of companies have legacy systems
- 74% of large companies have legacy systems: large corporations are even further behind than the average

A key finding of the committee is that companies where IT is the responsibility of an executive officer (CxO) progress, while in those which do not have a CxO in charge of IT systems, the company's IT governance is not functioning properly. Thus the report explicitly pushes for top executive management to take direct responsibility for IT systems, instead of neglecting this responsibility, and pushing it down to IT department level.

METI and "Mobility DX strategy" = Green Transformation (GX) + Digital Transformation (DX) + self-driving vehicles (SDV)

Given the economic and social importance of mobility, and the double transformation underway through the

- Green transformation (GX), i.e. decarbonization, electric vehicles and
- Digital transformation (DX), including self-driving vehicles (SDV).

METI has a dedicated Mobility Digital Transformation Office.

While Japan's public transport systems are unparalleled in the major towns, and the Shinkansen lines connect most major urban areas and economic centers in Japan, rail only transports about 4%-7% of freight, while 50%-60% is carried by road, and about 36%-44% by domestic coastal shipping. For passengers, about 12% of transport in Tokyo is by car, while in the countryside about 70% or more is by car. Thus outside major towns, car usage is dominant.

Five important forces drive Japan's mobility DX strategy:

- Japan's automakers have about 30% global market share. Major automakers are Toyota, Honda, Nissan, Suzuki, Mazda and Subaru. These automakers are very important for Japan's economic competitiveness and need to compete globally. Japan's target: achieve 30% Japanese share of global SDV sales by 2030-2035. In many areas Japan's resources, especially software engineers, make it challenging to compete in the area of SDV.

- Green transformation: The transport sector contributes about 18% of CO2 emissions in Japan. Given that Japan has announced its intention to achieve carbon neutrality by 2050, the decarbonization of Japan's transport sector is urgent. To achieve decarbonization, it is not sufficient to transition completely to electrical vehicles; it is also necessary to use 100% electricity from non-carbon sources.

- Japan's regions: Japan's population decrease happens in rural regions, and not so much in the main urban centers such as Tokyo/Kanto, Nagoya/Chubu, Osaka/Kansai, Fukuoka/Kita-Kyushu, etc. In Japan's rural areas, 70% of transport is by car, but aging drivers lose their ability to drive. Japan's long-distance high-speed shinkansen trains and local trains in major urban centers are owned and operated by private, largely stock-market listed, highly profitable, and growing companies - whose success is globally envied. On the other hand, 70% of local bus companies and 74% of local railway businesses are unprofitable and threatened with closure. GX + DX + SDV, including MaaS and sharing economy models, may be the only way to mitigate the social impact in rural areas.

- "2024 problem" in Japan's logistics. Since 2024, Japan has limited overtime working hours for truck drivers to 960 overtime hours per year, compounding the decrease in capacity due to aging of drivers and decreasing population. Self-driving trucks are the only chance to satisfy Japan's logistics needs long-term in the face of both a decreasing and aging population, and the need to secure safe working conditions for existing drivers.

- Economic losses from traffic accidents in Japan are estimated to be on the order of 6-8 trillion YEN (approx EURO 33 - 44 billion), corresponding to about 1.8% of GDP. It is hoped that SDV will reduce these losses.

Japan's target: achieve 30% market share of global self-driving vehicle (SDV) sales by 2030-2035 for Japanese makers.

"Mobility DX strategy" case studies

Woven by Toyota (WbyT)

Woven[7] by Toyota is Toyota's innovation ecosystem to create future mobility business. Woven started in 2018 as the Toyota Research Institute - Advanced Development (TRI-AD), and in its present form was incorporated in 2021, four years ago.

Woven currently has 2200 employees, and its mission is the development of new technology and business for mobility driven by software, including:

- Software development platform Arene[8]
- Automated Driving (AD) and Advanced Driver-Assistance Systems (ADAS)[9]
- Woven Capital Fund[10], founded in 2020 as a growth stage investment fund. Assets under management: US$ 1.6 billion, invested in about 17 ventures, focus on series B+
- Toyota Ventures[11], San Francisco Bay Area based, early-stage venture capital
- Toyota Invention Partners[12], founded in October 2025
- Test course for mobility Woven City[13], a living lab for mobility on the location of Toyota's former Higashi-Fuji plant (near Mount Fuji). The Higashi-Fuji plant was moved to Susono in Tohoku to contribute employment and economic revival to the Tohoku region after the March 11, 2011 earthquake and tsunami disaster.
- Woven City opened in September 2025. Currently, about 360 Toyota employees and their families live in Woven City, with long term plans for 2000 residents - residents are nicknamed "weavers", weaving Woven City.

Honda 0 (Honda Zero) – thin, light and wise

Honda introduced the Honda Zero Series[14] at CES 2024[15], the prototypes Honda 0 SALOON and Honda 0 SUV at CES 2025, and Honda 0 α (Honda Zero Alpha) at the Japan Mobility Show 2025[16]. Honda uses its in-house ASIMO OS as vehicle operating system[17] [18]

For autonomous driving (AD) and advanced driver-assistance systems (ADAS), Honda has invested in and partners with Helm.ai[19] Honda started its relationship with helm.ai by investing via its global open innovation program Honda Xcelerator Ventures[20].

HondaJet with Emergency Autoland vs Mitsubishi SpaceJet (terminated)

Honda's HondaJet stands out as an innovation success story. Most of Japan's car companies today either have a long corporate history or are spin-outs from large industrial conglomerates or traditional trading companies. As an example, Toyota Motors is a spin out from Toyoda Automatic Loom Works, which was founded in 1926 to produce weaving machines (looms), and which still exists today as Toyota Industries Corporation.

When Japan rebuilt after World War 2, much rebuilding was done following guidance from Japan's government. In contrast, companies like SONY and Honda are ventures built by entrepreneurs after World War 2 outside the Japanese government's industrial planning.

SONY was founded as Tokyo Tsushin Kokyo KK and built by two entrepreneurs, Akito Morita and Masaru Ibuka[21], while Honda was founded by Soichiro Honda. Masaru Ibuka and Soichiro Honda were friends, and Ibuka wrote a book entitled "My friend Honda Soichiro"[22]. Thus as a company, Honda has a completely different corporate "DNA" regarding its approach to product development, innovation and independence from most other traditional Japanese auto makers.

As an example, Mitsubishi SpaceJet was started as a Japanese government research program in 2003 to develop a regional jet aircraft with Mitsubishi Heavy Industries. Its first flight was on 11 November 2015, but the program was terminated on 6 February 2023, the prototypes were dismantled, and there are plans to dissolve Mitsubishi Aircraft Corporation.

Honda, on the other hand, started to study small business jets in the late 1980s, and started planning the light business jet HondaJet in 1997. The first Honda HA-420 HondaJet completed its maiden flight on 3 December 2003, received FAA type certification in December 2015, and was first delivered in the same month. Since then six different models have been developed and produced (HondaJet, HondaJet APMG, Elite, Elite S, Elite II and Echelon) and in total 259 Honda Jets have been built and sold[23].

On 15 October 2025, Honda announced successful completion of Federal Aviation Administration (FAA) certification flight testing for the Emergency Autoland (EAL) system on the HondaJet Elite II. The HondaJet Elite is anticipated to be the first twin turbine business jet equipped with Emergency Autoland, to be used should the pilot become incapacitated.

I can well imagine that experience gained by Honda in developing the Autoland functionality will also contribute to its SDV development.

Isuzu level 4 autonomous truck and bus business – autonomous driving logistics business development from January 2026

Isuzu's mid-term business plan "ISUZU Transformation - growth to 2030"[24] [25] plans

- Level 4 autonomous driving truck and bus business starting from 2028
- Increase the efficiency of logistics, deploy connected services to major overseas markets by 2028
- Introduce price competitive battery electrical vehicles (BEVs) and carbon-neutral peripheral businesses
- Establish an organization dedicated to business based on autonomous driving technology

Isuzu is planning autonomous level 4 trucks on the logistics route on public roads between the Isuzu Iwafune Parts Center in Iwafune, Tochigi-ken and the Chubu Parts Center in Ichinomiya, Aichi-ken, approximately 400km distance. This logistics route is managed by Isuzu subsidiary Isuzu Logistics. Isuzu is planning to start this test operation in January 2026 and run it until March 31, 2028, for approximately 2 years. The purpose is to develop a commercial autonomous driving logistics business model.[26]

This logistics business development is planned in three stages:

1. Phase 1: Vehicles jointly developed with partner company Applied Intuition Inc[27] [28] [29] will be used from January 2026. Level 4 automated driving will be on priority lanes for autonomous driving on the Shin-Tomei Motorway, with a (human) safety driver as backup in the vehicle.
2. Phase 2 in 2027 will verify operational efficiency and collect data for the development of autonomous vehicles
3. Phase 3 in 2028 will be final verification

Following this development program, Isuzu plans to start its Level 4 autonomous truck business in FY 2028. NOTE: Autonomous driving is classified into six levels:

- Level 0: No automation

- Level 1: Driver assistance. Advanced driver assistance systems (ADAS) use information about the driving environment
- Level 2: Partial automation
- Level 3: Conditional automation. ADAS controls all aspects of driving. Driver must respond appropriately to a request to intervene
- Level 4: High automation. ADAS controls all aspects of driving. If the driver does not respond appropriately to a request to intervene, the vehicle can stop safely
- Level 5: Full automation. ADAS controls all aspects of driving, under all conditions and circumstances

Digital Agency (Digital Ministry) and the MyNumber system

Japan's Digital Agency (Digital Ministry) is a Government Agency founded on the basis of Law No. 36 of May 19, 2021. The website describes its mission as "Human-friendly digitalisation: No one left behind", and says "Our aim is to establish a digital society that embodies the happiness of every individual, contributing to a future for Japan that we can proudly showcase to the world".

In reality, the main purpose as far as is visible today, 4 years after its foundation, is the introduction of the "MyNumber" registration system for Japan's citizens and residents, similar to the National Insurance number in the UK, or the Person-Nummer in Sweden. The MyNumber is essentially a tax number used to ensure efficient tax collection, and close loop-holes in the process. MyNumber needs to be disclosed to employers, and as part of the "Know-Your-Customer" process when opening a bank account or securities trading account.

The MyNumber system had some initial difficulties with an overcomplex multiple password system, and other complexities. These teething problems have now been resolved, and the MyNumber infrastructure works well. Citizens and residents of Japan can access their MyNumber accounts via the MyNaPortal website, via the Mynaportal App for iPhone and Android/Google Play, and in ApplePay.

Initially MyNumber only served as a tax number, but recently social insurance functions were added. For example, when I visit a medical doctor, e.g. for vaccination, or the dentist, instead of the health insurance cards used previously, the doctor's surgery has a terminal reading my MyNumber information from my iPhone or MyNumber Card via NFC, authenticating with face recognition or PIN. I can access my medical charge records on my MyNaPortal account.

Other Government administration functions will be added to the MyNaPortal step-by-step. As an example, an electronic driver's license linked to the MyNaPortal is already offered, in parallel with or as a replacement for the traditional driver's license cards. Other projects at the Digital Agency include Government information dashboards, e.g. for children's education, and another dashboard to show Japan's regional GDO statistical data and other statistical information.

Japan's aging society and human resource issues

Japan's falling population, low fertility rates, and aging population are well known, but not so well understood. Discussing Japan's aging society and falling population numbers is beyond the scope of this report on Japan's digital transformation, but digital transformation (DX) does have a role to play in

solving or at least easing problems resulting from falling population numbers and especially from the falling number of the working-age population.

We mentioned above the difficulties faced in providing mobility services in rural areas, where the consequences of the aging and falling population are particularly acute. Self-driving vehicles, including self-driving buses and trains, can potentially provide transport solutions for the aging population of rural areas.

Logistics and bus transportation are strongly affected by the aging of drivers, and self-driving trucks and buses could provide solutions and reduce accident numbers. As a case study, Seven-Eleven on 1 December 2025 announced the start of a test for autonomous truck delivery in Japan[30]. In the following section we discuss Isuzu's autonomous driving solutions for logistics problems.

Japan's digital industry success stories

SoftBank

SoftBank Group has played a leading role over the years in developing many components of Japan's IT and communications infrastructure, and in parallel also is a leading global IT investor via its vision fund and other paths. SoftBank is the creation of Masayoshi Son, and to understand SoftBank you need to understand the man.

Masayoshi Son, the son of Korean immigrants to Japan's westernmost island of Kyushu, at a young age was determined to break out of his Korean immigrant role and do something much larger. Through stubborn determination he secured a meeting with the founder of McDonalds Japan, Den Fujita, who advised him to study computers and to move to the US West Coast. At the age of 16 Son moved to attend High School in San Francisco and later studied at the University of California in Berkeley. As an undergraduate student at age 19, he developed a pocket translator which he sold to SHARP Corporation for about US$1.7 million, and earned further substantial amounts through selling patents to his inventions and through importing video games. This money allowed him to start SoftBank in 1981 at age 24.

Son developed many different businesses within SoftBank, and invested in many others, including software trade, trade shows, and so on. Son recognized the start of the commercialization of the internet, and in many cases succeeded in taking advantage of geographic and time lag arbitrage: Son used the fact that commercialization of the internet followed a similar path in Japan as in the US, but with several years delay, allowing Son to profit from exploiting this delay.

One of Son's most important early internet investment success stories is Yahoo. As explained in the next section, Son in 1995 acquired a 30% holding in the Silicon Valley company Yahoo for US$100 million together with the rights to build Yahoo-Japan as a joint venture between SoftBank and Yahoo. Son's following success stories included the acquisition of Vodafone-Japan for about US$15 billion followed by a very quick and successful turnaround[31]. (The background on why Vodafone failed in Japan, jumpstarting SoftBank's global growth, is explained in this reference[32].) Another big success story is Son's investment in the Chinese marketplace Alibaba. Son also founded the Vision Fund and recently has been investing a great deal in Artificial Intelligence (AI).

"There are two Yahoo's"

One of Masayoshi Son's most successful endeavors is Yahoo. In 1995, Son invested US$ 100 million for a 30% holding in Yahoo combined with the rights to create Yahoo-Japan as a joint venture between his company, SoftBank, and US Yahoo. Yahoo Japan separately went public on the Tokyo Stock Exchange, and for some periods in time, Yahoo-Japan was so successful that Yahoo-Japan's market

capitalization was higher than that of global Yahoo. This was not generally known in the USA, and I explained in TV interviews that there are two Yahoo's, the US Yahoo and SoftBank's Yahoo-Japan[33].

Yahoo-Japan[34] for a long time was, and today still is, one of the most important internet companies in Japan, providing a range of businesses, from online auctions to travel, search engine, online markets and more. In 2023 Yahoo-Japan merged with Z Holdings and five subsidiaries of Z Holdings, including Line Corporation, to form LY Corporation. LY Corporation is listed on the Tokyo Stock Exchange as No 4689, and its market capitalization is YEN 3 trillion (EURO 17 billion).

ARM

There are only two European companies critical for the global semiconductor industry – and one of these two, ARM, is owned by SoftBank. The two companies are:

- The Dutch company ASML[35], the sole supplier globally of extreme ultraviolet lithography (EUVL) machines

- Cambridge (UK) based ARM Holdings, designing central processing unit (CPU) cores and software development tools. ARM was initially an abbreviation for Acorn RiSC Machines, and the author of this report (Gerhard Fasol) did his PhD at the Cavendish Laboratory of Cambridge University, on the same lab bench as one of the founders of ARM, Herman Hauser[36].

Masayoshi Son recognized the critical importance of ARM for the global semiconductor industry and acquired the company in September 2016 for US$ 31 billion. Son listed ARM with an IPO on NASDAQ, and today ARM's market capitalization is around US$ 150 billion, a 5-fold increase since Son's acquisition.

We could ask the question: why did Son see more value in ARM than any European investor, or the investment community at the London Stock Exchange where ARM was traded before Son/SoftBank acquired it? Or, differently expressed: why was Masayoshi Son better at guessing the future value of ARM than any European investor?

LINE

While in Germany the leading messaging apps are WhatsApp Messenger (META), Telegram, Snapchat, Signal, Meta's Messenger, and Discord, none of which are European-owned companies, Japan has several Japan-owned messenger apps, including LINE, Viber (owned by Japanese company Rakuten), and others.

LINE is Japan's dominant whole-life application, centered around its messenger function. LINE also has a wide range of business applications. LINE dominates Japan's messenger market with 97 million monthly active users, covering about 80% of Japan's population. LINE is Japan's most popular messenger app, used by about 88% of Japan's population, from teenagers to old age pensioners.

LINE was created in-house by the Japan subsidiary NHN of South Korea's internet company NAVER, in 2011 in the aftermath of the Tohoku earthquake, tsunami and nuclear disaster on 11 March 2011. During the weeks following the Tohoku disaster, communications were difficult, as both fixed line and mobile phone networks were overloaded. To overcome these difficulties, NHN employees created an app initially for internal company use to facilitate communications during the disaster period. This internally created emergency communications app was developed into LINE. LINE listed on the New York Stock Exchange with an IPO in 2016 at a valuation of US$ 1.15 billion[37]. As noted earlier, in 2023 Yahoo-Japan merged with Z Holdings and five subsidiaries of Z Holdings including Line Corporation to form LY Corporation.

For European companies addressing consumers in Japan - and there are many - LINE is one of the most important channels through which to connect with Japanese consumers, not just to sell, but also to hire employees, and for the many other ways in which companies need to connect to individuals. I am often surprised (or rather, not surprised any longer) at how little the top management of important European companies know about their potential Japanese customers. In one of our projects, we worked with one of Europe's most important and famous consumer goods companies on their growth in Japan, on questions such as "what is holding us back in Japan" — why are we No 1 in most major markets – but not in Japan. At the conclusion of our project, we had a workshop with the global CEO, CFO, CTO and the 35-strong global executive management team. As part of our workshop I explained LINE to this group of 35 executives, and why LINE is probably the most important channel for them to communicate with their customers. At the dinner this group of top executives of one of Europe's most important consumer goods companies raised the question of why they had never heard about LINE, even though it was critical for their business growth in Japan and to communicate with existing and potential future Japanese customers, employees, and business partners.

Rakuten

Rakuten was founded in 1997 by charismatic leader Hiroshi Mikitani as the online retail marketplace Rakuten Ichiba, with 6 employees and initially 13 merchants as MDM Inc. Over time Rakuten built a large ecosystem including a very wide range of businesses, from credit cards, online banks, and online security trading, to online messenger, online travel service, the fourth Japanese mobile network provider, and more. At the center of Rakuten's business empire are Rakuten points. Rakuten aims to capture customers into its ecosystem, and encourage members to use more and more of Rakuten's wide range of services, encouraged by progressive awards of loyalty points.

Rakuten is one of Japan's largest credit card issuers, with 30 million credit cards issued, and users' purchases exceed all other Japanese credit card issuers by transaction value. Rakuten started with its online marketplace Rakuten Ichiba. While to some extent similar to Amazon's shopping site, Rakuten has a different model. Rakuten is an online shopping mall with tenants each building their own store fronts. Rakuten's and Amazon's business portfolios are different. Rakuten has a strong focus on financial services and credit cards in Japan, but it does not offer services comparable to AWS - Amazon Web Services. Rakuten is listed on the Tokyo Stock Exchange (TYO 4755), with a market capitalization of around 2 trillion Japanese yen (EURO 11 billion).

Japan's social media, social networking services (SNS)

Japanese people's usage of social media, social networking services (SNS), differs from other countries. Maybe most striking is that the No 1 SNS application is Japan's home-grown LINE, discussed in an earlier section.

Ranked by monthly active users (MAU) Japan's social media usage is:

1. LINE: 97 million MAU, engaging about 80% of Japan's population
2. YouTube: 78 million MAU
3. X/Twitter: 67 million MAU (Japan is one of X/Twitter's most important markets globally)
4. Instagram: 55 million MAU
5. TikTok: 26 million MAU
6. Facebook: 26 million MAU
7. Threads: 17 million MAU
8. Pinterest: 9 million MAU
9. Linkedin: 4 million MAU

Japan's first wave internet success stories

Commercial introduction of the internet to Japan started in 1992 with Internet Initiative Japan (IIJ) as Japan's first Internet Service Provider (ISP), creating a national internet backbone, and offering businesses and individual users paid internet access. Non-commercial internet access was possible earlier at universities. I myself worked at Tokyo University as a member of faculty at the Electrical and Electronic Engineering Department between 1991 and 1996. In 1991 internet access was possible at Tokyo University, and I had one of the first, if not the first, English-language websites in Japan during this time.

In 1995 Softbank invested in Yahoo and then created Yahoo-Japan as a joint-venture with US Yahoo. Around this time a first wave of entrepreneurs started a number of Japanese internet companies, and one of these was GMO Internet, which is discussed in the following section.

GMO Internet

GMO Internet was founded as Voice Media on 24 May 1991 by Japanese entrepreneur Masatoshi Kumagai, even now chairman of the GMO Internet Group. Voice Media was initially a value added (highly priced) voice fixed line services company. Using cashflow from Voice Media, Kumagai built a conglomerate of companies providing a range of internet services, from webhosting to domain registration, from internet payment services to online banking. The GMO Internet group has its own company philosophy / DNA, created by Kumagai, and consists of hundreds of companies, including about 10 companies listed on the Tokyo Stock Exchange. Because of the conglomerate discount, and difficulties in estimating the value of non-listed companies, the overall value is difficult to determine - I estimate that the total value of all GMO Group companies combined is on the order of US$ 10 billion. The GMO Internet Group is an important component of Japan's internet business world, and very well known in Japan, but it does not have much business outside the country.

I was myself an independent, Non-Executive Board Director[38] of one of GMO Internet's group companies, GMO GlobalSign Holdings KK[39], separately listed on the Tokyo Stock Exchange (Code TYO 3788) with about 1000 employees. GMO GlobalSign Holdings KK has an interesting history. The company was founded by current CEO Mitsuru Aoyama as an internet hosting and e-commerce solution company named Ail KK and merged in 1995 with GMO Internet.

GlobalSign was a Belgian venture providing digital encryption certificates, founded in 1996 in Belgium, and acquired by GMO Cloud KK in 2007. GMO Cloud KK later changed its company name to today's GMO GlobalSign Holdings KK. While the company GMO Cloud KK started as an internet hosting provider, with the acquisition of the Belgian digital encryption certificate company GlobalSign, it pivoted successfully into cybersecurity to become GMO GlobalSign Holdings KK. For the Belgian company GlobalSign, this path was to some extent a successful market entry to Japan, however today control is fully with the Japanese GMO Internet Group company GMO GlobalSign Holdings KK, and there are not many traces left of the originally Belgian roots of the company.

Docomo's I-Mode

NTT-Docomo was Japan's first mobile phone network company, starting as a very small part of Japan's former internal telecommunications monopoly NTT. International telecommunications were operated by a second monopoly company, KDD, which owned the monopoly for international communications. NTT-Docomo management is dominated by telecommunication and radio engineers, with deep technical know-how.

European companies, especially Ericsson and NOKIA, pioneered the development of second generation (2G) GSM mobile services — digital voice mobile services which were "circuit switched". First generation (1G) were analog voice mobile communications, dominated at the time by the US company

Motorola. Circuit switched means that when caller A calls caller B, a full communications channel is established and maintained for the entire duration of the call. Even if there is a pause in the discussion, the channel is fully reserved, leading to inefficient use of expensive bandwidth.

NTT-Docomo's CEO and management, radio engineers, understood the difference between circuit switched and much more efficient packet switched networks, and thus NTT-Docomo was the first mobile phone company globally to introduce packet-switched wireless mobile networks, offering the commercial Docomo DoPa service starting in March 1997. Packet switching means that the communication stream is divided into information packets, each packet has a header including routing information, and packets are sent from the sender to the receiver independently. Packet switching is also at the core of internet data transport. With the packet switched wireless communication network in place, NTT-Docomo created the world's first mobile internet service, I-Mode, introduced to the Japanese market on 22 February 1999.

Without packet switched networks, mobile phone companies in Europe, the US, or elsewhere outside Japan could not offer any comparable mobile internet services, and Europe and the US for a long time were restricted to 160-character SMS messages. While the mobile internet started in Japan with i-Mode on 22 February 1999, in the USA and Europe the mobile internet started with Steve Jobs's first iPhone release on 29 June 2007, eight years later than in Japan. Steve Jobs and Apple were, of course, close observers of developments in Japan, and many aspects of Apple's iPhone were inspired by the success of Docomo's I-Mode.

Japan's mobile phone companies pioneered a wide range of services. Here is a partial list of mobile communication services first introduced or invented in Japan:

- Packet switched mobile networks
- Mobile internet
- Applis, apps for mobile phones (first were Docomo's JAVA Applis)
- Camera Phones (the first camera phone was developed by SHARP, but Docomo refused SHARP's offer, so the first camera phone globally was a SHARP phone on J-Phone's network).
- First QR code usage on mobile phones
- First mobile payments
- First mobile wallets
- First mobile phone NFC connections
- First business model for paid mobile services by monthly subscription
- E-moji sets, and much more

Despite much effort, Docomo and Japan's other mobile communication companies did not succeed in building a global business based on their pioneering business models and technologies that were first brought to market in Japan. This failure to globalize pioneering technologies and business models developed for Japan's market is characterized as Japan's Galapagos syndrome. As mentioned at the beginning of this report, one of I-Mode's three creators, Takeshi Natsuno, after leaving NTT-Docomo created the "Post-Galapagos study group" to find out ways in which Japan's Galapagos syndrome could be overcome.

QR codes

QR codes are everywhere today. They are used to access information, for train and airline tickets, for payments, and much more. We can hardly imagine our digital world, and digital payments and digital information management, without QR codes.

QR codes were invented by Masahiro Hara of Toyota subsidiary Denso Wave in 1994 for automotive parts management. Masahiro Hara wanted to improve on traditional bar codes, as found for inventory management and at cash registers in supermarkets. Traditional bar codes had many

disadvantages: they can only encode a very small amount of information, and there is no error-correction. A traditional bar code ticket becomes unreadable if a small part of the bar code is missing. Masahiro Hara's QR codes can encode much more information, and include error correction, so that even if part of a QR code is unreadable, in most cases the encoded information can still be extracted. While Denso Wave retains ownership of the patents to QR codes, Denso Wave decided to waive enforcement, and in many cases Denso Wave's patents have now expired.

Although there have been attempts, including by Microsoft, I do not know of any stand-alone business models for QR codes themselves. Microsoft tried to develop Microsoft Tag into a proprietary competitor to QR codes but failed. Microsoft's High Capacity Color Barcode (HCCB, Microsoft Tag) was discontinued on 19 August 2015. So as far as I know Denso Wave or the Toyota Group does not have a direct business based on QR codes. That said, there is a very large volume of business, including payment businesses and much more, based on QR codes.

Japan's first wave internet ventures

Japan's relatively early adoption of the internet, and Japan's 8-year headstart in bringing mobile internet services to market, led to the foundation of many internet ventures around 1995 - 2000, the first wave of Japan's internet ventures. The GMO Internet Group and GMO GlobalSign Holdings KK were mentioned above, and there are many more.

Many of Japan's first-wave internet companies remained mid-sized companies by global standards, e.g. market capitalization on the order of EURO 1 billion; none of them became new Googles, Alphabets, Apples or Microsofts. All became success stories big enough to serve as inspiration for subsequent Japanese entrepreneurs, created venture funds investing in subsequent ventures, and several of their founders became Japanese community leaders, serving on Japanese government committees to push for changes.

Here some examples:

- Gree was founded as the social network service (SNS) GREE in December 2004. Today Gree Holdings[40] is a social media and video game company listed on the Tokyo Stock Exchange (TYO 3632) with a market capitalization of around 73 billion YEN (EURO 400 million).

- CyberAgent was founded in 1998 as a digital advertising company, and listed on the Tokyo Stock Exchange (TYO 4751) with a market capitalization of around 700 billion YEN (EURO 4 billion)

- DeNA, offering mobile portal ad e-commerce websites, Mobage cell phone platform, and the e-commerce website DeNA Shopping, was founded in 1999, and is listed on the Tokyo Stock Exchange (TYO:2432), with a market capitalization around 290 billion YEN (EURO 1.6 billion)

- Netyear Group, covering digital technologies, digital marketing strategy, and B2B marketing, was founded in 1999, and is listed on the Tokyo Stock Exchange (TYO 3622), with a market capitalization around 4 billion Japanese yen (EURO 22 million)

- Mixi[41], founded as job site Find Job! In 1997, started the social network service (SNS) mixi in 2004, and is listed on the Tokyo Stock Exchange (TYO 2121) with a market capitalization around 200 billion YEN (EURO 1.1 billion)

Did Japan miss out on the initial development of the internet?

Quick answer: No - Japan did not miss out on the initial development.

Internet commercial business development in Japan started not much later than in the USA. In Japan it was much driven by Masayoshi Son's Softbank and his investment in Yahoo, and subsequent foundation of Yahoo-Japan. In addition to SoftBank, several other early internet companies were founded, most mentioned in this report, such as Rakuten, and the GMO Internet Group.

Of course the large telecommunication groups NTT and KDDI - the former monopoly telecommunications service providers - continued to play an important role in developing Japan's internet and IT business space. NTT Docomo, KDDI and SoftBank's predecessor company Japan-Telecom/J-Phone had an important global impact in creating the first mobile internet services, 8 years before Steve Jobs and Apple's iPhone brought mobile internet to the US and European markets.

However, there is no Japanese (and no European) company remotely comparable in size, market capitalization and impact to the large US West Coast based Apple, Google/Alphabet, Facebook/META, Amazon, NVIDIA, and now OpenAI. SoftBank is maybe the Japanese company closest to the leading US internet companies, but SoftBank's market capitalization is about 25 times smaller than Apple's, 20 times smaller than Alphabet's and 15 times smaller than Amazon's.

Japan's DX case studies

Hitachi
Hitachi today is one of Japan's most successful traditional large industrial conglomerates. Hitachi was founded in 1910 in the town of Hitachi in Ibaraki-ken as a subsidiary of the Kuhara Mining Plant as an electrical machinery manufacturer and electrical repair shop. Hitachi is listed on the Tokyo Stock Exchange (TYO:6501), with a market capitalization of around 22 trillion YEN (EURO 122 billion). In business structure and size Hitachi is comparable to Germany's SIEMENS.

Around 1990 Hitachi was ranked the 9th largest company globally by revenue, while today Hitachi is ranked about 26th to 38th globally by revenue, and 137th most valuable by market capitalization. In 2008, Hitachi suffered the greatest annual loss of any company in Japanese history: US$ 7.8 billion in the single Financial Year 2008. While very painful, this dramatic loss enabled Hitachi's management to break through internal resistance and conflicts of interest. Hitachi restructured dramatically during the period 2008 to 2018:

- Reducing stock market listed group companies from 22 to 4
- Reducing consolidated subsidiary companies in Japan from 400 to 202

Hitachi changed its governance structure from Japan's traditional structure, where the same group of employees are simultaneously executives and Board Members, i.e. a single board, which simultaneously manages the company and supervises the management.

Following Japan's governance reforms[42], Hitachi switched to a new model now available in Japan, with an Executive Management Board, supervised by a Board of Directors composed largely of independent Directors who are not Hitachi insiders, and three committees

1. The Nomination Committee
2. The Audit Committee, and
3. The Remuneration Committee.

In 2021 Hitachi acquired the US headquartered and Indian origin software developer and digital engineering company GlobalLogic for US$ 9.6 billion. As part of Hitachi's digital transformation, Hitachi Vantara[43] offers data management, cloud infrastructure, infrastructure as a service, AI and analytics services.

Hitachi Lumada[44] focuses on co-creating value with customers based on digital transformation and includes Hitachi's Lumada Innovation Hub Tokyo[45].

All Nippon Airways (ANA) and Japan Airlines (JAL) vs Lufthansa

Japan Airlines (JAL) and All Nippon Airways (ANA) today are both globally highly respected airlines, with very different histories.

Japan Airlines is Japan's "national flag carrier", established in 1951 as Government-owned business. On 19 January 2010 Japan applied for protection under the Corporate Rehabilitation Law, and on the following day it was delisted from the Tokyo Stock Exchange.

Transport Minister Seiji Maehara personally visited Kyocera Headquarters to persuade the highly respected Kazuo Inamori, the founder of Kyocera and of KDDI, to become CEO of JAL and to manage its turnaround. I had the opportunity to hear Kazuo Inamori report about this at the Foreign Correspondents Club FCCJ in Tokyo[46].

Until 2014 Japan Airlines had two totally separate reservation systems:

- One reservation system for domestic in-Japan operations and
- A second independent reservation system for international operations.

In 2014 Japan Airlines switched[47] to a single integrated reservation system outsourcing the passenger service system (PSS) to the European, Spain-based Amadeus Altéa[48] system.

All Nippon Airways (ANA) started as Japan Helicopter and Aeroplane Transports Company, a helicopter service between Japan's many islands. Even today ANA's IATA airline code is NH, an abbreviation for Nippon-Helicopter. In the same way as Japan Airlines, ANA uses totally separate reservation systems for domestic and international flights. ANA will integrate domestic and international passenger service systems (PSS) on the Amadeus Altéa platform during 2025-2026[49].

It is interesting to compare ANA,'s JAL's and Lufthansa's paths to PSS digital transformation. ANA and JAL until recently had totally separate passenger service systems (PSS) and over the last 10 years switched to the European Amadeus Altéa cloud-based system.

Lufthansa, on the other hand, is a co-founder of Amadeus IT Group SA. Lufthansa co-founded Amadeus IT Group SA in 1987 together with Air France, Iberia, and SAS, i.e. almost 40 years ago, in order to create a neutral global distribution system (GDS). Here, "neutral" means that Amadeus does not in itself favor one particular airline or group of airlines.

Since we are looking in this report at Japan's digital transformation (DX), we could comment that while Lufthansa and other European airlines – Air France, Iberia, SAS – jointly created a neutral PSS and distribution system almost 40 years ago, the Japanese airlines JAL and ANA decided to join Amadeus 40 years later, finally combining their until recently separate domestic and international reservation and passenger service systems.

Artificial intelligence (AI) and quantum computing

Japan's government and Japanese industry see artificial intelligence (AI) as one of the most important revolutions in our lives, and see both the opportunity for new business growth, and the perils of losing initiative to the AI leaders USA and China. Most Japanese companies have AI programs and business development. There are large investments in AI-focused data centers.

Most remarkable is the Tokyo based venture company Sakana.ai. Sakana.ai is one of Japan's most valuable privately held recently founded AI based venture companies, with a valuation of US$ 2.65 billion following their latest funding round. sakana.ai's lead investors are Khosla Ventures and In-Q-Tel, and a large number of Japanese financial and industrial companies. sakana.ai is often held up by Japan's government and many others as a success story demonstrating the vitality of Japan's venture eco-system.

Japan's government, major industrial and financial companies, traditional trading companies (Mitsubishi Shouji, Mitsui Bussan, etc.) all aim for Japan to become a global leader in quantum computing, both in producing Japanese-made quantum computers and in applications. All invest in quantum computer development, application development and exploratory use for commercialization.

To my knowledge about 4 quantum computing systems are in operation in Japan, and of course many more globally are accessible via the cloud from Japan. This includes one of Japan's largest traditional trading companies cooperating with a foreign trapped-ion-based quantum computers venture, developing a wide range of industrial and financial application projects with their customers. They operate a trapped-ion quantum computer in a data center in Tokyo for commercial customers, mainly in Tokyo's financial industry.

Several Japanese-produced quantum computing systems are operating or in development, including at Osaka University and RIKEN. Most are cooperative endeavors between public research universities, public laboratories, and Japanese industrial companies for commercialization.

IBM Quantum System launched their first commercial quantum computer in Japan in 2021, updated to a 127-qubit Eagle processor in 2023.

DX: Opportunities for European companies in Japan

Japan's digital transformation (DX) and accompanying management transformation creates many opportunities for European companies, which can provide valuable solutions needed by Japanese companies.

Salesforce.com started to acquire large lead customers after the CEO change in 2003, while the initial CEO during 2000-2003 focused on small and medium enterprises (let us not conclude that this was a mistake: we believe, that without this initial work during 2000-2003 and establishing a track record in Japan, it would not have been possible to acquire the large model customers like Japan Post later). For the acquisition of small and medium sized enterprises in Japan, a key factor was the preparation of industry/business specific templates, initially 25 but later increased to 45, starting with a real estate agent business template. Another key driver specific to Japan is the very deep penetration of broadband connectivity, especially for mobile communications, and very high bandwidth mobile phone usage. The high frequency of natural disasters in Japan also favors cloud-based solutions from the business continuity point of view.

The top regional System Integrator (SI) partners driving salesforce.com business in Japan are NTT-Data, NTT-Communications, HitachiSoft, and NEC, as well as the ISV and VAR partners listed below.

Japan Post is Japan's headline customer, which created a shift in Salesforce.com's Japan business. Japan Post business was in partnership with NTT-Data initially, and then with HitachiSoft. There are now many partners beyond that.

Key milestones:

Company foundation: April 2000 (100% owned by JV-Partner)

Joint-Venture between Salesforce.com (75%) and JV-Partner (25%) formed: Oct 27, 2000

Japan service started: April 1, 2001

CEO changed to Eiji Ueda (March 2004)

Japan Post customer agreement: April 18, 2007

Joint-Venture dissolved, Salesforce.com acquires 100% of KK Salesforce.com: Oct 27, 2010

Toyota-Friend Joint-Venture with Toyota and Microsoft: May 23, 2011

With the relatively low exchange rate for the Japanese yen, and many factors pushing for transformation in the country, many opportunities exist for European companies to build business in Japan, or to invest in Japan. This includes acquisitions in Japan of companies with succession problems. There is a large number of excellent and profitable companies in Japan where no obvious successor exists to replace the aging CEO or founder, and the company is threatened with having to close.

DX: Opportunities for Japanese companies in Europe

In my view the most important opportunities for Japanese companies in Europe are to acquire or invest in one or more of Europe's excellent deep-tech venture companies. I mentioned GMO Cloud KK's acquisition of the Belgian venture GlobalSign, which has become GMO Cloud KK's core business, to the extent that the company name was changed to GlobalSign Holdings KK.

Another example is Japan's medical equipment company Terumo acquiring Oxford University spin-out company OrganOx for approximately US$ 1.5 billion, as announced on 30 October 2025. OrganOX is based on the work of Oxford University's Professor for Transplantation, Peter Friend. OrganOX produces the world's first normothermic machine perfusion (NMP) platform, transforming the entire field of organ technology.

There are many more examples of Japanese companies acquiring or investing in European deep-tech companies.

Summary and look into the future

The present is a very good opportunity for transformation in Japan, but it is also a critical time. With long years of no growth, Japan needs new business models to increase competitiveness and value creation based on IT and data, in a world of accelerating change. Long years without growth have also created the necessary pressure to enable transformation. We can be inspired by Hitachi's transformation, which was enabled by the largest losses of any Japanese company ever.

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