Artificial Intelligence in Japan

Industrial Cooperation and Business Oportunities for European Companies

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EU-Japan Centre
for Industrial Cooperation
日欧産業協力センター

"Over the next decade or two, approximately 49% of Japan's working population will be able to be replaced by AI or robots."

[1].

Please consider the environment before printing this document

About this report

This report has been made by Guillermo García for the EU-Japan Centre for Industrial Cooperation, a joint venture between the European Commission and the Japanese Ministry of Economy, Trade and Industry (METI). The Centre aims to promote all forms of industrial, trade and investment cooperation between Europe and Japan. For that purpose, it publishes a series of thematic reports designed to support research and policy analysis of EU-Japan economic and industrial issues.

To elaborate this report, the author has relied on a wide variety of sources. He reviewed the existing literature, including research papers and press articles, and interviewed a number of AI thought leaders and practitioners to get their views. He also relied on the many insights from the Japanese Artificial Intelligence community, including startups, corporation, regulators, associations and developers.

THE AUTHOR

Guillermo García is a Computer Engineer, Software Developer and Product Advisor at an Invest Fund specialized in tech startups including AI.

He has spent more than ten years working in the videogames industry where AI is being intensively used to control NPCs (Non-player characters, any character that is not controlled by a player). He graduated from an executive business program at Waseda University in Tokyo. Guillermo has published a travel guide book of Tokyo. After living in Japan he moved to New York where he learned iOS App Development. He can be reached on LinkedIn

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EXECUTIVE SUMMARY

Japan has positioned itself as a powerful and mainly independent force in the aspect of technological innovations that is progressive and in tune with that of other developed nations on the global map.

Unlike other countries into artificial intelligence development, Japan has been focused mainly on the cultural and social aspects of development rather than allocating resources to the military for war preparedness like the US or UK.

With more interest in robotics as sub-domains of artificial intelligence, Japan prides itself as a pivotal nation in the development of AI technology for medical and industrial purposes. The Japanese government is betting on AI to rewrite Japan's plan for the future and place Japan in a quintessential place among the league of technologically developed nations.

In January 2016, the Japanese government published its 5th Science and Technology Basic Plan[1] in which it sets the goal for Japan to become a "Society 5.0".

Society 5.0 is Japan's vision for the next step in human evolution. It comes after hunter-gather, agrarian, industrial, and information societies.

This new society is supposed to enhance industrial competitiveness and help with the establishment of a society more in tune with individual needs. It recognizes the vast potential of accumulating data, and new technologies, to find solutions to urging social issues like the declining birth rate, a rapidly aging population, and energy and environmental matters.

According to the Social Principles of Human-Centric AI document published in February 2019 Society 5.0 is a sustainable human-centric society that implements AI, IoT (Internet of Things), robotics and other cutting-edge technologies to create unprecedented value.

Business opportunities for EU companies

With the Japanese AI market expected to grow to JPY 87 trillion in 2030, an abundance of opportunities exist to European companies hoping to invest in startups and top-scaled Japanese AI firms.
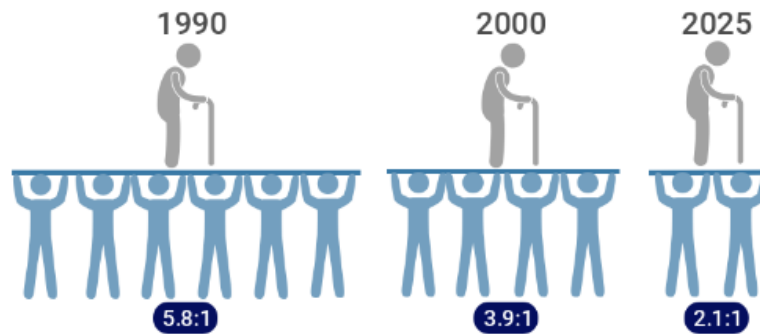
Inadequate funding and lack of versatility in creativity have been the historical fac-

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[1] 5th Science and Technology Basic Plan English report

A heavier lift
By 2050 Japan's dependency ratio—the number of aged dependents per worker—will rise to about 75 percent, by far the highest of any country.
(Ratio of workers to pensioners)

1990   2000   2025

5.8:1   3.9:1   2.1:1

Source: Japan Cabinet Office, White Paper on Aging 2017.

tors associated with artificial intelligence development in Japan. But the times have changed, and new data shows that the country is re-pivoting itself as a future AI force with increasing advent of small, promising AI startups taking shapes around the country.

This new approach provides business opportunities for European companies interested in AI Technology and Solutions.

The utilization of deep learning in AI is still a little behind in Japan; this will offer European companies the opportunity for robust delivery in this massive sub-segment which is also expected to grow into trillions of Yen in a little over a decade.

Japan is a superpower of **hi-tech products** making around a fourth of the world's production. Also, Japanese companies make around 30% of all **cars**. This huge market is a massive opportunity for AI foreign companies offering services to either of these industries.

The whole Japanese **videogames** industry is being disrupted by new smartphone game companies whose combined revenue surpasses the revenue of the eight biggest traditional game companies like Nintendo, Sony or Bandai Namco. This relatively new area presents an excellent opportunity for European videogames companies with experience on AI such as developing pathfinding, decision trees to guide the actions of NPCs, etc.

The global **shortage of IT talent** is hitting Japan hard and to lure and keep top talent companies need to offer hefty annual paychecks. This worrying problem can

provide an opportunity for EU software development companies, universities and continuing education companies to partner with tech giants like NTT and others to help them cope with this lack of talent. European companies need a future-oriented education based on lifelong learning and further education ideally supported by micro or mini credentials.[1]

Japan's population is aging fast and shrinking.

Some reports fear that Japan's total population could fall to around 87 million by 2060[2].

As a result, in 2060, there will only be 1.2 people of contributing age (20-64) supporting an aged dependent (65 or above). That compares with 2.6 supporting an aged dependent in 2010[3].

This aging society will benefit those companies providing opportunities for the elderly to remain in the workforce longer and also helping them engage in volunteering, care, and creative activities. These offer both social and economic benefits and relieve some of the fiscal pressures related to aging societies.
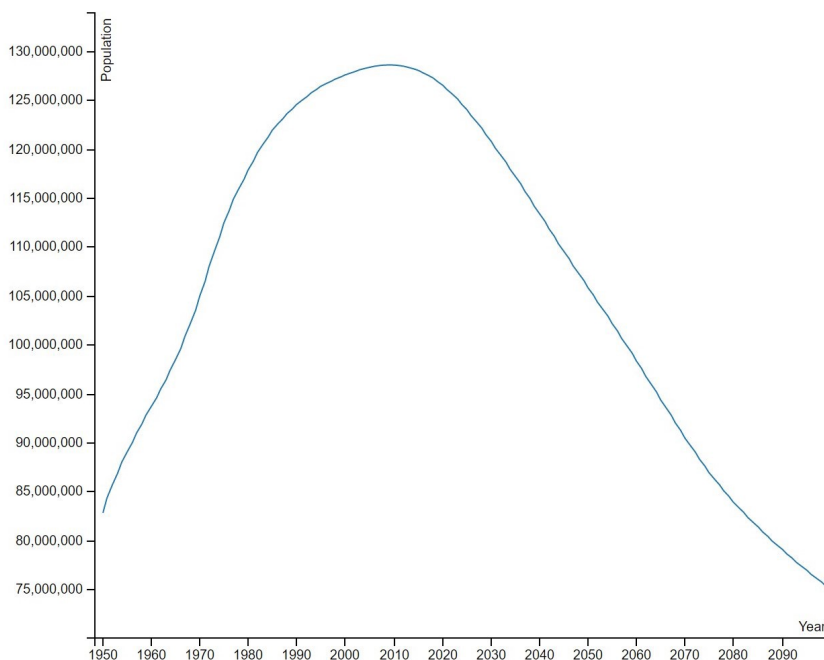
[1] Future Oriented industrial policy for Europe
[2] United Nations Experts Group Meeting on Policy Response to Low Fertility
[3] The Impacts of Population Decline in Japan

Other applications, like the one from the Accenture Liquid Studio[1]'s platform, could learn user preferences and behaviors and with that information suggest physical and mental activities.

Human pose detection is a critical application for elderly care robots for quick responses when accidents or falls happen.

Human pose detection with TensorFlow[2]

The Toyohashi University of Technology[3] developed a method [4] to evaluate various human poses using deep learning with depth data gathered from twin cameras installed in elderly care robots.

The elder will also require all types of eldercare robots applying machine learning, and computer vision to enable proactive suggestions, entertainment, and other activities in addition to wellness & environmental monitoring.

For example, a robot can remind human companions to take their medicines, remind the owners about appointments, and arrange methods of transportation for them.

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[1] Accentures Liquid Studio AI for the Elderly

[2] Human pose detection with TensorFlow - Medium

[3] ToyoHashi Universe of Technology

[4] Human pose estimation for care robots using deep learning

Pepper' during an afternoon exercise routine at Shin-tomi nursing home in Tokyo - Reuters[1]

[1] Pepper' during an afternoon exercise routine at Shin-tomi nursing home in Tokyo - Reuters

"Success in creating AI would be the biggest event in human history. Unfortunately, it might also be the last, unless we learn how to avoid the risks."

Stephen Hawking[1]

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[1]English theoretical physicist, cosmologist, and author

AI Concepts

3 TYPES OF AI

#1: ARTIFICIAL NARROW INTELLIGENCE (ANI)

Amazon's Alexa and Apple Siri are examples of ANI

Amazon's Alexa and Apple's Siri

An AI is called ANI (also known as Weak AI or Narrow AI) when its ability to simulate the intelligence of a human is secluded to a narrow range of parameters and contexts. That it an AI that was created to perform a specific task.

It is important to understand that narrow intelligence is not low intelligence.

Google uses an AI to rank pages and although it performs a narrow range of parameters and within a limited context this AI is not stupid. It's a complex multibillion dollars technology, but it cannot do much other than ranking pages.

#2: ARTIFICIAL GENERAL INTELLIGENCE (AGI)

An AI is called AGI (also known as Strong AI or Deep AI) when its ability to simulate the intelligence of a human is indistinguishable from that of a human.

We are still far from this level of complexity and simulate neural activity is an extremely difficult endeavor.

#3: ARTIFICIAL SUPER INTELLIGENCE (ASI)

An AI is called ASI when it doesn't imitate the intelligence of a human but transcends it. It would be able to surpass humans at everything: physics, architecture, philosophy, creativity, medicine, music… ASI is still in a speculative level, we can only imagine what it could be able to do but our own limitations inhibit us from seeing its real potential.

A synopsis of Artificial Intelligence

In order to understand the importance of AI it might be helpful to cover a few concepts first:

EXPONENTIAL GROWTH

The amount being added to a system is proportional to the amount already present. Something grows in relation to its current value, for example something doubles every month. Imagine you had 3 ladybugs 2 months ago and now you have 18.[1]

y(t) = a × ekt

Where y(t) = value at time "t"

a = value at the start = 3

k = rate of growth

t = time

e = Euler's Number[2] (2.718281828459…)

18 = 3 x e2k

Rate of growth (k) has to be greater than 0 or it wouldn't be exponential growth but exponential decay.

Taking the natural logarithm we know that:

k = ln(6)/2

In 2 more months you would have 108 ladybugs

And in one year you would have over **800,000 ladybugs.**

The graph of exponential growth looks like a straight line increasing with time but then suddenly this line becomes a very steep, almost vertical curve.

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[1] Math is fun

[2] Euler's Number, Math is Fun
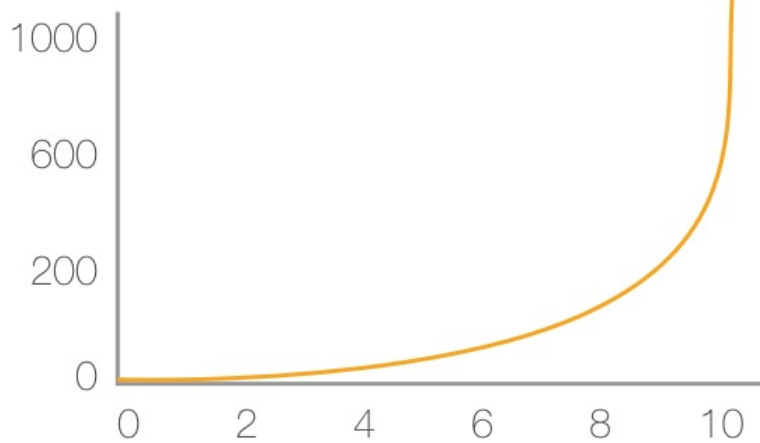
Example of Exponential Growth. Figure by the author.

MOORE'S LAW

Gordon Moore - 1981[1]

Moore's law States that the number of transistors on a microchip doubles every 18 months. Therefore we can observe an exponential growth in the microprocessor industry.

Gordon Moore was one of the founders and the CEO of the company Intel. He made the observation that later became Moore's Law in 1965.

Almost every aspect of any technologically advanced society benefits from this since smartphones, tablets, computers and every imaginable electronic device carries a processor inside. Faster computers can improve every industries from education to transportation, healthcare, communication, defense, music production, space exploration, economic growth, etc…

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[1] Gordon Moore - intel.com
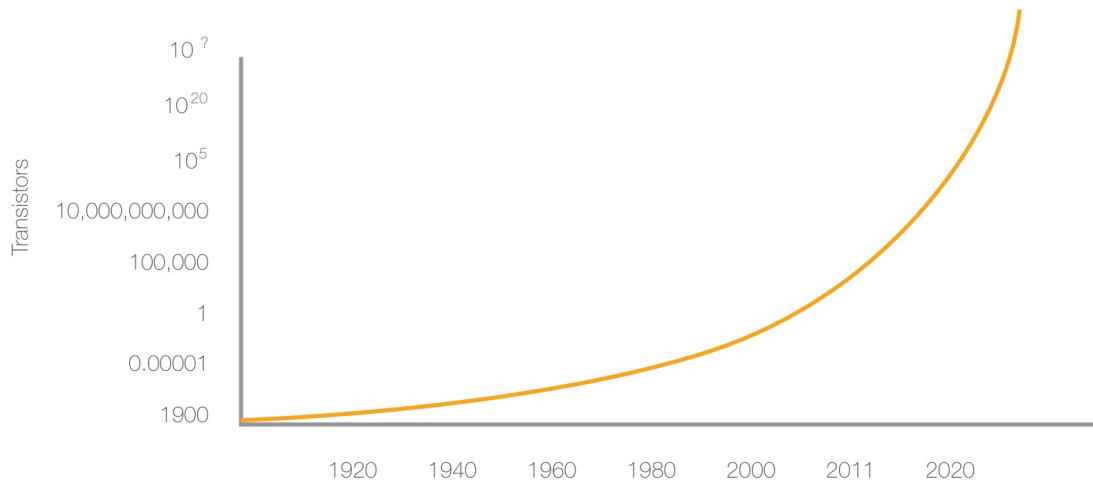
Advancement of number of transistors in the last century. Figure by the author.

According to some experts, and to Moore himself, **this trend cannot go on forever** and eventually it will "hit a wall". In part because of the huge amounts of energy required to cool down transistors which at some point would be higher than the actual energy passing through those transistors. Also it is expected that within fifteen years transistors size will approach the atomic scale, and so they must eventually end their shrinking[1].

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[1] The Foresight Guide, Superexponential Growth

"So we won't experience 100 years of progress in the 21st century — it will be more like 20,000 years of progress"[1]

Ray Kurzweil

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[1] <u>Ray Kurzweil, director of engineering at Google, futurist, inventor and author</u>

MORAVEC'S MIND CHILDREN

Hans Moravec

Hans Moravec[1] is an Austrian born Canadian futurist, computer scientist and author most famous for his works on artificial intelligence, robotics and his prediction that computer intelligence will reach human intelligence by 2040 and that machines will far surpass us in the years after. He believes that robots would overtake humans in the near future.

In his book from 1988 Mind Children and in a series of articles previous to the book, he generalizes Moore's Law's exponential growth and extrapolates it to other technologies including future forms of technology.

GERALD HAWKINS' MINDSTEPS

Gerald Stanley Hawkins - 1965[2]

Gerald Stanley Hawkins[3] was a British-born American astronomer and author

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[1] Encyclopedia Britannica, Hans Moravec

[2] Gerald Hawkins, Dickinson College archives

[3] Wikipedia, Geras Hawkins

renowned for his work in the field of archaeoastronomy, the study of the knowledge, interpretations, and practices of ancient cultures regarding celestial objects or phenomena[1].

In his book from 1983 "Mindsteps to the Cosmos" Hawkins explained his idea of 'mindsteps', dramatic and irreversible changes to models or world views, like giant leaps of understanding. He identified as mindsteps the invention of imagery, writing, mathematics, printing, the telescope, rocket, radio, TV, computer... "*Each one takes the collective mind closer to reality, one stage further along in its understanding of the relation of humans to the cosmos.*"

He couldn't help but to notice the acceleration in the arrival of new mindsteps since the waiting period between each mindsteps is getting shorter.

He developed an empirical 'mindstep equation' to quantify this, and gave dates for future mindsteps. The date of the next mindstep is 2021, then 2045 and 2051, until the limit of the series in 2053.

VINGE'S EXPONENTIALLY ACCELERATING CHANGE
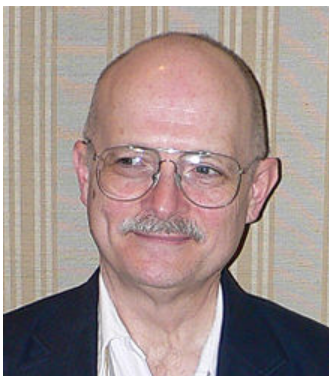
Vernor Steffen Vinge - 2006[2]

Vernor Steffen Vinge[3] is an American author and retired math and computer science professor at the San Diego State University.

He has won 5 Hugo Awards, one of the most important literary awards given annually for the best sci-fi and fantasy works and achievements.

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[1] The Free Dictionary, Archaeoastronomy

[2] Vernor Vinge - Wikipedia

[3] Wikipedia, Vernor Steffen Vinge

Vingel is notorious for his exact scientific approach to science fiction on his books. He is the initiator of the technological singularity concept.

In his novel from 1986 *Marooned in Realtime* he popularized the idea of exponentially accelerating technological changes that lead to shorter and shorter periods of time between the emergence of very sophisticated technological changes until human comprehension is reached.

In a subsequent novel A Fire Upon the Deep from 1992, he tales the story of a superintelligence passing through exponentially accelerating technological states until it transcends or reaches an almost omnipotent state incomprehensible by humans.

KURZWEIL'S THE LAW OF ACCELERATING RETURNS

Ray Kurzweil - 2005[1]

Ray Kurzweil[2] is an American futurist, inventor, author and director of engineering at Google.

He has published books on AI, optimal health, transhumanism, futurism and the technological singularity.

He coined the term The Law of Accelerating Returns in one of his books, The Age of Spiritual Machines, published in 1999. The law explain how the rate of change in a variety of evolutionary systems tends to increase in an exponential way. This does not only apply to technologies but to other systems too.

He also believes that whenever certain technology reaches a point or barrier at which it cannot progress any further, another technology gets invented that will al-

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[1] Ray Kurzweil - Wikipedia

[2] Wikipedia, Ray Kurzweil

low to cross that barrier. According to Kurzweil these changes, or paradigm shifts, will happen so rapidly and will represent such profound changes that humanity will experience a transformation like nothing we have experienced before in human history.

Ray also states that before the end of the 21st century and because of the Law of Accelerating Returns a technological singularity will take place and a machine intelligence will surpass human intelligence. Kurzweil expects this to happen sometime around the year 2045.

TECHNOLOGICAL SINGULARITY[1]

The **technological singularity** (also, simply, **the singularity**) is a theoretical point in the future when technological growth becomes uncontrollable and irreversible, resulting in unfathomable changes to human civilization.

According to the most popular version of the singularity hypothesis, called intelligence explosion, an upgradable intelligent agent (such as a computer running software-based artificial general intelligence) would enter a "runaway reaction" of self-improvement cycles, with each new and more intelligent generation appearing more and more rapidly, causing an intelligence explosion and resulting in a powerful superintelligence that would, qualitatively, far surpass all human intelligence.

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[1] Technological Singularity ' Wikipedia

Status of AI Industry in Japan

The Japanese A.I. industry is not the most competitive on a global scale. Just around 2 percent of research papers published on A.I. come from Japan.

Professor Yutaka Matsuo[1], from the University of Tokyo, alleges that A.I. is one of the few areas that could offer market opportunities for Japanese industries.

Professor Yutaka Matsuo (Photo by Keiichiro Sato)

However, for the Japanese monozukuri (ものづくり, technological prowess, know-how, and spirit of Japan's manufacturing practices) to get an advantage over competition, Japanese companies have to adopt deep learning more intensively and not only focus on IoT.

Several venture capital funds have set up in Japan with a focus on A.I. Realtech Fund, target technology start-ups and is one case into which Japanese companies have invested money.

This fund is one of the most important venture capital funds in Japan, including only private-sector companies. Investments cover ten fields, including A.I.

During the last 10–20 years, Japan has lost its technology leadership to companies in the west, and mostly because of software deficiencies.

Japan is still at the forefront of hardware development, such as robots and automobiles. However, this stronghold is in danger of being lost because software is increasingly critical to making those products work and to compete on the international market.

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[1] Yukata Matsuo's personal page

Toyota production line

When it comes to deep learning, there is a clear difference between Japan and the U.S., Europe, or China. In Silicon Valley, deep learning is mainly a way to make software better. Many Japanese companies, however, tend to look at deep learning as a way to improve the hardware.

For a long time, Japanese companies have been focusing on robot manufacturing itself (hardware) while overseas companies have focused more on the software side. Japanese manufacturers now need to implement a more customer-oriented perspective to develop robots that better match the users' needs. The Japanese government aims to trigger a robotics revolution with AI-equipped robots that can communicate with each other.

The Cabinet Office Council[1] on industrial competitiveness has announced that the introduction of self-driving cars, drones, and technologically enhanced production management, including smart factories, is expected to raise Japan's productivity.

The Prime Minister Shinzo Abe himself said the following:

"The key of the second stage of Japan's growth strategy is the realization of the fourth industrial revolution. Individualized services and new business models tailored to each individual will be created as a result of IoT and robots. All factories and shops will be connected through IoT, enabling zero inventory and instantaneous order-made production. This could represent a game-changer for industry as we know it."

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[1] Industrial Competitiveness Council

Prime Minister Shinzo Abe making the statement

A report by a separate council on regulatory reform is recommending 80 changes in fields such as medicine, employment, and investment. Another development that, over time, will cause the A.I. market to expand is the trend that Japanese corporations are setting up AI R&D bases in the U.S., for instance, Toyota and Hitachi.

In addition to applications in self-driving cars, Toyota is planning to use A.I. to improve people's lives via robots. Being exposed to new ways to incorporate A.I. into products and platforms will positively impact the domestic A.I. market as a result.

Public Japanese research institutes such as AIST and RIKEN have established R&D centers, and this is expected to speed up new technological advancements within the A.I. field.

The shrinking population will start taking a toll on the labor market as the population continues to get old. Japan plans to make up for the shortfall in the working people with extensive use of AI-powered robots.

TRENDS

Artificial intelligence has started to gain attention in Japan beyond research institutes and corporations already active in this field. Media coverage is increasing, with many articles appearing in economic newspapers such as Nikkei Shimbun.

Honda has established an R&D base in Tokyo, specializing in artificial intelligence. The firm will consolidate most of its AI-related R&D activities in Japan into this base called Honda R&D Innovation Lab Tokyo.

Nomura Research Institute[1] has tried to quantify the potential impact of artificial intelligence on the job market and has indicated that robots or artificial intelligence may replace approximately half of Japan's labor force within the next 10–20 years. The service sector will be the most severely affected.

Artificial intelligence is increasingly entering a commercialization phase in Japan. According to the Japanese government, A.I. technologies are expected to generate an economic return of about JPY 121 trillion by 2045.

According to a study by **Ernst & Young Institute**[2], the size of the A.I. market is expected to reach 23 trillion in 2020, a six-fold increment. Moreover, by 2030, the market size will reach about JPY 87 trillion.

The transport sector, including driverless taxis and trucks, will exhibit the most significant increase over the estimate period and is expected to reach JPY 30.5 trillion by 2030.

The manufacturing sector that includes self-driving vehicles is predicted to grow to nearly JPY 12.2 trillion by 2030. The study gives examples of major AI-related factors that will impact the market:

improved cost efficiency, further development of a driverless society, and extensive use within the manufacturing industry.

EXAMPLES OF AI

Customers organizations in various sectors of the economy are already using A.I.

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[1] Nomura Research Institute

[2] EY Institute

technologies in diverse business cases. For example, banking speech recognition technology is used to automate customer service telephone interactions.

• Mizuho Bank is using a combination of IBM's Watson AI platform and Softbank's Pepper humanoid robot to provide customer support.

• The public sector has adopted A.I. technologies for a variety of purposes.

• West Japan Railway is applying A.I. to identify signs of intoxication in passengers at train stations. In media & advertising, some companies are using data analytics technology to outline articles such as corporate earnings reports automatically.

• CyberAgent, a Tokyo-based leader in AI-empowered Internet ad business, supports advertising and promotion activities to customers in Japan.

• In the recruitment area, companies like Tokyo-based Forum Engineering, use people analytics to help customers find the best candidate for a job.

EUROPE AND JAPAN STATUS ON AI
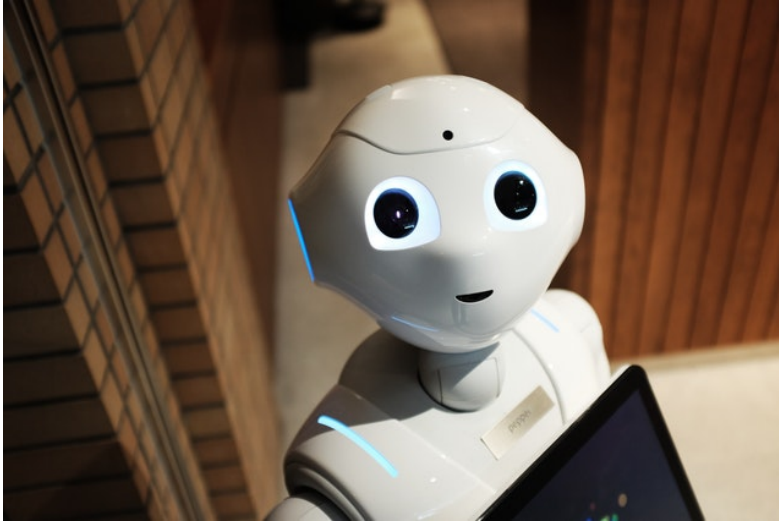
JAPAN

In 2016, Japanese Prime Minister Shinzō Abe required the Japanese government to build up a «Artificial Intelligence Technology Strategy Council». They then created the Artificial Intelligence Technology Strategy[1]. In June 2018, the Japanese government reported that artificial intelligence would likewise turn into an official piece of its

«integrated innovation strategy.» The administration plans to «dramatically increase» young specialists in the AI field with funding to priority areas.

Another component of Abe's strategy is to bring together information organizations and measures all through different businesses to upgrade the capacity to use big

[1] Artificial Intelligence Technology Strategy

data techniques in Japan. In November 2017, an artificial intelligent «boy» was allowed residency in Tokyo. The AI framework is a chatbot coded to act like a seven year old kid named Mirai, which means «future» in Japanese. The choice to make Mirai an official resident is part of a project for making local government more accessible to local citizens.

On July 28, 2017, Japan published the Draft AI R&D GUIDELINES for International Discussions in anticipation of the Conference toward AI Network Society. In this document Japan recognizes the enormous benefits that AI will bring for people as well as for the society and the economy, making important contributions to solve different difficulties that people, local communities, countries, and the world are faced with.

They also identify certain risks such as lack of transparency and loss of control.

In view of such awareness, the purpose of these guidelines are to protect the advantages of users and preventing the spread of risks, therefore achieving a human-centered "Wisdom Network Society" by way of improving the benefits and decreasing the risks of AI.

Identifying its purpose, the Guidelines lists five fundamental philosophies:

1. To achieve **a human-centered society** where all human beings across the board enjoy the benefits from their life in harmony with AI networks, while human dignity and individual autonomy are respected.

2. To **share the Guidelines**, as non-binding soft law, **and their best practices internationally among stakeholders**, as, with the rapid development of the R&D and utilization of AI, networked AI systems are expected to have broad and significant impacts on human beings and society beyond national borders.

3. **To ensure an appropriate balance between the benefits and risks** of AI networks, so as to: (a) promote the benefits from AI networks through innovative and open R&D activities and fair competition; and (b) mitigate the risk that AI systems might infringe rights or interests, while fully respecting the value of the democratic society such as academic freedom and freedom of expression.

4. To make sure that AI R&D activities based on specific technologies or techniques are not hindered in light of **ensuring technological neutrality**, and **to be mindful that developers are not imposed of excessive burden**, as the rapid progress of AI-related technologies is anticipated to continue. And

5. **To constantly review the Guidelines and flexibly revise them as necessary** through international discussions, considering the extent of the progress of AI networking, because AI-related technologies and AI utilization are expected to continue to advance dramatically. Also, to strive for broad and flexible discussions

including the involvement of related stakeholders, when reviewing the Guidelines.

The guidelines also list 9 AI A&D principles:

1. **Principle of collaboration**: Developers should pay attention to the interconnectivity and interoperability of AI systems.

2. **Principle of transparency**: Developers should pay attention to the verifiability of inputs/outputs of AI systems and the explainability of their judgments.

3. **Principle of controllability**: Developers should pay attention to the controllability of AI systems.

4. **Principle of safety**: Developers should take it into consideration that AI systems will not harm the life, body, or property of users or third parties through actuators or other devices.

5. **Principle of security**: Developers should pay attention to the security of AI systems.

6. **Principle of privacy**: Developers should take it into consideration that AI systems will not infringe the privacy of users or third parties.

7. **Principle of ethics**: Developers should respect human dignity and individual autonomy in R&D of AI systems.

8. **Principle of user assistance**: Developers should take it into consideration that AI systems will support users and make it possible to give them opportunities for choice in appropriate manners.

9. **Principle of accountability**: Developers should make efforts to fulfill their accountability to stakeholders including AI systems' users.

EUROPE

High-Level Expert Group on Artificial Intelligence, In June 2018, a group of independent experts was appointed by the European Commission as part of the AI Strategy. This group of 52 experts will have as a general objective to advance the implementation of the European policy on AI.

The High-Level Expert Group on Artificial Intelligence (AI HLEG) will develop recommendations on future-related policy development and on ethical, legal and societal issues related to AI, including socio-economic challenges.

The group's responsibility is to advise the Commission on next steps addressing AI-related mid to long-term challenges and opportunities and recommend AI ethics guidelines covering concerns such as fairness, safety, transparency, the future of work, democracy and the impact on privacy and personal data protection, dignity, consumer protection and non-discrimination.

In January 2019 and as a result of this work the AI HLEG prepared the **Ethics Guidelines for Trustworthy AI** [1]. According to the guidelines, a trustworthy AI should be:

- **Lawful:** Respecting all applicable laws and regulations

- **Ethical:** Respecting ethical principles and values

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[1] Ethics Guidelines for Trustworthy AI

- **Robust:** Both from a technical perspective while taking into account its social environment

They set out 7 key requirements that AI systems should meet in order to be trust-worthy:

- **Human agency and oversight:** AI systems should empower human beings, allowing them to make informed decisions and fostering their fundamental rights. At the same time, proper oversight mechanisms need to be ensured, which can be achieved through human-in-the-loop, human-on-the-loop, and human-in-command approaches

- **Technical Robustness and safety:** AI systems need to be resilient and secure. They need to be safe, ensuring a fall back plan in case something goes wrong, as well as being accurate, reliable and reproducible. That is the only way to ensure that also unintentional harm can be minimized and prevented.

- **Privacy and data governance:** besides ensuring full respect for privacy and data protection, adequate data governance mechanisms must also be ensured, taking into account the quality and integrity of the data, and ensuring legitimised access to data.

- **Transparency:** the data, system and AI business models should be transparent. Traceability mechanisms can help achieving this. Moreover, AI systems and their decisions should be explained in a manner adapted to the stakeholder concerned. Humans need to be aware that they are interacting with an AI system, and must be informed of the system's capabilities and limitations.

- **Diversity, non-discrimination and fairness:** Unfair bias must be avoided, as it could could have multiple negative implications, from the marginalization of vulnerable groups, to the exacerbation of prejudice and discrimination. Fostering diversity, AI systems should be accessible to all, regardless of any disability, and involve relevant stakeholders throughout their entire life circle.

- **Societal and environmental well-being:** AI systems should benefit all human beings, including future generations. It must hence be ensured that they are sustainable and environmentally friendly. Moreover, they should take into account the environment, including other living beings, and their social and societal impact should be carefully considered.

- **Accountability:** Mechanisms should be put in place to ensure responsibility and accountability for AI systems and their outcomes. Auditability, which enables the assessment of algorithms, data and design processes plays a key role therein, especially in critical applications. Moreover, adequate an accessible redress should be ensured.

Companies like Microsoft have strongly endorsed the principles and values within these guidelines. [1]

A piloting process will be set up as a means of gathering practical feedback on how the assessment can be improved. Then the AI HLEG will review the assessment lists in early 2020 and based on this review, the Commission will evaluate the outcome and propose any next steps.

Interrelationship of the seven requirements. Source:Ethics Guidelines for Trustworthy AI[2]

In December of 2018 the European Commission published their Coordinated Plan on Artificial Intelligence[3] that proposes joint actions for closer and more efficient co-

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[1] Microsoft - EU Policy blog

[2] Ethics Guidelines for Trustworthy AI

[3] Coordinated Plan on Artificial Intelligence

operation between Member States and other European nations on in four key areas: increasing investment, making more data available, fostering talent and ensuring trust.

In their Communication Artificial Intelligence for Europe [1] published in April 2018 the European Commission puts forward a European approach to Artificial Intelligence based on three pillars:

Being ahead of technological developments and encouraging uptake by the public and private sectors. The Commission increased its annual investments in AI by 70% under the research and innovation programme Horizon 2020. It will reach EUR 1.5 billion for the period 2018-2020. But expecting to reach more than EUR 20 billion per year over the next decade.

Prepare for socio-economic changes brought about by AI. To support the efforts of the Member States which are responsible for labour and education policies, the Commission will: support business-education partnerships to attract and keep more AI talent in Europe; set up dedicated training and retraining schemes for professionals; foresee changes in the labour market and skills mismatch; support digital skills and competences in science, technology, engineering, mathematics (STEM), entrepreneurship and creativity; encourage Members States to modernise their education and training systems.

Ensure an appropriate ethical and legal framework. To deal with new AI applications that may raise new ethical and legal questions, related to liability or fairness of decision-making.

INDIVIDUAL EU MEMBERS POLICIES[2]

Other EU members have announced their policies an initiatives on AI or have announced their intention to develop their strategies or plans on AI.

DENMARK

Denmark's Strategy for Denmark's Digital Growth, released January 2018, aims to make Denmark a leader in the digital revolution and to create growth and wealth for

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[1] Communication Artificial Intelligence for Europe

[2] An overview of national AI strategies by Tim Dutton

all Danish people. The strategy goal is to make Danish businesses the best at using digital technologies. As per funding, a pool of DKK 75 million was allocated in 2018, followed by DKK 125 million each year until 2025, and DKK 75 million in perpetuity for the implementation of the strategy's initiatives. Major announcements include the creation of Digital Hub Denmark (a public-private cluster for digital technologies), SME:Digital (a coordinated scheme to support the digital transformation of Danish SMEs), and the Technology Pact (a nationwide initiative to foster digital skills).

FINLAND

 In May 2017, Finland's Minister of Economic Affairs Mika Lintilä appointed a group to determine how Finland can become one of the world's top countries at the application of AI technologies. The first report, Finland's Age of Artificial Intelligence, surveyed Finland's strengths and weaknesses in AI and provided eight recommendations to turn Finland into a global leader in the application of AI. Key initiative included the creation of the Finnish Centre for AI (a joint partnership by Aalto and Helsinki Universities to increase AI research, talent, and industry collaboration), an AI accelerator pilot program and the integration of AI in the public service.

FRANCE

 President Emmanuel Macron unveiled France's €1.5 billion plan to transform France into a global leader in AI research, training, and industry at the end of the AI for Humanity Summit in Paris. The program draws heavily from the report, For a Meaningful Artificial Intelligence: Towards a French and European Strategy, in which Cédric Villani, France's famed mathematician and Deputy for the Essonne, and the other members of the "Villani Mission" outlined a number of policies and initiatives for the government to consider. First, Macron announced several initiatives to strengthen France's AI ecosystem and attract international talent. Second, France will develop an open data policy to drive the adoption and application of AI in sectors where France already has the potential for AI excellence, such as healthcare. Third, the government will create a regulatory and financial framework to support the development of domestic "AI champions." Finally, the government will adopt development regulations for ethics to ensure that the use and development of AI is transparent, explainable, and non-discriminatory. Details for the following have not be released, but €700 million will go towards research, €100 million this year to AI startups and companies, €70 million annually through France's Public Investment Bank, and $400 million to industrial projects in AI. Instead, he only talked about the

potential of AI for healthcare and transportation.

GERMANY

Before releasing its AI strategy, which will be published at the Digital Summit 2018 in Nuremberg (December 3–4), Germany's federal cabinet released a paper in July 2018 that outlines the goals of the strategy. In short, the government wants to strengthen and expand German and European research in AI and focus on the transfer of research results to the private sector and the creation of AI applications. The proposed plan is quite comprehensive and also includes measures to attract international talent, respond to the changing nature of work, integrate AI into government services, make public data more accessible, and promote the development of transparent and ethical AI. The German Research Centre for AI (DFKI) is a major actor in this pursuit and provides funding for application-oriented research. Other relevant organizations include:

- The Alexander von Humboldt Foundation, which promotes academic cooperation and attracts scientific talent to work in Germany.

- The Plattform Lernende Systeme brings together experts from science, industry, politics, and civic organizations to develop practical recommendations for the government. It consists of 19 MPs and 19 AI experts and is tasked with developing a report with recommendations by 2020 (a similar task force released a report on the ethics of autonomous vehicles in June 2017).

NORDIC-BALTIC REGION

The countries agreed to collaborate to "develop and promote the use of artificial intelligence to serve humans." They specified that they would collaborate on:

1. improving opportunities for skills development,

2. enhancing access to data,

3. developing ethical and transparent guidelines, standards, principles, and values,

4. developing standards for hardware and software that enable privacy, security, and trust,

5. ensuring AI gets a prominent role in European discussions of the Digital Single

Market,

6. avoiding unnecessary regulations and

7. using the Nordic Council of Ministries to facilitate policy cooperation.

POLAND

Poland's Vice-President of the Council of Ministers, the Minister of Science and Higher Education, the Deputy Minister of Digital Affairs and representatives of the scientific community and related institutions attended a roundtable focused on the policies and tools needed to foster an environment conducive to the creation of AI technologies in Poland. It is unclear when the government will release its strategy. Prime Minister Jarosław Gowin stressed that the government is aware of the need to create a strategy and that Poland's plan will include AI solutions for the future of health care, public administration, education, and cybersecurity.

SWEDEN

 Sweden released its strategy, National Approach for Artificial Intelligence, in May 2018. It outlines the strategic priorities for AI in Sweden and will serve as a reference for all upcoming government decisions related to AI. The strategy argues that Sweden needs to train more skilled AI-professionals, increase basic and applied research in AI, and develop a legal framework to ensure the development of sustainable AI (AI applications that are ethical, safe, reliable, and transparent). This includes funding for AI-training for professionals, an AI Science Park, and AI-related innovation projects through Vinnova (the government's innovation agency). Prior to the release of the strategy, Vinnova also released an extensive review of Sweden's capabilities and potential in AI.

AI INDUSTRY IN JAPAN

10 AI STARTUPS IN JAPAN BY FUNDING[1]

The following chapter will serve as an overview of leading AI companies in Japan. Performing a search on Crunchbase, the leading destination for company insights where you can get company funding data and other info, you can get the 10 most funded

Founded in 2014, Tokyo startup Preferred Networks has raised **$130 million putting its valuation at a $2 billion** making it the only unicorn (current private companies valued at $1B+) in Japan according to CB Insights[2]. Preferred Networks applies cutting-edge deep learning technology to applications in the the Internet of Things.

They have thee primary business domains:

Transportation - Research and development of technologies related to autonomous driving and connected cars. They have been collaborating with Toyota since October 2014.

Manufacturing - Applying machine learning and deep learning to robotics and machine tools, and conduct research and development of object recognition, control, anomaly detection, and optimization technology. They have been collaborating with Fanuc since June 2015, and with Hitachi since December 2017.

Bio/Healthcare - Analysis of medical images such as CT and MRI, and developing systems to allow early diagnosis of cancer using blood samples. They have been collaborating with the National Cancer Center of Japan since December 2017.

Website www.preferred-networks.jp/en/
Facebook View on Facebook
LinkedIn View on LinkedIn
Twitter View on Twitter
Contact Email pfn-info@preferred.jp

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[1] Nanalize - top 10 AI startups in Japan

[2] CB Insights - The Global Unicorn Club

Founded in 2012, Tokyo startup Abeja has raised **$45.4 million** from investors like Google an Nvidia. Abeja is a platform that integrate AI technologies including IoT, big data and deep learning and enables to carry out analyses with accumulated data. Also ABEJA offers a variety of services optimized for each industries, especially for Retail, Manufacture, Infrastructure.

AI Solutions offered:

Behavioral Analysis of Skilled Craftsman - AI analyzes the working process of skilled craftsman. Applicable for making instruction manuals for non-experts.

Product classification - AI enables automated commodity selection and assortment work.

Demand Prediction at Factory - Prediction of the volume of products to be manufactured and when to be sold. Possible to realize optimization of stock by AI.

Dynamic Pricing - Based on the market demands and commodity supply circumstances, prices can be changed in real time.

Efficiency in Maintenance Support - Predict repair methods and necessary parts based on the problem description in inquiries. AI supports the improvement of repair rate.

Retail Store Analysis - Obtaining and analyzing customers' behavior data such as age, sex, visit rate, repeat rate

Flow Analysis - Tracking the line of people's flow at various locations such as retail stores, commercial facility, airport, warehouse, etc.

Website abejainc.com
Facebook View on Facebook
LinkedIn View on LinkedIn
Twitter View on Twitter
Contact Email info@abejainc.com
Phone Number +81364528848

Ascent

Founded in 2016, Tokyo startup Ascent Robotics has raised **$17.9 million** to develop intelligent solutions in industrial robotics and autonomous vehicles. Their goal is to help create a more autonomous future.

Website ascent.ai
Facebook View on Facebook
LinkedIn View on LinkedIn
Twitter View on Twitter
Contact Email hello@ascent.ai

cinnamon

Founded in 2012, Tokyo startup Cinnamon has taken in a total of **$17 million** to automate the data extraction from unstructured documents. The company is based in Tokyo and Vietnam and is now expanding to the US.

Cinnamon.ai is an AI Document Reader to automate the data extraction from unstructured documents. This tool can apply for both hand-writing and text data like invoices, receipts, insurance claims, financial statements, etc…

Website www.cinnamon.ai
LinkedIn View on LinkedIn

Founded in 2012, Tokyo startup LeapMind has raised **$13.5 million** in funding from Intel to carry out research on original chip architectures in order to implement Neural Networks on a circuit with low power.

Their three products are:

DeLTA-Kit is a hardware kit for easily deploying deep learning - It provides a complete set of hardware materials which are necessary to implement deep learning on

a palm-sized device. It also makes easier for you to deploy the deep learning models created by DeLTA-Lite.

DeLTA-Lite is a solution for building embedded deep learning models - Once labeled data and a hardware to load models get ready, deep learning models can be executed on a palm-sized device. Without advanced knowledge and programing, you can save a substantial amount of time working on from model building to model validation on hardware.

Training data labeling support tool for building deep learning models - This product is designed for supporting you to create a bunch of high quality labeled training data needed to build deep learning models. It remarkably helps task allocation and approval flow management, allowing for your tasks and workloads running in a centralized, uniformized and efficient manner.

Website leapmind.io/
Facebook View on Facebook
LinkedIn View on LinkedIn
Twitter View on Twitter
Contact Email info@leapmind.io
Phone Number +810357789948

COGENT
LABS

Founded in 2015, Tokyo startup Cogent Labs has raised **$12.9 million** to conducts advanced fundamental and applied AI research to create business solutions leveraging expertise across fields including time-series forecasting, information extraction, natural language, voice processing, and reinforcement learning.

Website cogent.co.jp
Facebook View on Facebook
LinkedIn View on LinkedIn
Contact Email contact@cogent.co.jp

Moneytree

Founded in 2012, Tokyo startup Moneytree has raised $10.5 million to develop a financial data aggregation platform for individuals and corporations. They cover 2600 services from all over Japan.

With their aggregation service users can register their bank accounts, credit cards, securities holding accounts or loyalty cards.

All their transactions are saved into its platform and used to provide valuable historical information and current analytics.

Website moneytreehq.com
Facebook View on Facebook
Twitter View on Twitter
Contact Email support@moneytreehq.com
Phone Number 81 3 5962 7732

mujin

Founded in 2011, Tokyo startup Mujin has raised **$7 million** in funding to develop automation solutions for industrial robots to simplify factory automation and increase worldwide manufacturing productivity.

Mujin's Products:

Mujin Controller SIM - a solution that replaces traditional human teaching by automatically planning efficient, fast, collision free robot programs that have guaranteed accuracy when executing on the real robot. With minimal teaching, a user can optimize the robot's task time while avoiding collisions with obstacles. It can dramatically reduced a robot systems's implementation cost and improve manufacturing productivity.

Mujin Pick Worker - a bin-picking system with real-time obstacle avoidance and grasp-planning technologies. It is based on the Mujin's motion planning technology. By detecting the 3D CAD model of the part using machine vision and specifying ideal grasp points, the Mujin Pick Worker can immediately start moving any robot to grasp cluttered parts in a bin the place them at a customer's desired position.

Mujin Laser Worker - ia 3D laser cutting system that employs motion planning to

simplify the teaching process of the laser cutting applications. Laser cutting machines can now automatically avoid self-collisions and the part being cut. The system uses the 3D CAD data to predict where the part surface is and how to cut along it. The system can be used for any custom-built machine to deliver the same motion planning quality for 3D laser cutting.

Website www.mujin.co.jp
Facebook View on Facebook
LinkedIn View on LinkedIn
Twitter View on Twitter
Contact Email info@mujin.co.jp
Phone Number +81 3-4577-7638

Founded in 2016, Tokyo Startup Alpaca has raised **$5.8 million** to develop predictive models for financial markets and offer a Commission Free Stock Trading API.

Alpaca started out with a US stock brokerage for software developers. It provides simple REST Trading API and real-time market data to let developers build and trade with various types of algorithms and bots for free. Securities are offered through Alpaca Securities LLC.

Website alpaca.markets
Facebook View on Facebook
LinkedIn View on LinkedIn
Twitter View on Twitter
Contact Email info@alpaca.markets

Founded in 2015, Tokyo startup **MJI** (**M**ore **J**oyful **I**nnovation) has raised **$5 million** to develop a cute virtual assistant called Tapia. They have also developed a home medical assistant called "anco," based on Tapia's hardware.

On their website the state that they are looking for companies in the field of software and system development who would like to commission projects, and partner companies that can conduct joint development. If you are interested please **contact**

them by filling this form.

Website mjirobotics.co.jp/en/
Facebook View on Facebook
LinkedIn View on LinkedIn
Twitter View on Twitter
Contact Email info@mjirobotics.co.jp

Name	Application	City	Funding (USD millions)
Preferred Networks	Internet of Things	Tokyo	130.0
ABEJA	Big data	Tokyo	45.4
Ascent Robotics	Autonomous vehicles	Tokyo	17.9
Cinnamon	Optical character recognition (OCR)	Tokyo	17.0
LeapMind	Edge devices	Tokyo	13.5
Cogent Labs	OCR, natural language understanding	Tokyo	12.9
Moneytree	Fintech	Tokyo	10.5
MUJIN Inc.	Robotics	Tokyo	7.0
Alpaca	Fintech	Tokyo	6.7
MJI	Smart assistant	Tokyo	5.0

The European Artificial Intelligence Landscape

In 2018 the Venture Capital firm based in Berlin, Asgard,[1] with focus on early stage artificial intelligence companies, together with the global consulting Roland Berger[2] published their Artificial Intelligence Strategy for Europe[3] report.

They analyzed the information on 3,465 startups to define their geographical distribution and reach. The study further focuses on startups producing a primary product or service utilizing machine learning, deep learning, image recognition, natural language processing, or other frontier AI technology, and expressly excludes startups using existing AI solutions on the market to develop new services or products.

In the study they look at two key variables: the main sector that the company focuses on, narrowed down to the 26 commonest industries, and the main technology used or provided. This narrowed down the initial list of 7,500 startups to just over 3,400.Source:

The European Artificial Intelligence Landscape

Top 10 Artificial Intelligence Startup Hubs

London 97 · Berlin 30 · Paris 26 · Madrid 15 · Stockholm 12 · Amsterdam 9 · Moscow 9 · Copenhagen 7 · Barcelona 7 · Dublin 6

2017 | Berlin | Asgard - Human Venture Capital for Artificial Intelligence | www.asgard.vc

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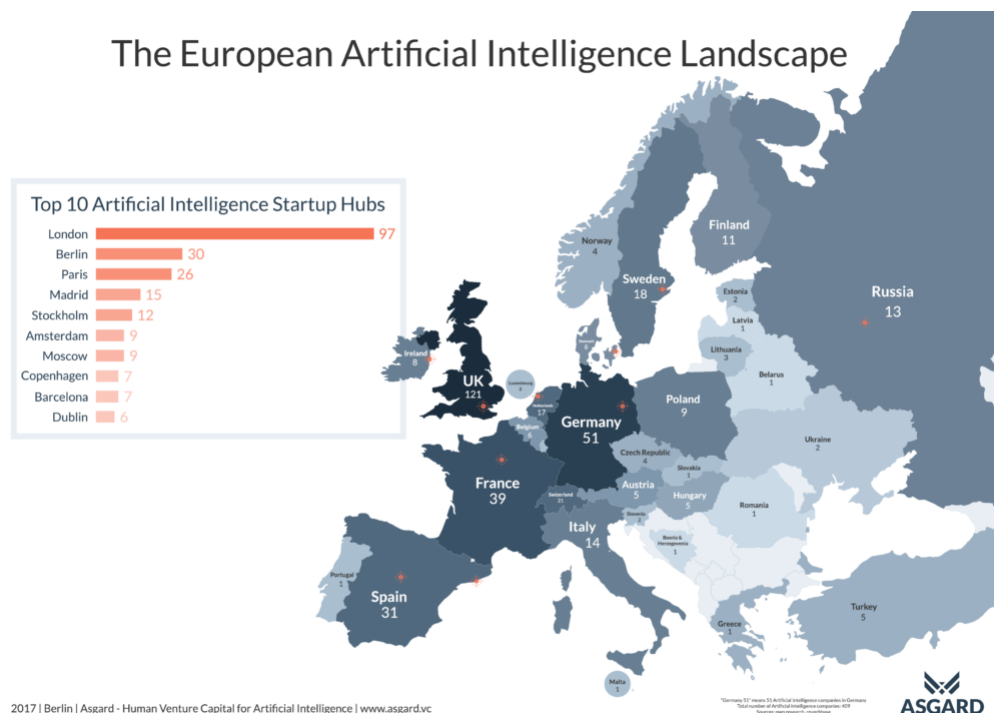
[1] Asgard

[2] Roland Berger

[3] Artificial Intelligence Strategy for Europe report

Source: The European Artificial Intelligence Landscape and largest AI hubs in Europe

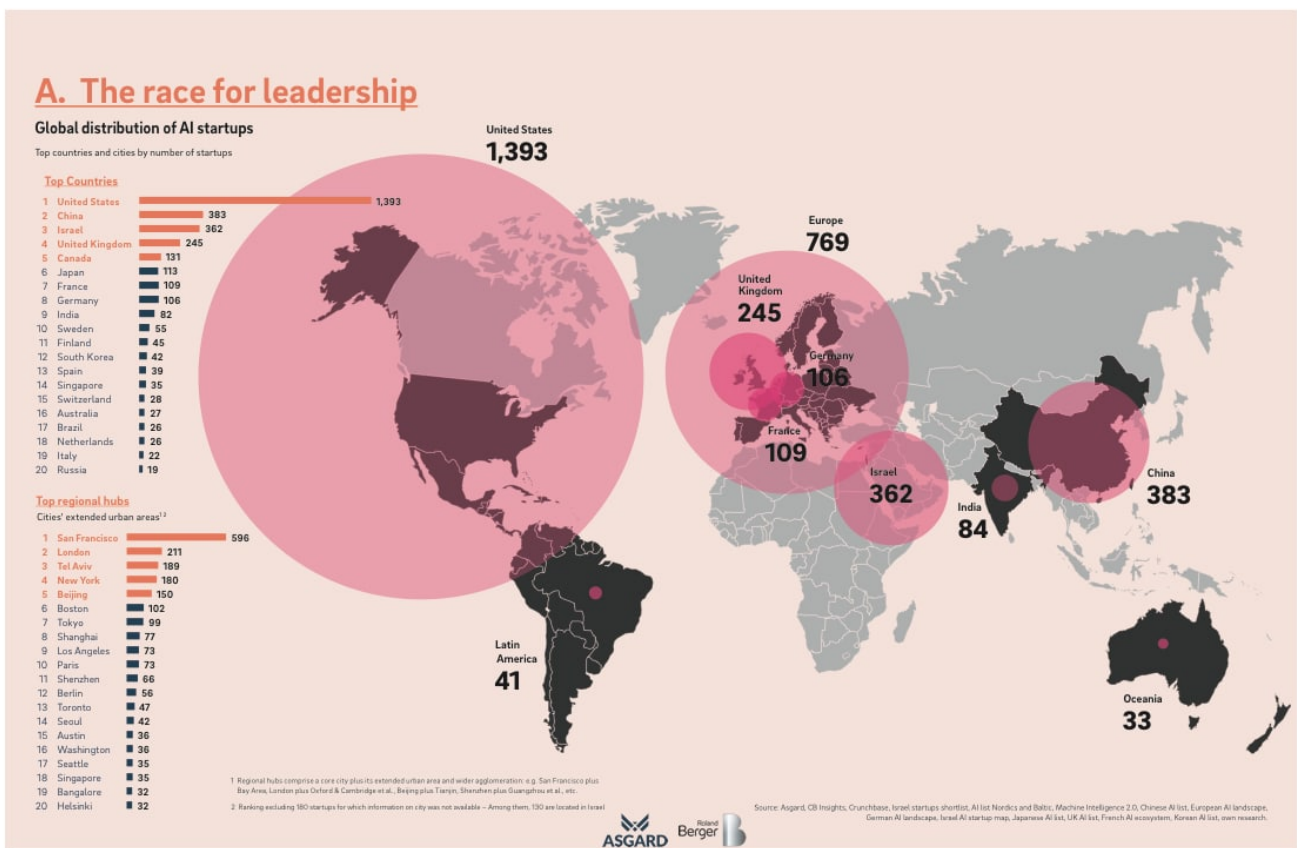In their investigations they found out, not surprisingly, that the United States leads the AI ecosystem with 1,393 startups, 40 percent of the total number of AI startups worldwide. China comes in second place, with 383 startups, 11 percent of the total worldwide.

Europe as a whole contributes with 769 AI startups or 22 percent of the total worldwide but no individual European Union Member State can compete with the US and China.

A. The race for leadership

Global distribution of AI startups
Top countries and cities by number of startups

Top Countries

1	United States	1,393
2	China	383
3	Israel	362
4	United Kingdom	245
5	Canada	131
6	Japan	113
7	France	109
8	Germany	106
9	India	82
10	Sweden	55
11	Finland	45
12	South Korea	42
13	Spain	39
14	Singapore	35
15	Switzerland	28
16	Australia	27
17	Brazil	26
18	Netherlands	26
19	Italy	22
20	Russia	19

Top regional hubs
Cities' extended urban areas[1][2]

1	San Francisco	596
2	London	211
3	Tel Aviv	189
4	New York	180
5	Beijing	150
6	Boston	102
7	Tokyo	99
8	Shanghai	77
9	Los Angeles	73
10	Paris	73
11	Shenzhen	66
12	Berlin	56
13	Toronto	47
14	Seoul	42
15	Austin	36
16	Washington	36
17	Seattle	35
18	Singapore	35
19	Bangalore	32
20	Helsinki	32

United States **1,393**

Europe **769**

United Kingdom **245**

Germany **106**

France **109**

Israel **362**

India **84**

China **383**

Latin America **41**

Oceania **33**

1 Regional hubs comprise a core city plus its extended urban area and wider agglomeration: e.g. San Francisco plus Bay Area, London plus Oxford & Cambridge et al., Beijing plus Tianjin, Shenzhen plus Guangzhou et al., etc.

2 Ranking excluding 180 startups for which information on city was not available – Among them, 130 are located in Israel

Source: Asgard, CB Insights, Crunchbase, Israel startups shortlist, AI list Nordics and Baltic, Machine Intelligence 2.0, Chinese AI list, European AI landscape, German AI landscape, Israel AI startup map, Japanese AI list, UK AI list, French AI ecosystem, Korean AI list, own research.

ASGARD   Roland Berger

Source: The European Artificial Intelligence Landscape and largest AI hubs in Europe

Japan's Business Environment

JETRO INVEST IN JAPAN REPORT

The Japan External Trade Organization[1]

The Japan External Trade Organization, JETRO, is a government-related organization that works to stimulate mutual trade and investment between Japan and the rest of the world. It was established in 1958 to promote Japanese exports overseas.

Attractiveness of doing business in Japan

Rank	Answer	Votes 1st
1	Japanese market	158
2	Existence of suitable partners, (companies, universities, etc.) with outstanding technology or products	25
3	Stability of country and society	16
4	High quality of R&D	19
4	Existence of renown global companies	24
6	Infrastructure (traffic, logistics, ICT, energy, etc.)	4
7	Potential for securing talented human resources	4
8	Well-maintained living environment	4
9	Japan's location (e.g. position as a gateway to Asia, advantage as a base for regional headquarters, etc.)	3
9	Expected increase in demand and sales toward the 2020 Tokyo Olympics	3
11	Well-structured legislation regarding intellectual property	2
NA	Other	4

[1]The Japan External Trade Organization

In 2018, and as part of JETRO's Invest In Japan Report, 266 foreign-affiliated companies supported by JETRO in their entry into the Japanese market replied to a questionnaire[1] about their perception of the business environment in Japan.

While Japan's market is expected to shrink in the future, a significant number of foreign-affiliated companies perceive "Mid-and long-term growth potential of the business field" and "Opportunities for innovation due to Japan's status as a frontrunner in addressing global challenges" as mostly attractive about the Japanese market
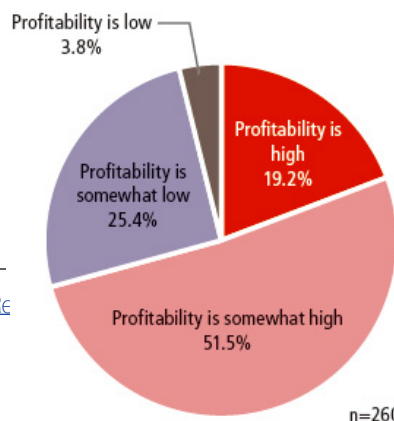

Source: JETRO "Survey on Japan's Investment Climate 2018

Over **70% of the companies** perceive Japan as a **somehow high profitable** market.
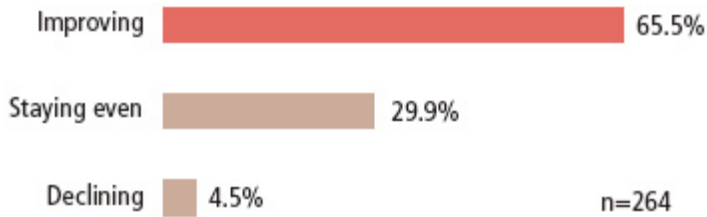
How do you evaluate the Japanese market in terms of profitability?

The report shows that in general there is a high level of business confidence among foreign-affiliated companies and a positive outlook on the future.

Outlook of the business conditions in Japan (over the next one or two year)
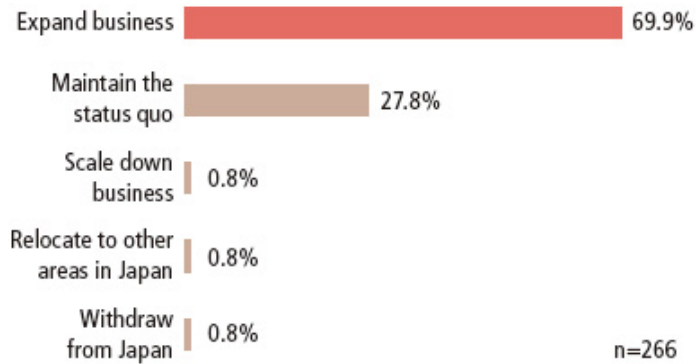
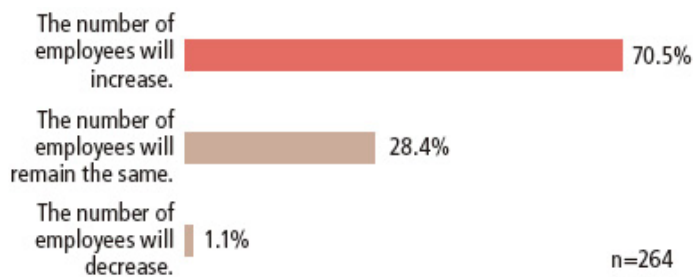Improving — 65.5%
Staying even — 29.9%
Declining — 4.5% n=264

Source: JETRO "Survey on Japan's Investment Climate 2018

The report also shows that about 70% of foreign-affiliated companies plan to expand their business operations and employment.

Investment plans within the next 5 years

Expand business — 69.9%
Maintain the status quo — 27.8%
Scale down business — 0.8%
Relocate to other areas in Japan — 0.8%
Withdraw from Japan — 0.8% n=266

Source: JETRO "Survey on Japan's Investment Climate 2018

The number of employees will increase. — 70.5%
The number of employees will remain the same. — 28.4%
The number of employees will decrease. — 1.1% n=264

Projected number of employees in Japan (within the next 5 years)

Source: JETRO "Survey on Japan's Investment Climate 2018

Lack of human resources with foreign language ability — 54.4%
Difficulty in finding experts — 41.8%
Recruitment, hiring, and employment cost — 34.2%
Awareness of workers (e.g. preference for large companies, reluctance to work for foreign-affiliates) — 29.7%
Low mobility in labor market — 19.8%
other — 3.8%
n=263

Engineering — 58.7%
Sales and customer service — 47.1%
Corporate planning — 21.2%
General affairs — 5.4%
other — 9.7%
n=259
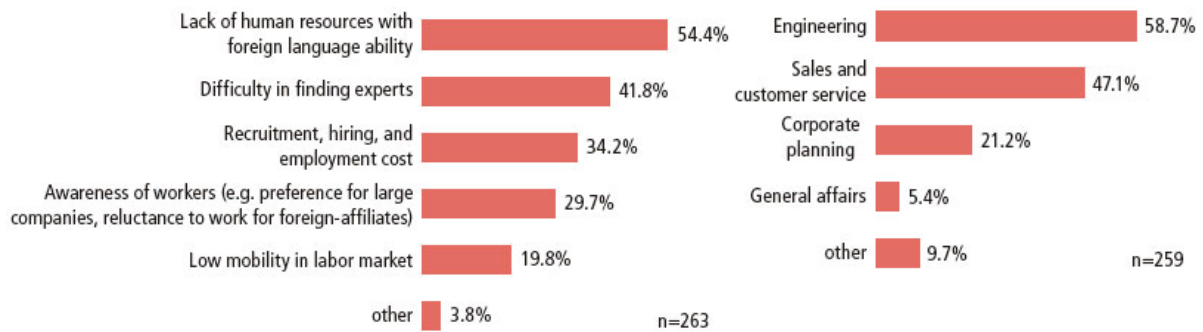
Rank	Answer	Votes 1st
1	Difficulty in finding human resources	87
2	Difficulty in communicating in non-Japanese languages	54
3	High business costs	41
4	Complicated administrative procedures	36
5	Rigid regulations	24
6	Difficulty in finding business partners	11
7	Immigration control system	7
8	Difficulty in financing	0
9	Difficulty in living conditions for foreigners	0
NA	other	6

One of the most interesting findings of this report although it might not come as as surprise to companies already in the AI industry is the fact that the **biggest obstacle** to doing business in Japan is difficulty in **finding human resources**.

Finding human resources with foreign language ability and with engineering background are the two biggest difficulties.

When asked about "Complicated administrative procedures," many companies pointed to the "Excessive amount of required documents," "Lack of English translation" and "Excessive amount of time required to complete procedures," especially with "Tax matters," "Labor matters" and "Matters related to status of residence (visas)".

JETRO'S ACTIVITIES TO PROMOTE INWARD FDI[1]

Apart from providing information on Japanese business environment in the form of overseas seminars, symposiums, Invest Japan website and other information on entering/investing in the Japanese market, JETRO also support inward Foreign Direct Investment by:

Supporting individual FDI projects in Japan:

- Provision of individualized support in collaboration with overseas offices, domestic offices, and the Tokyo and Osaka Head Offices

- Target fields in FDI: R&D hubs and similar offering high added value and benefits for Japan's economy

- Close company partners: Introduction of the Personal Advisors System for Foreign Companies

- Example cases of responses to requests and consultations from foreign companies and newly established business endeavors in Japan through JETRO support

Overview of the Personal Advisors System for Foreign Companies

Source: JETRO Efforts to Promote Investment in Japan

Promoting secondary investments and contributing to regional revitalization

- Support for staffing -networking opportunities between foreign-affiliated

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[1] JETRO's activities to promote internal FDI

companies and foreign exchange students in Japan

- Networking opportunities for companies to expand their business

- Joint endeavors with local governments to attract foreign investment to local regions (the Support Program for Regional Foreign Direct Investment in Japan and Regional Business Conference (RBC))

Approach toward improvement of the business environment

- "Survey on Japan's Investment Climate" sent to foreign-affiliated companies

- "Investment Advisor Assignment System"

- "Personal Advisors System for Foreign Companies"

- Visas for Coworking Space Users

SETTING UP A COMPANY IN JAPAN

Setting up your company in Japan might feel daunting due to the language barrier and the cultural differences. Because of this JETRO has a website[1] that provides an overview of the laws, regulations and procedures related to setting up a business in Japan.

There is also a flowchart outlining the basic steps and a model case showing approximate start-up costs. The website provides detailed information in the different areas involved in the company set up:

Incorporating Your Business - With definitions and comparisons of various business operations; procedures and guidelines for establishing/registering each of these distinct operations in Japan.

Visas and Status of Residence - Information on the entry procedures into Japan, conditions and provisions that apply to various types of visas and working/residence statuses; the alien registration process; details concerning family members accompanying foreign nationals.

Taxes in Japan - Aspects of Japan's tax systems most relevant to a foreign corporation/individual investing in Japan (emphasis on corporate tax structures, tax treaties as well as personal and consumption taxes).

Human Resource Management - Japan's labor laws and regulations; topics include; recruitment; employment contracts; wages, working hours; work rules;

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[1] JETRO: How to set up business in Japan

workplace safety and hygiene requirements; resignation and dismissal procedures and Japan's social security, health and pension systems.

Trademark and Design Protection Systems - Japan's trademark and design protection systems; registration validities, periods of protection as well as trademark and design registration procedures.

Simple outline of the steps involved in setting up a business in Japan.
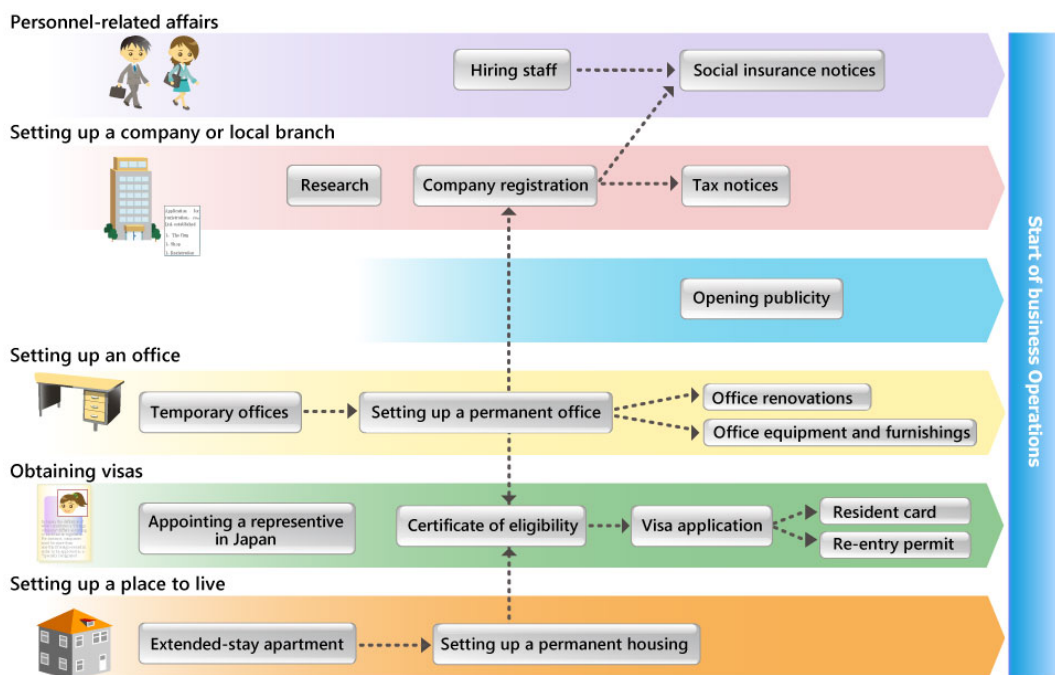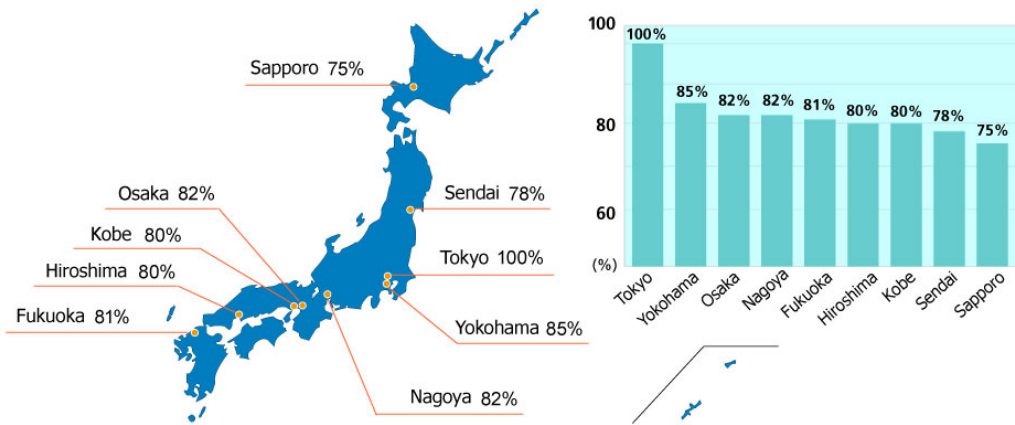

Source: JETRO "How to Set Up Business in Japan"

For the establishment of a Japanese corporation or a branch, the costs are generally as follows.
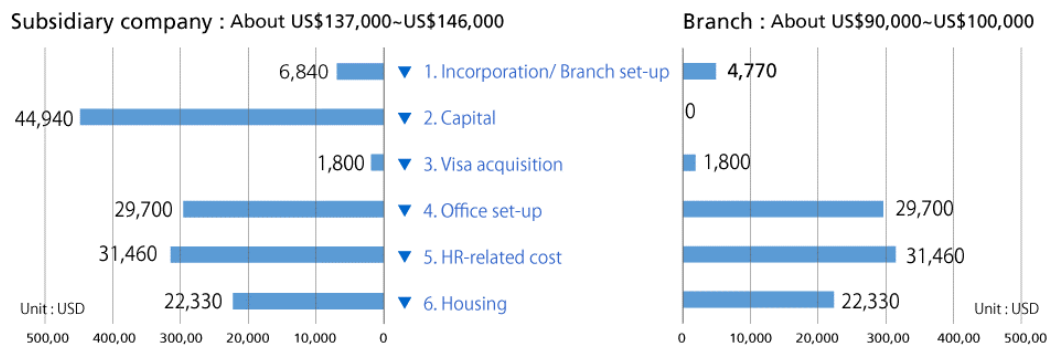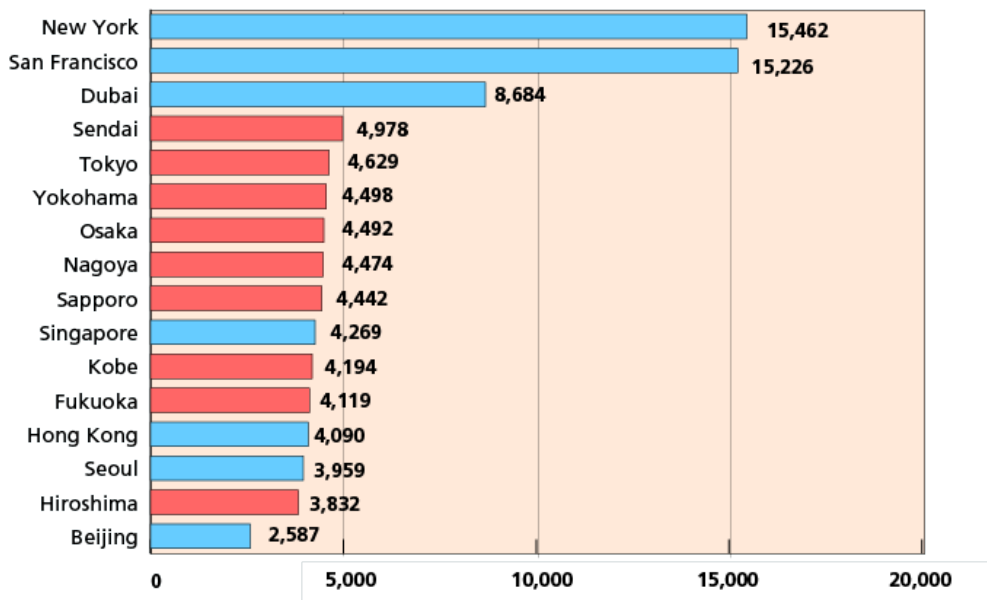
Comparison of initial start-up costs for subsidiary in major business areas

Source: JETRO "Initial Cost Estimation"

Personnel expenses in Yokohama and Osaka are cheaper than that of San Francisco and Dubai.

Comparison of manager wages by city in non-manufacturing industries (monthly) Unit: US$

Source: JETRO "Initial Cost Estimation"

FUNDING OPPORTUNITIES AND SUPPORT IN JAPAN

INCENTIVE PROGRAMS

To facilitate investment in Japan, the government offers appealing incentives, as well as operating single contact points in relevant ministries and agencies for inquires/support regarding doing business in Japan.

Local governments also offer various incentives and support exclusively for foreign-affiliated companies and foreign companies that are planning to open an office in their region.

I. National incentives

I.   A. Incentives related to investment in Japan

II. Incentives for enterprises that foreign-affiliated companies can also use

I.   Tax incentives for strengthening local business facilities

II. Incentives regarding Special Zones

III. Incentives based on Industrial Competitiveness Enhancement Act

IV. Incentives based on the Act on Special Measures for Productivity Improvement

V.   Tax Deduction System based on the Regional Future Investment Promotion Act（Regional Future Investment Promotion Taxation）- A tax deduction system for projects which create high added value in utilizing advantages of local regions and with which a ripple effect on local economies can be expected, on the condition that they are confirmed as projects which will particularly contribute to strengthening the basis of regional economic growth, in accordance with standards set by the competent minister.

VI. Tax incentives for Research and Development (R&D Tax Credit System)

VII.Incentives for Highly Skilled Foreign Professionals from for-

eign countries: Incentive measures for foreign nationals concerning startups

VIII. Tax incentive for wage and productivity improvement

III. Incentives related to disaster recovery

I. Subsidies for new business establishment and employment creation in areas recovering from the tsunami and nuclear disaster

II. Preferential tax treatment for special zone

II. **Prefectural and municipal incentives** - Prefectures and Municipals have their own unique incentives.

Information about this and more can be find on the JETRO's website of incentive programs.[1]

INVEST JAPAN BUSINESS SUPPORT CENTER (IBSC)

For foreign companies planning to set up a business base or looking to expand existing business base in Japan JETRO's IBSC offers the following:

Temporary Offices - Temporary office space for starting up or expanding operations is available free-of-charge for up to 50 business days at IBSCs located in Tokyo, Osaka, Kobe, Nagoya, Yokohama and Fukuoka. Private office space

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[1] JETRO - Incentive programs

equipped with a telephone and Internet access, along with communal areas including conference rooms.

Support by JETRO's international experts - JETRO staff from various countries and regions ready to support your company in their native languages. They will provide information, consultation, and other services free of charge. (Some services are offered for a fee.)

JETRO's broad network - Help support your business in Japan through their broad network.

Examples of services offered by JETRO's IBSC:

• Help with procedural obligations for establishing a business base

• Information on regulations and relevant legal systems

• Estimates on costs for establishing a Japan office

• Market and industry information

• Introducing service providers

• Search for office location

• Information on national, prefectural, and municipal incentives

• Arranging meetings with government authorities and receiving requests for deregulation

• Support for establishing a new business base or expanding your existing business base into other regions in Japan

JETRO has the Invest Japan Business Support Center (IBSC) on the same floor as the Tokyo One-Stop Business Establishment Center. This allows foreign firms to handle all arrangements and procedures for beginning their work in Tokyo on the 7th floor of JETRO Headquarters.

TOKYO ONE-STOP BUSINESS ESTABLISHMENT CENTER

Tokyo One-Stop Business Establishment Center

The Japanese Government together with the Tokyo Metropolitan Government launched the Tokyo One-Stop Business Establishment Center[1].

This is the first center in Japan that has integrated the procedures for establishing business by overseas-affiliated or venture companies in one location.

Through face-to-face consultation, staff members and experts in this field assist with a wide range of administrative procedures required when forming a legal entity and starting operations in Tokyo including for certification of articles of incorporation, corporate registration, taxes, pension, social insurance and immigration control. The center will also provide interpretation and translation services in multiple languages.

Within this center, contact points of two related organizations were also opened:

Business Development Center Tokyo - bilingual consultants will help business matching and matters concerning life for individual workers of overseas companies intending to start business in Tokyo.

Tokyo Employment Consultation Center - helps non-Japanese firms or enterprises which have just established business accurately understand the employment rules in Japan and smoothly develop their operations.
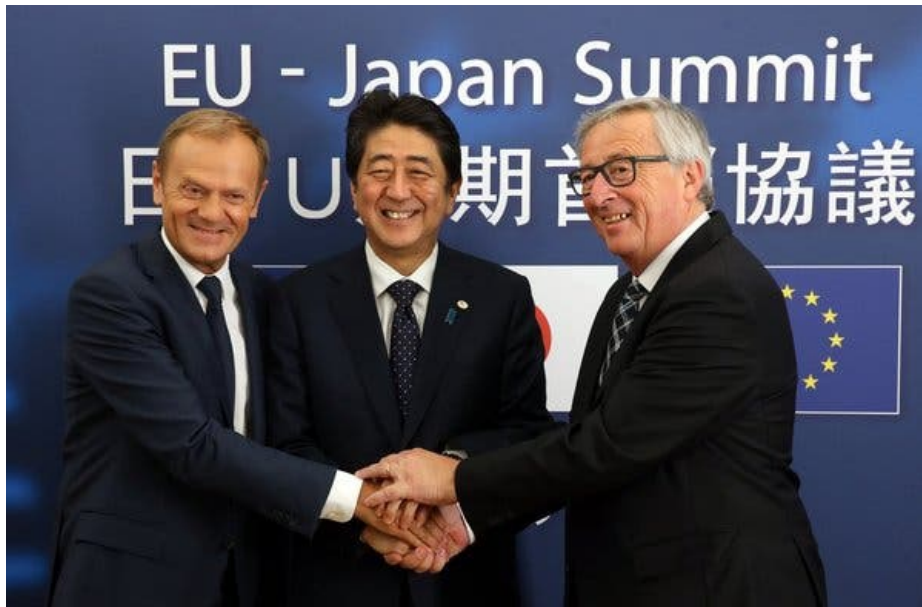
Contact:

Tokyo One-Stop Business Establishment Center Tel: +81-3-3582-8352

Business Development Center Tokyo Tel: +81-3-6269-9981

Tokyo Employment Consultation Center Tel: +81-3-3582-8354

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[1] One Stop Business Establishment Center

EU AND JAPAN HISTORIC FREE TRADE AGREEMENT

Prime Minister Shinzo Abe of Japan, is welcomed in Brussels by Donald Tusk, president of the European Council, and Jean-Claude Juncker,, president of the European Commission.Pool photo by Francois Walschaerts[1]

On July of 2017 the European Union and Japan signed a historic free-trade agreement in Tokyo that will reduce or remove tariffs on exports between both countries. [2]

The EU-Japan Economic Partnership Agreement (EPA) is the world's largest open economic area, covering one third of the global economy and affecting around 600 million people. The colossal trade deal stresses the developing economic alliance between Europe and Asia.

According to Donald Tusk, president of the European Council the agreement is "the largest bilateral trade deal ever." The Economic Partnership Agreement enter in place in February of 2019 allowing businesses and consumers across Europe and in Japan to take advantage of the largest open trade zone in the world.

The Economic Partnership Agreement eliminates almost all of the €1 billion of tariffs paid yearly by EU companies exporting to Japan. Once the agreement is complete-

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[1] EU Japan Trade Deal - NYTimes

[2] Texts of the agreement

ly implemented, Japan will have removed customs duties on 97% of imports from the EU.

	The value of EU exports of goods to Japan is **€58 billion**
	The value of EU exports of services to Japan is **€28 billion**
	600,000 jobs tied to EU exports to Japan
	550,000 people employed by Japanese companies in the EU
	The value of tariffs paid by EU exporters to Japan is **€1 billion a year**
	The predicted increase of annual EU exports to Japan is **over 13% or additional €13 billion**
	The predicted annual increase of EU exports of processed foods to Japan is **51% or just over €1 billion;** exports of dairy products are predicted to **increase by 215% or €729 million**
	The predicted annual increase of EU exports of chemicals to Japan is **6.9% or additional €1.6 billion**
	The predicted annual increase of EU exports of textiles to Japan is **220% or additional €5.2 billion**
	Almost 74,000 EU companies are exporting to Japan. **78% of those are smaller firms**

Source: Europa trade policy - EU and Japan EPA

The agreement also removes several old non-tariff obstacles, for example by endorsing international standards on cars. It will also break down barriers for key EU food and drink exporters to 127 million Japanese consumers and will increase export opportunities in many other sectors. The annual trade between the EU and Japan could increase by nearly €36 billion once the agreement is implemented in full.

Regarding data protection, the EU and Japan adopted decisions to allow personal data to flow freely and safely between the two partners. They agreed to recognize each other's data protection systems as 'equivalent', which will create the world's largest area of safe data flows. Japan is the EU's second-biggest trading partner in Asia after China.

EU-Japan: Trade in goods

EU-Japan: Trade in services

EU-Japan: Foreign direct investment
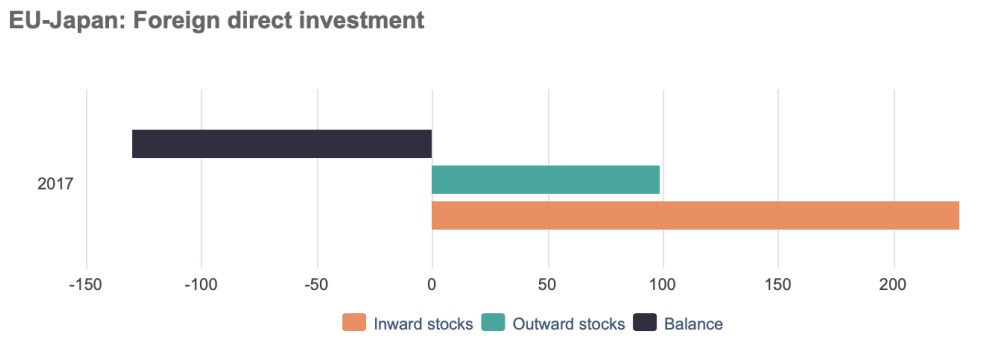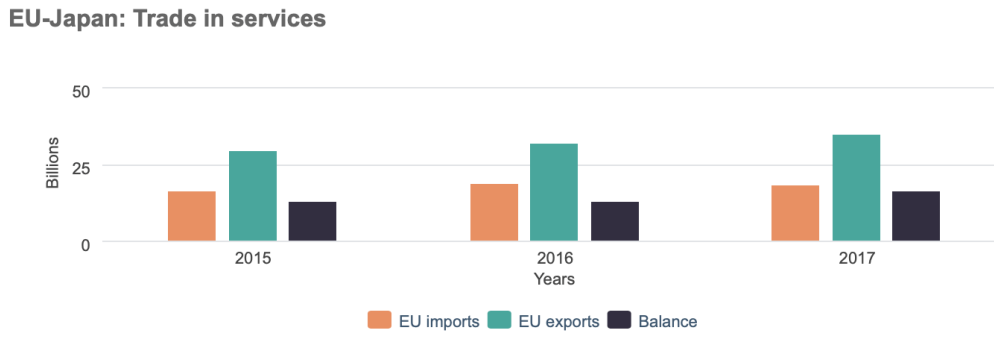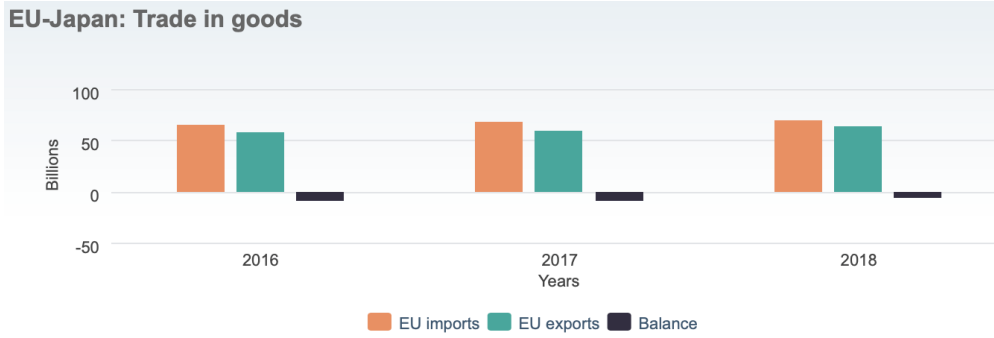
Source: Europa trade policy - EU and Japan EPA

Trade picture[1]

- Together the EU and Japan account for about a quarter of the world's total GDP.

- Imports from Japan to the EU are dominated by machinery, electrical machinery, motor vehicles, optical and medical instruments, and chemicals.

- EU exports to Japan are dominated by motor vehicles, machinery, pharmaceuticals, optical and medical instruments, and electrical machinery.

SUPPORT BY THE EUROPEAN COMMISSION

EU-Japan Centre for Industrial Cooperation[2]

The objective of the EU-Japan Center for Industrial Cooperation is to advance all types of industrial, trade and investment engagements between Japan and the EU and to fortify the technological capacities and attractiveness of the European and Japanese industrial frameworks. It is partially funded by the European Commission and the Japanese Ministry of Economy, Trade and Industry (METI). It oversees policy matters and business aid operations, including, but not limited to, administrative training programs, research, group missions, seminars, student internship programs, business conferences, and help desk services to create synergy between European and Japanese businesses with the following actions:

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[1] EU Trade policy - Countries and regions

[2] EU-Japan

Step in Japan

The EU-Japan Center for Industrial Cooperation will also give support through free transitory office space (Step in Japan), trade matching (using the European Enterprise Network), group support, and their web- site which contains information for EU businesses. This program provides background knowledge of the Japanese business environment to European firms, primarily SMEs, on several important topics, particularly "Environmental and Energy-related Technologies."

The EU-Japan Center for Industrial Cooperation also offers helpdesk services on tax inquiries, technology transfer protocols, patent search and public acquisitions in Japan.

EU Gateway to Japan[1]

The "EU Gateway to Japan" program supports SMEs intending to penetrate the Japanese market. The promotion program is an initiative financed by the EU with the sole aim of coordinating intercession of potential business contacts with potential associates/ partners with regards to topical business visits to Japan.

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[1] EU Gateway

Enterprise Europe Network (EEN)[1]

As a result of the peculiar characteristics of the Japanese market, a large portion of companies from abroad have been able to surmount hindrances through partnerships with local firms.

To assist, the EU-Japan Center for Industrial Cooperation provides a matchmaking service using the Enterprise Europe Network (EEN).

The COSME program funds the Enterprise Europe Network (EEN) under the management of DG Grow, which helps businesses reach markets in and beyond the EU.

The EEN for Japan is part of the EU-Japan Center for Industrial Cooperation. The project aims to help SMEs to locate business and technical partners. It also funds various IPR (Intellectual Property Rights) SME Help- desks.

Japan Tax and Public Procurement Helpdesk[2]

To conquer these obstructions, the Japan Tax, and Public Procurement Helpdesk, is offering tender interpretations and backings with tenders and offers.

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[1] EEN

[2] Japan Tax and Public Procurement Helpdesk

Procurement and challenges

Even though Japan is a subscriber to the World Trade Organization's Government Procurement Agreement, EU businesses still face administrative hurdles, such as a lack of access to information and administrative high-handedness during the procurement process.

The EU evaluates that, despite the GPA, EU businesses should be able to get contracts worth 0.7% of Japan's GDP (about 22 billion EUR), while Japanese firms in sharp contrast can secure contracts worth 2.1% of EU GDP (exactly 312 billion EUR). This development has been attributed to deliberate confinements, low consideration of bids and requirements set for securing contracts by railroad and urban transport operators.

No access to contract information / Lack of transparency: The Japanese legal system for public acquisitions is an intricate arrangement of statutes and guidelines available in various legal writings. The Accounting Law guides unusual practice, the central government's procurements while the Local Autonomy Law regulates the regional government's acquisitions. There is no abridged English version of these legislations.

Lack of a particular point of access to tender declarations/announcements. A similar counterpart of the EU's central electronic Tender Database (TED) is absent from Japan's public procurement framework. Though the central government's tender announcements are all accessible in the National Gazette, local raw publications are scattered across different sources and on several undetermined web sites. Additionally, only the declarations published by central government are available on the JETRO[1] site are accessible in English

Tendering process: Administrative obstructions: the procedure of business assessment (keishin) is too long to permit organizations to partake sufficiently in a specific tender after the publication of a tender notification. One particular concern range is the absence of a minimum level required for every specific ability. The registration is necessary before joining each procurement agency and is renewable every two years without the option of automatic renewal.

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[1] JETRO

Redresses available: it is tough to dispute awards of contracts done by a contracting authority. The Cabinet Office constitutes the body responsible for investigating award disputes (CHANS); its decisions are merely unenforceable recommendations. Besides, it doesn't address award disputes involving local authorities that don't have such a setup. The Acquisition is mostly on a cost-basis rather than on a value-for-cash basis.

EU Framework: Horizon 2020[1]

Horizon 2020 is the **greatest EU Research and Innovation program in existence** with almost €80 billion of funding accessible over seven years (2014 to 2020). It targets not just European players with projects in the EU; it can also be used to foster EU-Japan cooperation and projects in Japan.

The EU-Japan Center has been appointed as the approved National Contact Point (NCP).

EU Framework: Small Business Act for SMEs

Furthermore, the European Union provides business support under the Small Business Act for European SMEs. The SBA is an extensive system for the EU approach on Small and Medium Enterprises (SMEs). It plans to enhance the ways of dealing with enterprises in Europe to streamline the regulatory and administrative framework for SMEs and remove remaining obstructions to their advancement. It should be remarked that the SBA is a support scheme and not an real target for entry into the Japanese market.

Available funding opportunities for SMEs can be researched on the SME Internationalization Portal[2]. The majority of them provide services such as seminars, export

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[1] Horizon 2020

[2] SME Portal

credit schemes, forum discussions, matchmaking opportunities, support for new businesses, etc. It is an exceptionally vital tool that is indispensable for any European exporter as it could help facilitate enterprises in several ways.

The Market Access Database (MADB)

The European Commission manages the Market Access Database (MADB). It provides information about import requirements in third-country markets to firms exporting from the EU.[1]

EU Member States embassies, EU Delegation [2]

The delegation of the European Union in Japan is the representative in Japan, and it is entitled to the full status and privileges of a diplomatic mission. Its mission is to speak for, advance, and propel the interests and principles of the European Union in Japan. It also has the responsibility to create and reinforce bilateral political, cultural, social, economic, scientific research interests, and other sectorial partnerships between the European Union and Japan. This delegation is expected to use its mandate to advance and propel EU interests and principles at international and local levels.

Moreover, most EU member states have government offices in Japan by employing policy staff to research, compile, and supply information on a particular segment of the industry.

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[1] MADB

[2] EU Delegation

RECENT TRENDS IN AI[1]

The Japan Patent Office (JPO) published on July 8 the results of a research on trends in patent applications for Artificial Intelligence (AI)-related designs which are getting notable recognition in recent years.

Simultaneously with the extraordinary development of the AI focusing on deep learning, the trends in AI-related patens have earned important attention. Hence, the JPO examined current trends in patent applications for AI-related designs* in Japan and other countries.

AI-related inventions include (i)AI-core inventions classified in G06N as International Patent Classification (IPC) and (ii)AI-applied inventions which apply AI to various technical fields.

New trends of AI-related inventions can be summarized as follows.

- The number of domestic patent applications for AI-related inventions has increased rapidly since 2014 due to the impact of the 3rd AI boom. About 3,100 applications for AI-related inventions were filed in 2017 (+65% compared with the previous year), including about 900 applications for AI- core inventions (+55% compared with the previous year).
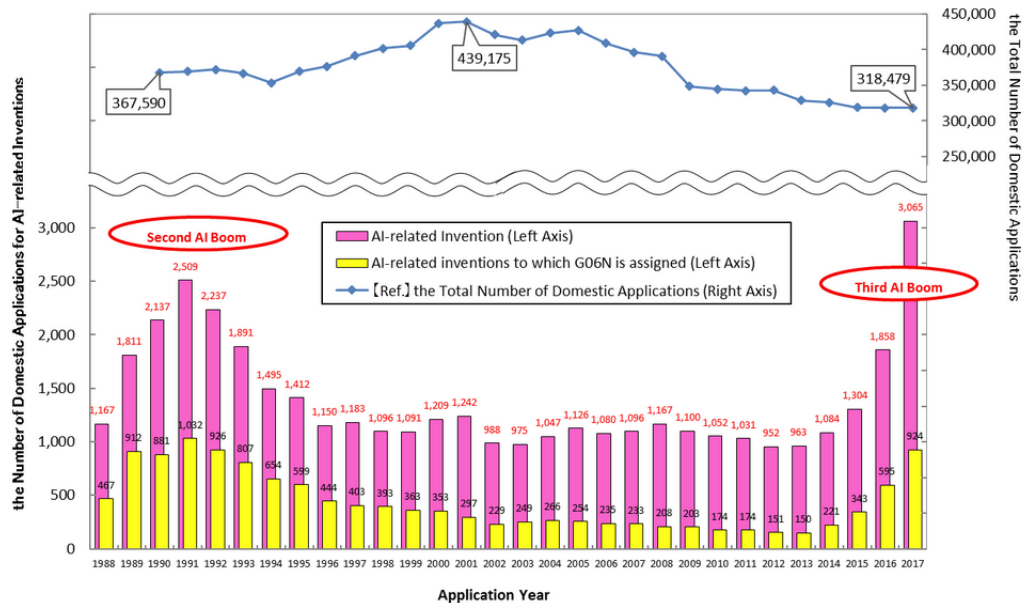

Figure 1   The number of domestic applications for AI-related inventions

- The major method used in AI-related inventions is machine learning. Among

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these, inventions referring to deep learning are rapidly increasing, and nearly half of AI-related inventions refer to deep learning in the application documents in 2017.

- As for AI-applied fields, the numbers of applications in the image processing, information retrieval/recommendation, business method and medical diagnosis fields are large, and the growth rate in control / robotics fields is particularly high.

- The numbers of applications for AI-core inventions in the Five IP Offices (Japan, US, the EPO, China, and Korea) and PCT applications are both increasing, with the number in US and China leading the way.

ACCELERATORS IN JAPAN

Fintech Business Camp Tokyo[1]

The Accelerator Program FinTech Business Camp Tokyo has been held by Tokyo Metropolitan Government with the purpose of attracting foreign startups with the latest technologies to come to Tokyo and expand their knowledge of both Japan's different market and the diverse needs of companies in the metropolis.

Further, by granting Tokyo companies the possibility to familiarize themselves with technologies owned by foreign companies, the program tries to improve business matching and bring foreign companies to Tokyo.

The program looks for foreign companies with advanced technologies (e.g. AI, IoT, blockchain, VR/AR, robotics) that supports digitalization in the financial industry, and which have not yet established a Japanese corporate entity.

Tech Business Camp Tokyo[2]

The Tokyo Metropolitan Government also launched an accelerator program targeting foreign startup companies possessing cutting-edge technologies related to the

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[1] Fintech Business Camp Tokyo

[2] Tech Business Camp Tokyo

Fourth Industrial Revolution, such as IoT, artificial intelligence, and robotics, etc.

Tech Business Camp Tokyo invites foreign companies to come to Tokyo to learn about the uniqueness of the Japanese market and needs of companies within the city, while also aiming to create business matchups between the foreign companies and Tokyo companies by providing the latter with opportunities to gain a deeper understanding of the former's technologies.

By matching up Tokyo companies and foreign companies with leading software technologies, the TMG hopes to achieve its vision of becoming a "Safe City", a "Smart City" and a "Diversity (Diverse City)".

Target companies are foreign startups possessing the latest IT technologies and business models, and which do not yet have a presence in Japan.

MUFG Fintech Accelerator[1]

Mitsubishi UFJ Financial Group Inc. runs an intensive 4 months program for startups once a year with the usual Demo Day at the end. The program is aimed to FinTech companies applying advanced technologies like Blockchain, IoT, AI, quantum computing, etc…

They offer participating companies a working space in the Tokyo Nihonbashi area, networking and partnering opportunities with their network of MUFG and MUFG affiliated companies. Also they provide mentoring from other MUFG companies.

Their website is only in Japanese.

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[1] MUFG Fintech Accelerator (Japanese)

Softbank Innovation Program[1]

The giant holding conglomerate Softbank runs a program aiming to match Softbank's resources and technology with those of the applying companies or startups.

They want the entrants to be already equipped with their own technology.

They will only allow entries in the form of a real product, solution or service.

The final product's cost will be covered by Softbank and the prototype will be tested and market using Softbank's own channels. The website of the program was last updated in 2018 so this might be discontinued.

Plug And Play[2]
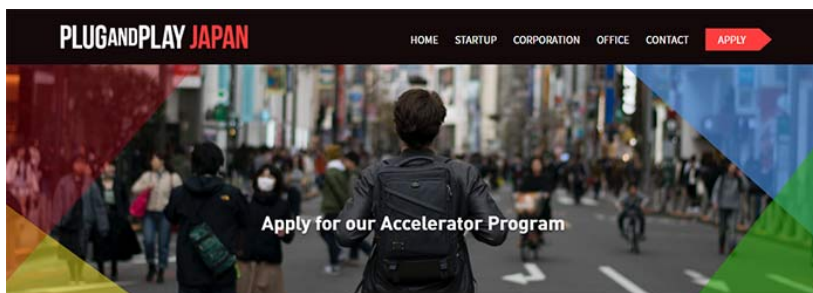
2 Plug And Play

The California based accelerator has a Japan branch for startups who plan on reaching Silicon Valley and other markets thanks to Plug And Play's wide international network. They operate in 26 different locations.

The program runs for 12 weeks with the opportunity to pitch your company in Silicon Valley at the end. They also offer free office space for the companies accepted in the program. One of the accelerator's interest is FinTech. They claim they are a "Silicon Valley style" accelerator and they have partnered with big Japanese companies and service partners to help entrepreneurs reach their goals.

Coral Capital, ex 500 Startups[1]

One of the most well known early-stage venture funds and seed accelerators in the world, based in California, had a Japan branch too. They have presence in more than 60 countries and a vast network available to the community of companies accepted into the program.

They had a 4-months seed program where they gave access to mentorship, hands-on sessions with startup experts and office space. They also claimed to bring Silicon Valley best practices to Japan including financing documents, fundraising and more.

In march 2019 the 500 Startups Japan team broke off to start a new early-stage investment firm, Coral Capital. It is not very clear if they will launch an accelerator program similar to the one 500 Startups was running but it cannot hurt to keep an eye on their website for news on this subject.

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1 Coral Capital

CONNECTING WITH JAPANESE STARTUPS

(This whole section is courtesy of Tim Romero[1] from Disrupting Japan[2])

I get asked a lot about the best way to get involved with Japanese startups, how to connect with other founders in Japan, and for advice on how to start a startup in Japan. I enjoy answering questions and talking about startups, but I am a fundamentally lazy person, so I put this together to save some time and hopefully provide some value.

This is by no means comprehensive. In fact, we are barely scratching there surface, and with the startup scene expanding so quickly, it's sometimes hard to keep track of all the new groups that are popping up, but the following resources will plug you directly into the heart of the Japan startup scene and help you connect with Japanese startups even if you don't speak much (or any) Japanese.

This is a very personal list. These are events I attend, the services I use, the websites I read, and people I trust.

Meetups

[HackerNews](#)

There are dozens of startup events in Tokyo, but this is the best place to start networking with Japanese and foreign startup founders. HackerNews is held monthly, and there is usually a good mix of Japanese and foreigners, and programmers and business types. If I'm in town, I usually show up. They also run an active and friendly [Slack channel](#).

[Startup Weekend](#)

A weekend-long startup simulator, and a great first step if you have never run a startup and want to understand how to create a good business plan and also gain some insight into the stressful team dynamics involved in starting a company. Start-

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[1] [Tim Romero - About](#)

[2] [Disrupting Japan](#)

up Weekend is non-profit, run by volunteers, and laughably inexpensive for the experience you get. I volunteer as a coach or a judge occasionally. They run a lot of events and the quality varies considerably, but the "International" events are done in English and tend to be quite good.

Dev Japan

Dev Japan is one of the best, lowest-stress ways to connect with other developers in Tokyo. Dev Japan runs in English, and while their meetups do have some short presentations, for the most part they are just a group of designers and developers who get together on the weekend to hang out and work on their own projects.

FinTech Association of Japan

FinTech Association meetups have a good mix of finTech startup founders and representatives from larger, more traditional financial companies. You won't have any trouble figuring out who is who. The site is in Japanese as are most of the members, but they are quite welcoming to foreign finTech entrepreneurs.

Business in Japan

BiJ is technically not a startup organization. It's more of a casual gathering of Tokyo's foreign business community, but plenty of people from the startup world attend as well. Everything is in English, so it's a great place to meet people when you are new in Japan.

Tokyo Tech Startups

TTS a very welcoming group of (mostly) foreign startup founders and aspiring founders. They have a high percentage of developers and designers and people who actually build things. These meetups usually involve one or two early-stage startups pitching to the group, a bit of Q&A, and lots of conversation.

Tokyo Digital Marketers

If your skills learn more towards marketing, Tokyo Digital Marketers is the biggest bilingual meetup of its kind in Tokyo and the memership seems to tilt heavily towards startups.

Doorkeeper

Run by Paul McMahon, a foreign entrepreneur in Tokyo. This is a great way to discover bilingual startup events in Japan. I monitor this site closely.

Big Startup Events

Tech In Asia – Tokyo

One of the oldest and largest events of its kind. Thousands of attendees, hundreds of startups, multiple tracks, and dozens of speeches and panel discussions. Everything is simultaneously interpreted into Japanese/English. It's usually held in September and you really need to go it you are in town then.

Slush Tokyo

Slush is every bit as good as Tech In Asia, but completely different. TiA can feel a bit like an academic conference, and Slush can feel a bit like a rock concert. Everything is in English, it's a lot of fun, and you shouldn't miss it if you are in town. Slush is usually held in March.

Innovation Leaders Summit

Innovation Leaders Summit focuses on connecting startups to Japanese enterprises. There are presentations and discussions, but the focus of the event is startup-enterprise collaboration and networking. ILS is conducted in Japanese and without interpretation, but it is very welcoming to foreignen startups who can pitch in Japanese.

TechCrunch Tokyo

TechCrunch Tokyo is not nearly as large or as over-the-top as the Disrupt events in San Francisco and New York, but it's big. While the other large events are very international, TechCrunch Tokyo focuses squarely on Japanese startups and those who love them. The pitches and presentations are all in Japanese, but this is a great deep dive into the Japanese startups. TechCrunch Tokyo is usually held in November.

Startup Jobs in Japan

[Wantedly](#)

Wantedly has an English interface, but most of the content is still in Japanese. If you speak Japanese this is **the** place to find out which Japanese startups are hiring and to arrange to visit their offices. Wantedly is a hotbed for startups looking for employees and for aspiring founders looking for each other.

[Justa](#)

An English-language jobs board catering exclusively to the Japanese startup community. They are relatively new, but they are serious about serving Japan's startup community. No English teaching or modeling jobs to be found here.

[Jobs In Japan](#)

One of Japan's first and best job sites for people looking for work in Japan. Jobs In Japan is not particularly start-up focused but lists a huge variety of open positions available to those without strong Japanese-language skills.

Jobs for Hackers by Hackers

A number of small, independent, worthwhile, job boards are maintained by some of the leaders of the engineering community here. It's a great place to look for English-friendly development roles at Japanese startups.

- [Tokyo Dev](#)

- [Tech Jobs Tokyo](#)

- [Techy Tokyo](#)

Japan Startup News

The big media sites cover the unicorns and big investments, but it's hard to get good information about Japanese startups in English. Sadly, even while startups are booming in Japan, there are fewer and fewer media outlets providing good coverage. At this point, there is only Disrupting Japan and [The Bridge](#), who I highly recommend. They are smart, well connected and have a point of view.

Other Resources

Terrie's Take

Long-time Tokyo entrepreneur Terrie Lloyd has been publishing this weekly news-letter for more than a decade. It's not exclusively focused on startups, but Terrie has a depth of experience and a hands-on perspective on the state of business in Japan that is rare to find in any language. It's worth signing up.

Conclusion

JAPANESE MARKET POTENTIAL FOR EUROPEAN COMPANIES

Japan is one of the first nations to take many social issues facing a mature society, like the declining birthrate and aging population, labor deficit, rural depopulation, and expanded fiscal spending.

Artificial Intelligence (AI) is viewed as a fundamental technology to save society from these difficulties, to address the goals set forth in the United Nation's Sustainable Development Goals (SDGs), and to create a sustainable world.

"Around 30% of the cars are made in the world are made by Japanese companies."

Following the EU-Japan Economic Partnership Agreement Japan has accepted to bring its standards for cars fully in line with the same international standards the EU adopts. This will make it more accessible for EU car manufacturers to sell their vehicles in Japan.

According to Mr. Takao Watanabe CEO of Mitsugo, a Japanese company working on conversational AI to help young children acquire language, Japan is not at the leading position when it comes to AI but it still has very strong industries like vehicles leading the world and collecting enormous amounts of data that could benefit from foreign AI solutions to process.

The EU-Japan Economic Partnership Agreement will make it easier for EU firms to sell their services or products in Japan.

Firms in the **following areas** in particular are expected to benefit from the partnership:

• Business services

• Financial services, in particular insurance

• Telecoms

• Transport

• Distribution

• Postal and courier services

SOME EXPERT'S TIPS

[Suzana Ilić](#) is the Founder and Director at Machine Learning Tokyo (MLT)[1], a nonprofit organization dedicated to democratizing Machine Learning and supporting the AI ecosystem in Japan. MLT consists of around 50 active core contributors and 3,500 members in Tokyo.

The community is comprised of Machine Learning Engineers and Researchers, Data Scientists, Roboticists, professionals and students alike.

In the past two years MLT held more than 50 technical hands-on Deep Learning workshops and facilitated more than 250 hours of Machine Learning study and implementation. Each workshop is focused on algorithms and model building. More than 3,000 people have participated in MLT workshops and [Meetups](#) in Tokyo.

Some of the leading machine learning and deep learning researchers and practitioners have been invited to give a talk for MLT. François Chollet (Creator of Keras, Google AI), Anima Anandkumar (ML Research Director, NVIDIA) and David Ha (Research Scientist, Google Brain) were among the guest speakers. For these events MLT collaborates with top Universities in Tokyo (e.g. University of Tokyo, Tokyo Institute of Technology, etc.)

Suzana has some interesting insights into the Japanese AI industry and advice for foreign companies trying to enter the market.

Suzana believes that **development and deployment in Japan take a bit longer** than in leading countries such as the US or China. But as in any industry, **a careful and thoughtful planning phase is priority**. However, with Japan being one of the **leading countries in the fields of robotics**, Suzana sees a lot of interesting

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[1] [MLT Website](#)

things happening towards machine learning on edge devices.

As an advice for foreign companies she points that **Japan likes to see things work elsewhere** very well, **before adoption**. That might be a good opportunity for nimble startups to develop and bring products to market, showing success. That will help entering the Japanese market (B2B).

Tim Romero is a Tokyo-based entrepreneur, author, and educator who has started several companies since coming to Japan more than 25 years ago, he is deeply involved in Japan's startup community as an investor, founder, and mentor. In 2014 **Tim founded Disrupting Japan[1].**

According to Tim Disrupting Japan is the **first and largest startup podcast in Japan** and the best way to hear directly from the new generation of startup founders who are changing the Japanese economy. Guests have included both post-IPO CEOs and new founders, and all guests have amazing stories to tell.

The insights that come from the in-depth discussions have appeared in leading Japanese business publications such as the Nikkei and the Fuji Sankei.

When asked about his insights into the Japanese AI industry and how foreign companies working on A.I. can expand to Japan Tim (who gets contacted at least once every month by an AI startup wanting to come to Japan) believes that:

- **Funding and risk markets are not as developed** in Japan as they are in China and the US.

- Lots of the base tech is not new and it is already around 30 years old. What is really new is **access to cheap processing power and massive data sets**, that is where US and Chinese companies have an edge since they have immense re-

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[1] Disrupting Japan podcast

sources and massive access to data.

 - Due to the almost **full employment** rate in Japan there is a talent crunch and it is really **hard to find qualified engineers** to fill technical positions. There are basically more jobs than candidates.

- **Generalists companies have a hard time** making it in Japan so companies wanting to come to Japan need to make sure they are not generalist and offer a specific solution with a strong knowledge of what they are doing.

Terrie Lloyd has spent 30 years learning how to compete/collaborate with Japan's major companies. Using foreign technology and foreign employees, he has created more than 20 companies, 8 of which were successful enough to be sold at good returns to the investors. Mr Lloyd is CEO of Japan Travel KK, full-stack travel company focused on Japan Inbound travel sector and publisher of Japan's number 1 inbound travel site.

When asked about his insights of the AI industry in Japan and if it is behind other nations Mr Lloyd believes that:

1. **Japanese like physical products versus soft ones**. As an example, look at cell phones. The Japanese i-mode system was great, but it could not compete with Apple's smartphone paradigm. Think of Apple's buttons being images whereas Japanese phone makers included actual physical buttons (such as "send" for email).

2. The Japanese have been doing case-based AI for many years in manufacturing, but **lagged in neural network AI** because they don't like the idea of black boxes that can't be fully explained (such as, how does a true neural network actually learn?).

3. The **application of AI** in user-interfaces is **an antipathy of the traditional Japanese value** system. Japan is a human-oriented culture, where remote "anything" is frowned upon and where business is only done after meeting the counterparty.

4. Japanese **major companies own and control** most of the economy and thus **most of the big data** that AI would typically be run on. These companies have traditionally protected all internal data as a point of competitive vulnerability, so there is a huge reluctance to share that big data.

5. Then there are commodity factors, such as the **shortage of data scientists, lack of venture capital** for start-ups, the low **quality of computer science education**, the lack of ability to translate local breakthrough products to international markets, etc.

When asked about his opinion on how foreign companies can benefit in Japan, Mr. Lloyd says that:

The easiest point of attack for foreign companies is **direct to consumer**, since then **they don't have to reeducate the customer** (Japanese consumers respond, just like in other countries, to great ideas, designs, and functionality). If the foreign firm doesn't have B2C expertise, they should consider either:

1. **Partnering with a Japanese start-up** and giving them access to the technology in return for a share of the resulting B2C business.

2. **Setting up a fund** for start-ups to use their tech.

Acknowledgement

Glossary

A

A/B Testing

A controlled experiment intended to compare two variants of a system A and B.

Algorithm

In mathematics and computer science, an algorithm is an unambiguous specification of how to solve a class of problems. Algorithms can perform calculation, data processing and automated reasoning tasks.

Artificial Intelligence

The study and design of intelligent systems that perceive their environment and take actions which maximize their chances of success.

Artificial Neural Networks

Artificial neural networks or connectionist systems are computing systems vaguely inspired by the biological neural networks that constitute animal brains.

Automated Speech Recognition

A subfield of Computational Linguistics involved in methods that allows the recognition and translation of spoken language into text by computers.

B

Batch

The set of examples used in one gradient update of model training.

Bayes's Theorem

A used by statisticians to explain the probability of an event based on prior knowledge of conditions that might be related to an occurrence.

Bias

Inductive Bias: the set of assumptions that the learner uses when predicting outputs given inputs that have not been encountered yet.

Confirmation Bias: the predisposition to search for, interpret, favor, and recall information in a way that confirms one's own beliefs or hypotheses while giving disproportionately less attention to information that contradicts it.

Bias-Variance Tradeoff

A conflict arising when data scientists try to minimize bias and variance, that prevents supervised algorithms from generalizing beyond their training set.

C

Chatbot

An AI or a computer program designed to interact with human users through conversation.

Clustering

In Machine Learning, the unsupervised task of grouping a set of objects so that objects within the same group, or cluster, are more analogous to each other than they are to those in other groups or clusters.

Cold-Start

A potential issue resulting from the fact that a system cannot infer anything for users or items for which it has not gathered a sufficient amount of data yet.

Collaborative Filtering

A method of recommender systems used to make predictions about the interests of a user by collecting preferences from a larger group of users.

Computer Vision

The field of Machine Learning that studies how to gain high-level understanding from images or videos.

D

Data, Unstructured: raw, unprocessed data.

Data, Structured: data processed in a way that it becomes ingestible by a Machine Learning.

Decision Tree

A category of Supervised Machine Learning algorithms where the data is split following a given criteria.

Deep Blue

The first computer chess-playing system to win both a chess game and a chess match against a reigning world champion. Designed by IBM.

Deep Learning

A broader family of Machine Learning methods based on learning data representations, as opposed to task-specific algorithms. Deep Learning can be supervised, semi-supervised or unsupervised.

E

Epoch

In the context of training Deep Learning models an Epoch is one pass of the full training data set.

F

Feature

A variable that is used as an input to a model.

Feature Learning

An group of techniques meant to automatically discover the representations needed for feature detection or classification from raw data.

False Positive

An error where a result did discard the null hypothesis when it shouldn't have.

False Negative

An error due to the fact a result did not discard the null hypothesis when it should have.

F-Score

A measure of a model's accuracy considering both the precision and the recall to compute the score. Its maximal value is 1 perfect precision and recall, the minimum is 0.

G

Garbage In, Garbage Out

A principle stating that when the input data is defective, it will lead to misleading results and produces nonsensical output (garbage).

General Data Protection Regulation (GDPR)

A regulation in EU law on data protection and privacy for all individuals within the European Union aiming to give control to citizens over their personal data.

H

Human-in-the-Loop

Human-in-the-loop (HITL) is a branch of artificial intelligence that requires human interaction. to create machine learning models. In a human-in-the-loop approach, human feedback is included into the learning loop of the machine in order to help it improve faster.

I

Image Recognition

The method of determining whether an image contains some specific object, feature, or activity.

Inference

The process of making predictions by using a trained model to new, unlabeled occurrences.

Information Retrieval

Information retrieval is the science of searching for information in a document, searching for documents themselves, and also searching for metadata that describe data, and for databases of texts, images or sounds. Automated information retrieval systems are used to reduce what has been called information overload.

L

Learning-to-Learn

A new path within the field of Machine Learning studying how algorithms can change the way they generalize by analyzing their own learning process and improving on it.

Learning-to-Rank

The application of Machine Learning to the creation of ranking models for Information Retrieval systems.

M

Machine Learning

A subfield of Artificial Intelligence that uses statistical techniques to offer computers the capacity to "learn", i.e., progressively improve performance on a specific task.

Machine Translation

A subfield of computational linguistics that studies the usage of software to translate text or speech from one language to another.

Model

A model is an abstracted representation of what a Machine Learning system has learned during the training process.

Multi-Task Learning

A subfield of Machine Learning that utilizes similarities and differences across tasks to solve multiple assignments at the same time.

N

Natural Language Processing (NLP)

An area of Artificial Intelligence that studies interactions between computers and human languages, especially how to process and analyze big amounts of natural language data.

Neuron

An unit in an Artificial Neural Network processing numerous input values to generate a single output value.

O

Optical Character Recognition

The conversion of images of text, handwritten, printed or typed into a machine-friendly textual format.

Optimization

The selection of the best element from a set of available alternatives.

P

Pattern Recognition

An area of Machine Learning focusing on the recognition of patterns in the data, the recognition can be supervised or unsupervised.

Personally Identifiable Information

Any piece of information that can be used on its own or in combination with other information to identify a particular individual.

Precision

The number of correct positive results divided by the number of all positive results returned by a classifier.

Pre-trained Model

A model that has been preliminary trained.

R

Regularization

The method of introducing additional information to prevent overfitting.

Reinforcement Learning

A subfield of Machine Learning inspired by human behavior studying how an agent should take action in a given environment to maximize a notion of cumulative reward.

S

Synthetic Data

Data generated artificially when real data cannot be collected in sufficient amounts, or when the original data doesn't meet certain criteria.

T

TensorFlow

A popular open-source library used for machine learning applications such as neural networks.

Time Series

A sequence of data points logged at specific times and indexed according to their order of occurrence.

Training Data

In the context of Supervised Machine Learning, the creation of algorithms that can learn and make predictions from data.

Transfer Learning

An area of Machine Learning that focuses on using knowledge learned to solve a specific task and apply this knowledge to a different but related task.

Turing Test

A test developed by Alan Turing to evaluate a machine's capacity to show intelligent behavior comparable to that of a human. The test consists in having the machine chat with a human. The machine is said to have passed the Turing test If a human evaluator observing the conversation from outside the place where the test takes place cannot tell the machine from the human.

U

Uncertainty

A range of values likely to enclose the true value.

List of Abbreviations

	Definition	Page
AGI	Artificial General Intelligence	19
ANI	Artificiall Narrow Intelligence	19
API	Application Programming Interface	42
ASI	Artificial Super Intelligence	19
BAT	Baidu, Alibaba, Tencent in China	9
CAD	Caomputer Aided Design	41
CEO	Chief Executive Officer	21
CHANS	Cabinet Office is an agency of the Cabinet of Japan.	66
COSME	COSME is the EU programme for the Competitiveness of Enterprises and Small and Medium-sized Enterprises	65
DFKI	German Research Centre for AI	34
DKK	Danish Krone	33
EEN	Enterprise Europe Network	64
EPA	EU-Japan Economic Partnership Agreement	60
EPO	European Patent Office	69
Foreign	Foreign Direct Investment	4
GAFA	Google, Amazon, Facebook, Apple	9
GDP	Gross Domestic Product	61
GDPR	General Data Protection Regulation	13
GPA	Government Procurement Agreement	65
HITL	Human-in-the-loop	13
HLEG (AI)	The High-Level Expert Group on Artificial Intelligence	29
IBM	International Business Machines Corporation	12
IBSC	Invest Japan Business Support Center	5

ILS	Innovation Leaders Summit	75
IPC	International Patent Classification	68
IPO	Initial public offering	79
IPR	Intellectual Property Rights	65
JETRO	Japan External Trade Organization	4
JPO	Japan Patent Office	68
JPY	Japanese Yen	6
LLC	Limited Liability Corporation	42
MADB	Market Access Database	67
METI	Ministry of Economy, Trade and Industry or METI, is a ministry of the Government of Japan	3
MJI	More Joyful Innovation	42
MLT	Machine Learning Tokyo	78
MRI	Magnetic resonance imaging	37
MUFG	Mitsubishi UFJ Financial Group Inc	71
NCP	National Contact Point	66
NLP	Natural Language Processing	15
NTT	Nippon Telegraph and Telephone Corporation	7
NVIDIA	Nvidia Corporation	78
PCT	Patent Cooperation Treaty,	69
RBC	Regional Business Conference	51
REST	Representational State Transfer	42
SBA	Small Business Act	66
SME	Small and medium-sized enterprises	33
STEM	Science, Technology, Engineering and Mathematics	33
TED	Tender Database	65
TMG	Tokyo Metropolitan Government	70
TTS	Tokyo Tech Startups	74

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The author tried to provide concrete examples where she could, these mentions are not meant to be indications nor endorsements. Instead, they serve to give a taste of what is out there. She encourages any and all interested in Blockchain to explore on their own and discover this vibrant community and all the activity it has spawned in Japan and Europe. Hopefully this paper can serve a useful purpose as an initial guide.

Thank you!

Photo: Kuromon Ichiba Market, Ōsaka-shi, Japan, Source: Stock Photo, Andy Kelly (Unsplash)