

Investment Recipes

by  AtonRā Partners



6 NOVEMBER 2019

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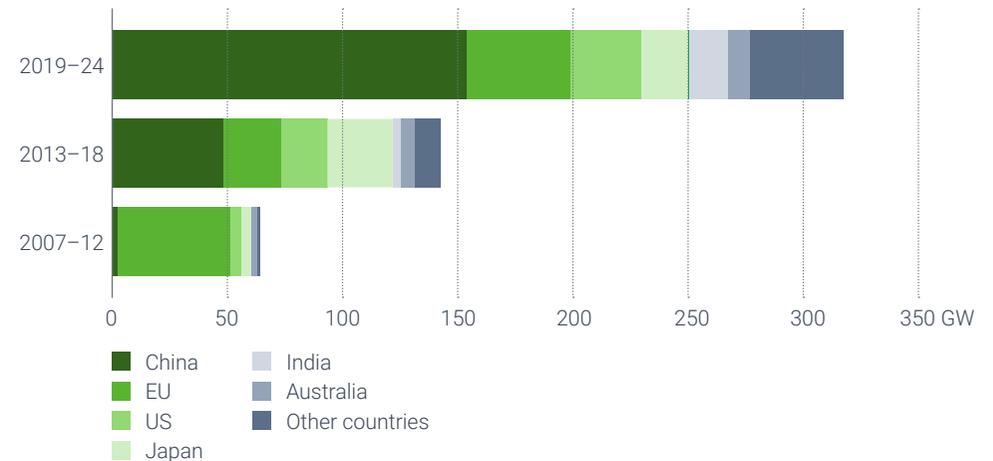
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UTILITIES AND RENEWABLES – A STRONG NEGATIVE CORRELATION AMONG THEM

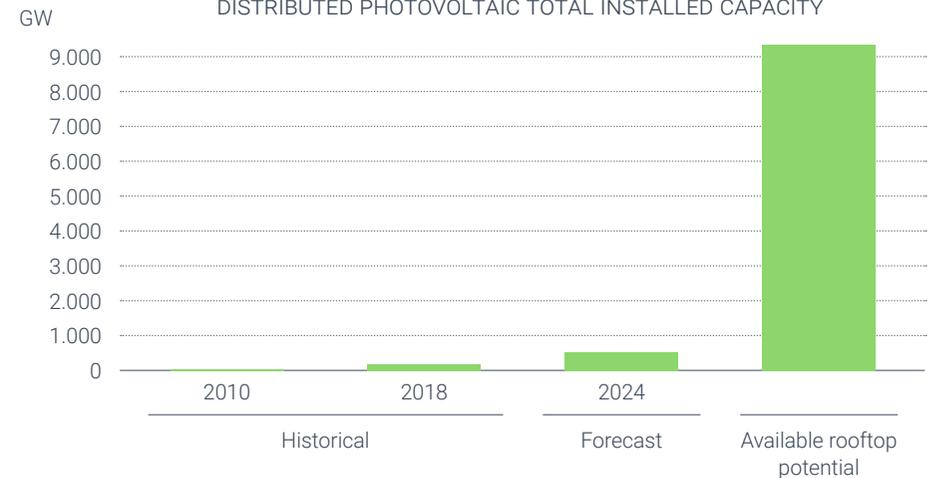
Renewables disrupting the utility sector

- Traditionally, utilities' role relied on building large **centralized** power plants, transmission & distribution lines, and selling electricity to **passive consumers**.
- The emergence of renewable energy is shaking up their stable business model in many ways:
 - **Regulations** are increasingly requiring the integration of renewable energy into the power generation mix and thus forcing utilities to transition away from fossil fuels;
 - Development of **Distributed Energy Resources (DER)** and more especially **Distributed Solar PhotoVoltaic** (see side figure) is creating new integration challenges on the power grid while reducing the amount of electricity buyers.
- Utilities' historical monopoly is being disrupted by **prosumers** who instead of simply consuming electricity have now the option to produce it themselves.
- Global Distributed Solar PhotoVoltaic capacity is expected to more than double by 2024, representing only 6% of the technically available rooftop potential (source: IEA).

DISTRIBUTED PHOTOVOLTAIC GROWTH BY COUNTRY / REGION



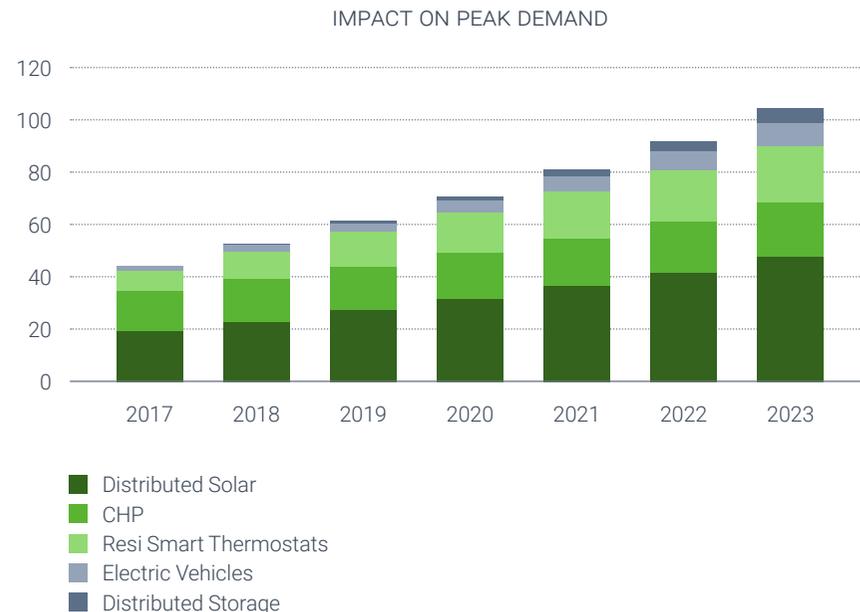
DISTRIBUTED PHOTOVOLTAIC TOTAL INSTALLED CAPACITY



SOURCES:
<https://www.iea.org/media/presentations/Renewables-2019-Launch-Presentation.pdf>
 Market analysis and forecasts to 2024, IEA Renewables 2019

The rise of distributed energy resources

- Distributed Energy Resources (DER) are small decentralized systems connected to the distribution grid and affecting the local energy profile. They include:
 - **Distributed Generation:** mainly Distributed Solar or small Combined Heat and Power (CHP) such as heat pumps, thermal boilers, thermal storage etc.;
 - **Distributed Storage:** such as home battery systems storing surplus generation;
 - **Electric Vehicles (EV) Infrastructure:** particularly (smart) chargers which optimize EV's charging cycles according to power availability and constraints;
 - **Smart Devices:** such as smart thermostats which allow more energy efficient consumption.
- Residential DERs are increasingly impacting utilities by **adding variability** to the grid demand.
 - According to GTM Research, “flexible” power capacity in the US is expected to **double by 2023** (from 2017 levels).
 - This variable capacity can be either seen as an issue or a potential asset for grid balancing, peak load reduction, and reliability improvements.
- Therefore, utilities need to upgrade their infrastructure and transform it to a smarter, digitalized, and more efficient power network.



SOURCES:

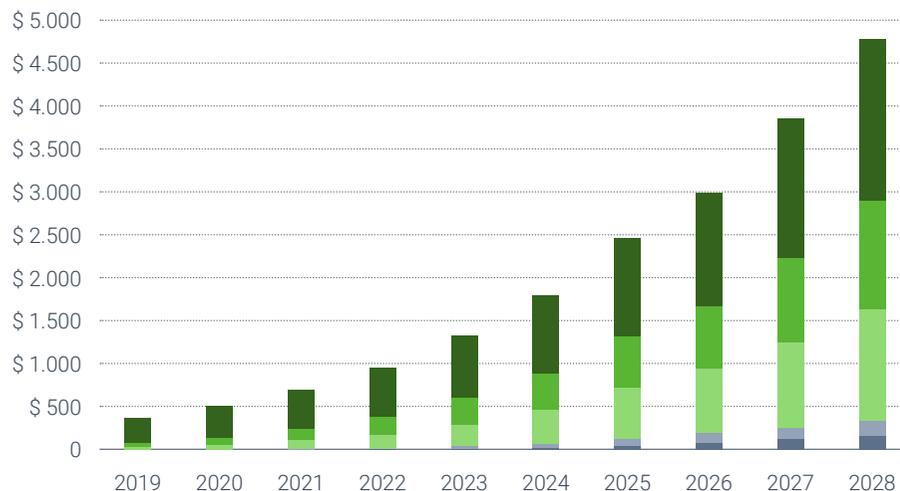
GTM Research and Department of Energy, Grid Edge Innovation Summit 2018

https://assets.greentechmedia.com/assets/content/cache/made/assets/content/cache/remote/https_dqbasmyouzi2.cloudfront.net/content/images/articles/2018_grid_edge_summit_chart_2_2408_1326_80.jpg

The growth has just started

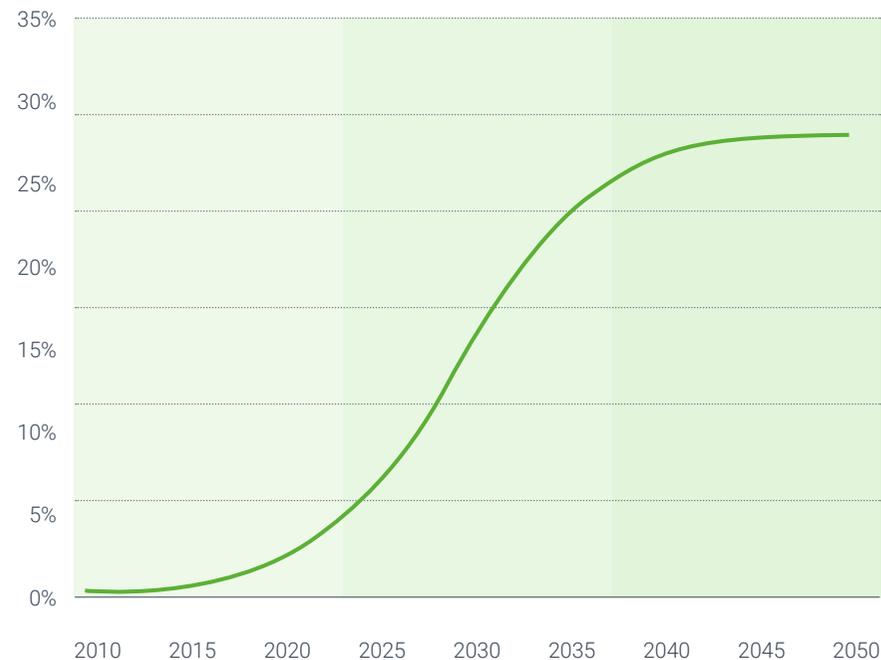
- According to Navigant Research, utilities' spending in Distributed Energy Resources (DER) are expected to grow at a very fast pace (~30% CAGR), from less than \$500mn to \$4.8bn by 2028 .
- While today's rate of DER adoption over the total energy consumption is still pretty low (below 5% on average), the DER penetration is entering its "sustained growth" phase and is expected to reach 30% in the coming twenty years.
- The growing influence of DERs on electricity consumption is putting pressure on utilities, forcing them to innovate their business models.

DER SPENDING BY REGION, WORLD MARKETS: 2019-2028



SOURCES:
 Navigant Research
 Evolving Business and Regulatory Models in a Utility of the Future World, Brattle Research, 2017

IMPACT ON PEAK DEMAND



EMERGING TECHNOLOGY LIGHT DER PENETRATION

Effect of incremental DER within the range of load uncertainty.

No pressing need for new in technology or strong concern about inefficient subsidies.

DER PENETRATION INCREASES RAPIDLY

DER becomes attractive relative to traditional service.

Significant fixed costs to upgrade/build up information and control systems,

MATURE DER TECHNOLOGY

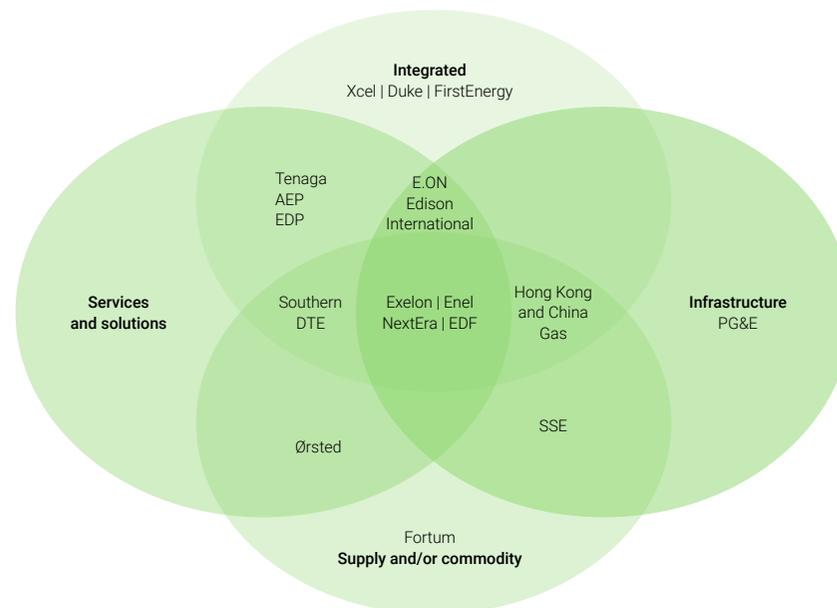
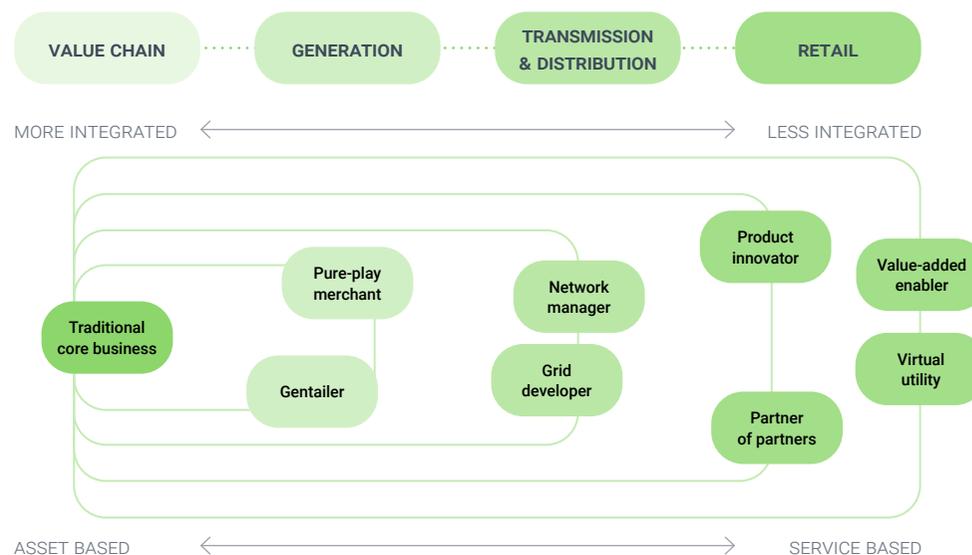
With systems in place, easier to assimilate additional resources.

DER more likely to be viable substitute for upstream T&D.

Reinventing the business model

- Utilities are now facing an “evolve or die” dilemma where business as usual is no longer an option.
- Utilities must deal with a set of different models and operate with multiple markets along the entire value chain.
 - Utilities can still own & operate generation assets, develop transmission & distribution lines and sell power (traditional more integrated model).
 - But on top of that they can propose optional renewable power (product innovator), sell home-related energy services from partners (partner of partner), collect valuable data and leverage on it (value-added enabler), or even aggregate various third party DERs and act as a network integrator and market facilitator (virtual utility).
- As a general trend, European Utilities are leading the way with regards to value proposition and innovative service offering.
 - **Enel (ENEL IM)** is offering e-mobility services, demand response and storage solutions through its subsidiary Enel X, and produces 46% of its power from renewables while targeting full decarbonization;
 - **Ørsted (ORSTED DC)** is focusing its activity on developing renewable generation (mainly on offshore wind, where it is the world leader) and it intends to reach 99% of renewable energy generation by 2025 (from 64% in 2017);
 - **E.ON (EOAN GR)** and **RWE (RWE AG)** showed an explicit example of business model revamp as they swapped assets, with E.ON obtaining RWE’s network and retail services while RWE obtained E.ON’s renewable business “Innogy”.

BUSINESS MODEL CHOICES



SOURCE:
Global power strategies, PwC's Strategy, 2019

UTILITIES AND RENEWABLES – A STRONG NEGATIVE CORRELATION AMONG THEM

Catalysts:

- **Regulations.** Most countries have deployed mechanisms to enable a progressive integration of renewable energy in the electricity mix.
- **Grid Parity.** Decreasing technology costs for solar and battery technologies are fostering the growth of distributed generation.
- **Digitization.** The integration of digital technologies in the grid infrastructure is opening the way to grid management improvements and new business opportunities (such as net-metering).

Risks:

- **Rise of Prosumers.** People's desire for self-generation is set to grow and add pressure to electricity prices and load variability.
- **New Entrants.** New players arising from the renewable energy boom are threatening traditional utilities in deregulated regions.
- **Climate Change.** Warmer climate and increased likelihood of extreme weather events are putting utilities' ageing infrastructures at risk.

Bottom line:

- Utilities are not anymore the only ones capable of providing power to people, distributed renewable energy forces them to innovate and find new revenue streams.
- There are significant discrepancies among utilities with regards to renewables integration and grid modernization.
- In our Sustainable Future Certificate, we strive to identify revolutionary utilities which benefit from fast growth of renewables as well as innovators in the smart grid sector.
- Leading providers of digital-enabling technologies to the grid include for instance: **Schneider Electric (SU FP)** or **Cisco Systems (CSCO US)**

KILL CASH, VOL. 1 – A LIBRA SEQUEL

A step forward into the future: cashless society and e-money

- Moving on from "Libra (un)chained" (9th October Investment Recipe issue), we are now looking at the implications of **e-money** and a **cashless society**.
- No society in the world has yet gone "cashless". Communities close to being cashless showed that such a shift has to be planned in advance not to leave people behind.
 - Keeping the **cash infrastructure** for scarce cash usage is a significant cost.
 - Retirees, recent immigrants, people with disabilities and those inhabiting rural areas are more vulnerable to cash disappearance.
 - The economic gap between rural and urban areas may enlarge.
- A report by the International Monetary Fund (IMF) highlighted that cash and bank deposits will face tough competition from **e-money**.
 - Electronic money may be more convenient than cash and bank deposits as a means of payment. E-money would add pressure on banks, which are already suffering increased competition from the fintech world.
 - 90% of Kenyans over age 14 pay with M-Pesa and the value of e-money transactions in China surpass those of Visa (V US) and Mastercard (MA US) combined.

SOURCES:

<https://www.accesstocash.org.uk/media/1087/final-report-final-web.pdf>

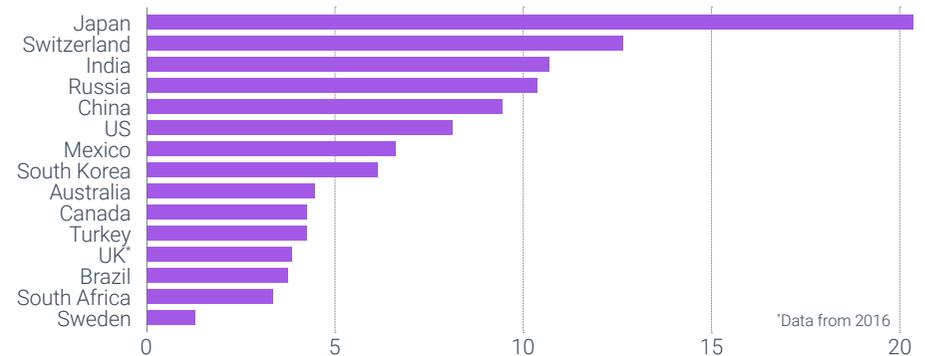
"The Rise of Digital Money", IMF, Jul 2019

<https://www.weforum.org/agenda/2019/05/in-a-cashless-society-vulnerable-citizens-may-end-up-paying-the-highest-price/>

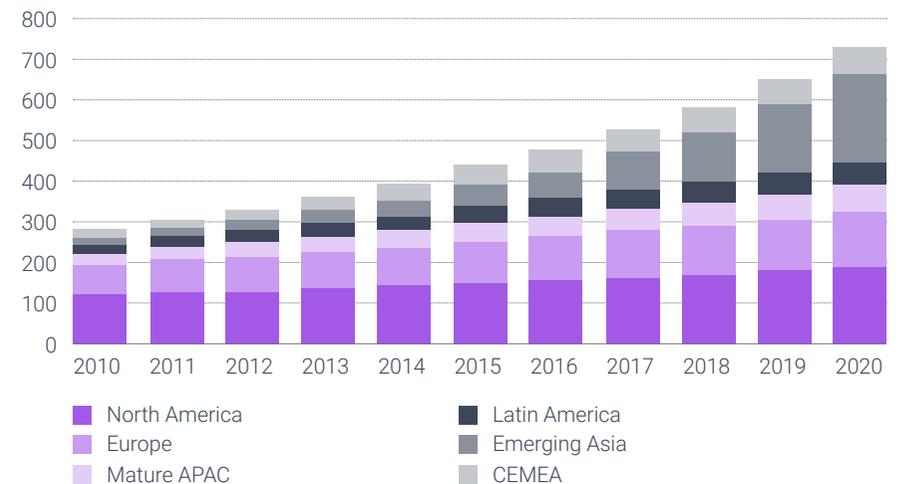
<https://www.afr.com/technology/the-role-of-banks-in-a-cashless-world-20190624-p520qa>

The road to cashless societies, UBS, Apr 2018

CASH USE VARIES BY COUNTRY
BANKNOTES & COINS IN CIRCULATION, 2017 (AS % OF GDP)



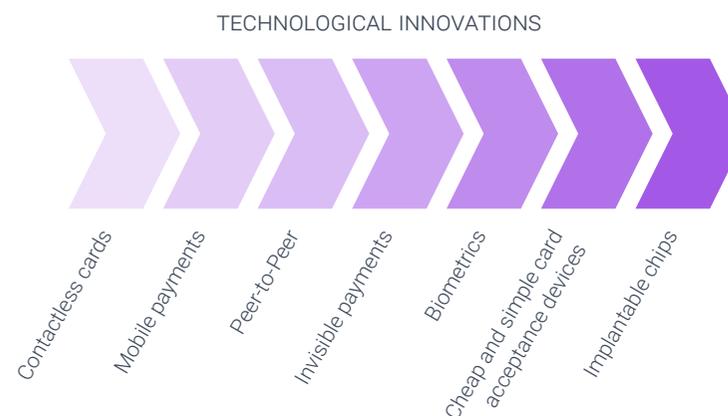
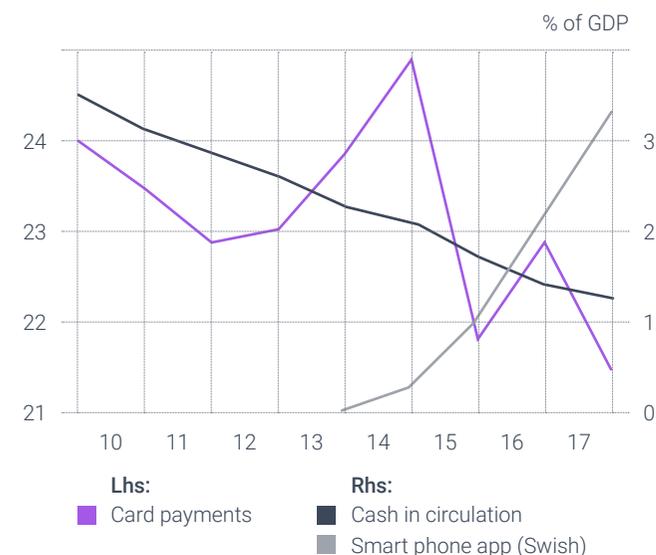
NUMBER OF WORLDWIDE NON-CASH TRANSACTIONS (IN BN)



Closing the Cash Tap

- Technological innovation has pushed reality as far as science-fiction: around 4'000 people in Sweden have had tiny **microchips implanted** under their skin. They can be used to access buildings as well as to make payments.
- Easy-to-use technology is already there (mobile payments, biometrics, implanted chips, ...). Winning people's trust in new technologies is key.
- Ensuring a seamless experience all over a territory requires investments. People need to be sure a given means of payment is accepted.
- **Sweden** is going to be fully **cashless in three to five years**.
 - The Riksbank stated that retail payments in cash have declined to 15% from 40% in 2010. The outstanding value of cash circulating dropped to 1% of Swedish GDP.
 - Approximately 900 out of 1600 Swedish bank branches stopped to distribute cash or accept deposits made in cash. Sweden's central bank has told banks to keep offering cash services.
 - The shift needs to be slowed down not to leave people behind.
- Reducing cash usage would negatively affect wide portions of the population.
 - UK cash infrastructure costs £5bn a year, paid for mostly by retail banks and run especially by commercial operators. Consumers ultimately bear the cost through taxes and charges: the fewer the users, the higher the unit cost. Sharing deposit facilities into an integrated network is what Finland and Sweden are pursuing.
 - Rural communities would become less viable and their inhabitants would find higher barriers to do everyday things. A sudden change in policy will affect charities and homeless as well, not benefiting from people having small change anymore.
- A strong indicator of cash dependence is income. Low-incomers have a more difficult access to digital infrastructure.

RAPID INCREASE IN USE OF NEW PAYMENT SOLUTION IN SWEDEN



SOURCES:

<https://www.weforum.org/agenda/2018/11/sweden-cashless-society-is-no-longer-a-utopia/>
<https://www.bis.org/publ/bppdf/bispap101.pdf> | <https://www.accesstocash.org.uk/media/1087/final-report-final-web.pdf> | AtonRâ

Digital Money on the Rise

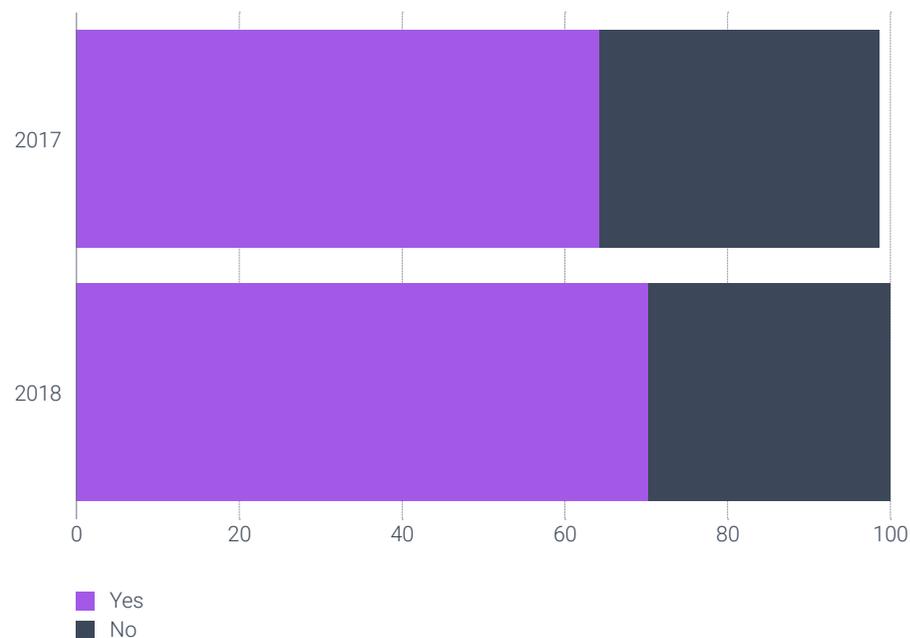
- E-money providers might be allowed to have **central bank deposits**, as other banks are. Many financial authorities promptly accepted fintech players within the financial system.
 - The Reserve Bank of India, the Hong Kong Monetary Authority, and the Swiss National Bank allow non-bank fintech companies to hold reserve balances. The process is subject to the grant of special-purpose licenses.
 - E-money providers would then overcome market and liquidity risk, transforming themselves in narrow banks. As we explained in our research "A Libra debunking" (Jul 2019), narrow banks would cover 100% of their liabilities with bank reserves without lending money to privates. They would just operate as payments facilitators.
- New entrants in the payment field may become banks themselves and thus offer **credit**.
 - Central banks will be key in setting the rules for new digital monies to exist.
 - Credit may be granted based on the information new entrants will have acquired through their users.
 - Within certain countries where e-money is extending its reach, users trust telecommunications and social media companies more than banks.
- Monetary authority may then partner with e-money providers to effectively provide **central bank digital currency (CBDC)**, a digital version of cash.
 - CBDC could protect users' data from third parties, bring efficiency to the payments system and stability to the financial system, as well as fostering financial inclusion.

SOURCES:

"The Rise of Digital Money", IMF, Jul 2019
"A Libra debunking", AtonRâ Partners, Jul 2019
<https://www.bis.org/publ/bppdf/bispap101.pdf>

CENTRAL BANK DIGITAL CURRENCY WORK

Engagement in CBDC work, 2018 survey



Catalysts:

- **Infrastructure overhaul driving cash use down.** The increased acceptability of cards, shops increasingly refusing cash, and the enhanced coverage of mobile connectivity are a step forward to facilitate new means of payments.
- **Technology penetration pushing mobile payments.** The increased use of mobile shopping and easier digital payments (i.e. contactless cards, biometrics, etc.) expand the reachable user base.
- **Authorities issuing digital currency.** Philadelphia Federal Reserve bank's president, Patrick Harker, said it is "inevitable" for central banks to start issuing digital currency.

Risks:

- **Regulators slowing down fintech takeoff.** A federal district court in New York recently blocked the attempt by the U.S. Office of the Controller of the Currency from issuing national operating licenses to fintech firms.
- **Consumers mistrusting digital payments.** Users' loss of faith in digital payments because of system failures and increased concerns over privacy would drive cash usage up.
- **Too-fast shift to cashless.** A not well-planned change in payment habits may enlarge differences between citizens and trigger financial exclusion.

Bottom line:

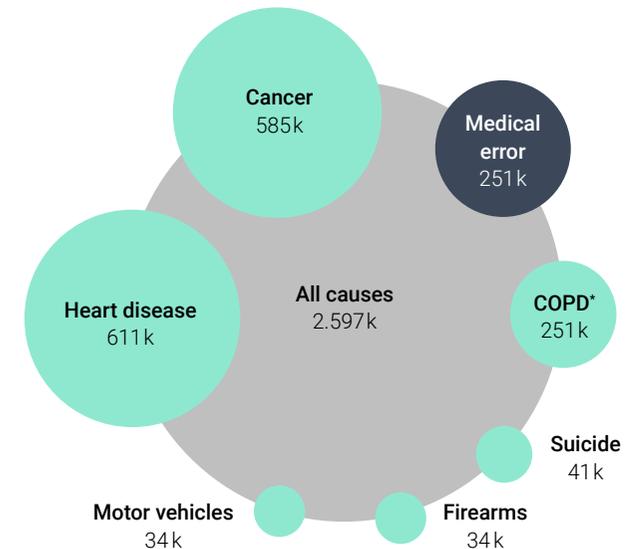
- Reaching a cashless society has to advance step by step. Our system cannot afford to leave people behind.
- Central authorities issuing digital currencies, thus making cash usage marginal, may set the ground for a **massive financial disintermediation**. We may be close to a major disruption in the financial system.
 - Fintech and mobile payments are already undermining financial institution. Central authorities stepping into these fields of innovation would be a major breakthrough.
- **Central bank digital currency** (CBDC) is the element that may be driving the change.
- We are going to further analyse this scenario in upcoming Investment Recipes.

HOW GENOME SEQUENCING AND AI ARE CHANGING THE DIAGNOSTIC LANDSCAPE?

Diagnosis: a considerable need for innovation.

- In 2018, John Hopkins University showed that **medical errors** are responsible for 250'000 deaths per year in the United States, making them the **third leading cause of death!**
 - Nearly 30% of deaths related to medical errors are due to inaccurate, delayed, or incomplete diagnoses.
- **Misdiagnosis** is responsible for **17% of preventable deaths** in hospitalized patients.
 - Cancer and cardiovascular disease are among the most avoidable deaths: 30-50% of all cancers are preventable with an early diagnosis.
- Beyond the need to increase accuracy and safety, **cost savings is also a priority**: misdiagnoses cost the US economy \$750 billion a year (~20% of total health spending).
- **Artificial intelligence and next-generation sequencing** make it easier for doctors to detect diseases and interpret results more quickly.

CAUSES OF DEATH, US, 2013



Based on Centers for Disease Control and Prevention estimate, medical error is the 3rd most common cause of death in the US. However – medical error is not recorded on US death certificates, so that data is not counted.

*Chronic obstructive pulmonary disease

SOURCES:

- <https://sciencebasedmedicine.org/wp-content/uploads/2016/05/Medical-Error.jpg>
- https://www.hopkinsmedicine.org/news/media/releases/diagnostic_errors_more_common_costly_and_harmful_than_treatment_mistakes
- <https://hms.harvard.edu/news/high-cost-preventable-deaths>
- https://cdc.gov/nchs/data/nvsr/nvsr64/nvsr64_02.pdf

Doctors supported by AI: a "great" team.

- **AI and Machine learning** can change the diagnostic landscape by analyzing **medical imaging**, screening cancers, studying patient's medical history and helping establish the right treatment plan.
 - Cancers, chronic diseases, rare diseases, neurology and even eyes diseases can be diagnosed through AI systems.
- Many studies showed a **clear advantage in using AI**.
 - A competition between an AI system and doctors was recently conducted in China to diagnose brain tumors: AI took **15 minutes** to make **225 diagnoses with an 87% accuracy rate**, while doctors needed **30 minutes** and had a **66% accuracy rate**.
 - Google's artificial intelligence has succeeded in detecting breast cancer cases on medical images with an **efficiency of 89%**, compared to **73% for specialist doctors**.
- Most of the pure players are still private, main public players are big tech companies: **Siemens (SIE US)**, **Hologic (HOLX US)**, **Philips (PHG US)**, **IBM (IBM US)** with **Watson and Alphabet (GOOGL US)**.

DIAGNOSTIC TOOLS CLEARED BY FDA (FOR MEDICAL IMAGING)

COMPANY	INDICATION
Apple (AAPL U)	Atrial fibrillation detection
Viz.AI (Not listed)	Stroke diagnosis
Idx LLC (Not listed)	Diabetic retinopathy
Imagen (Not listed)	Wrist fractures
Quantitative Insights (Not listed)	Breast cancers
MedyMatch Technology (Not listed)	Brain bleeds
Arterys (Not listed)	3 diagnostic tools in cardiac diseases and liver/ lungs cancers
Neural Analytics (Not listed)	Stroke diagnosis
Icometrix (Not listed)	MRI brain interpretation
Zebra Medical Vision (Not listed)	Coronary calcium scoring
Quantib (Not listed)	Measures brain atrophy related to aging, dementia and multiple sclerosis
Bay Labs (Not listed)	Echocardiogram
iCAD (Not listed)	Breast density
Aidoc (Not listed)	Brain bleeds
MaxQ AI (Not listed)	Brain bleeds in stroke and trauma
Subtle Medical (Not listed)	Improve PET image quality

SOURCES:

<https://bmjleader.bmj.com/content/2/2/59>

<https://aibusiness.com/chinese-ai-diagnosis-brain-tumours/>

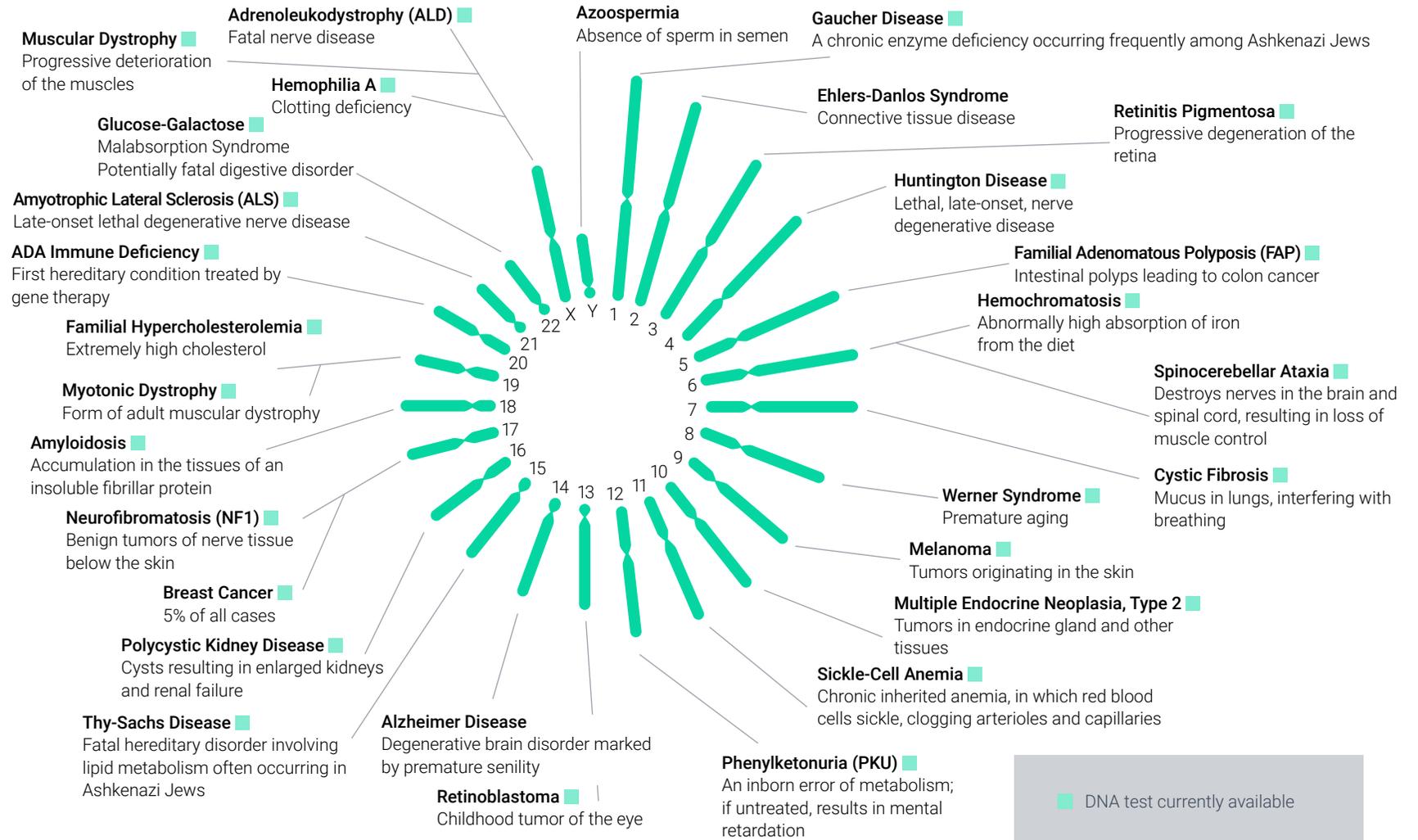
Genome mapping leading to personalized treatment.

- **Genome sequencing** has a high potential to improve and quicken detection of rare diseases and cancers.
 - Many **cancers** are driven by specific mutations (melanoma, thyroid, colorectal).
 - 80% of the 8,000 rare diseases have a genetic origin and patient's median diagnosis time **is almost 4 years**.
- Once the diagnosis has been made, sequencing can allow for tailor-made treatments.
 - The FDA has already approved three genetic-driven drugs for cancers by **Merck (MRK US)**, **Eli Lilly (LLY US)** / **Bayer (BAYN GR)** and **Roche (ROG SW)**.
- Medicare expanded financial coverage for genetic tests in some cancers and children-specific rare diseases, notably when a doctor recommends the test due to the patient's family medical history.
- The Next Generation Sequencing market is expected to grow from \$4.5bn in 2018 to \$18bn by 2026 (**a CAGR of 19%**)
 - **17 million people** have already done direct-to-consumer testing, even if they show a small part of the entire picture compared to whole-genome sequencing.
 - **The growing interest in these "simple" tests**, proposed by companies such as **23andMe** (Not listed), reflects **people's awareness** and rising **acceptance** of genetic testing.

NEXT GENERATION SEQUENCING	TECHNIQUES	COMPANIES
Whole Genome Sequencing		
DNA sequencing	Screen the 25,000 genes in the body.	Thermo Fisher (TMO US), Roche (ROG SW), Qiagen (QGEN US), Lexogene (Not listed), Agilent Technologies (A US).
RNA sequencing (transcriptome sequencing)	Screen the presence and quantity of RNA at a given moment.	
Microbial sequencing	Sequencing entire bacterial, viral, and other microbial genomes.	
Epigenomics	Study the modifications in the DNA that affect gene expression without altering the DNA sequence.	Agilent Technologies (A US), BioRad (Bio US), Epigenomics (ECX FR)
Single gene tests	Screen 100-500 genes most likely to have been mutated.	Invitae (NVTA US), Fulgent Genetics, (FLGT US) Centogene (Not listed), NeoGenomics (NEO US)

SOURCE:
Researchandmarkets.com

Which Hereditary Diseases Can Be Currently Diagnosed Through DNA Testing?



SOURCES:
https://upload.wikimedia.org/wikipedia/commons/thumb/8/84/Human_chromosome_diseases_set_en.svg/1920px-Human_chromosome_diseases_set_en.svg.png

Catalysts:

- **The rising prevalence of cancers and other chronic diseases.** By 2030, there should be 23.6 mn new cases of cancer worldwide each year.
- **Increasing demand for personalized medicine.** Discovery of genetic origins for many diseases has paved the way for personalized treatments.
- **Falling costs.** The cost of whole human genome sequencing has fallen to around \$1'000 from \$300k in 2006, and will continue to decrease.
- **Government incentives.** The FDA proposed a framework to speed up the approval of medical devices that use Artificial Intelligence or Machine Learning (AI / ML-based Software as a Medical Device).

Risks:

- **Training of doctors and other professionals.** Use of artificial intelligence requires specialized training for doctors.
- **Ethics.** Issues on data privacy and replacement of doctors raise some ethical issues which can delay the development of new technologies in diagnostics.
- **Over-diagnosis:** The popularity of consumer genetic testing to find predispositions to disease can lead to unnecessary stress and burdensome treatments. These tests only detect the degree of risk of developing a disease.

Bottom line:

- Combining AI and next generation sequencing have the potential to increase the accuracy of diagnoses by mapping and decoding our genes.
 - In January 2018, **Microsoft (MSFT US)** and **Adaptive Biotechnologies (ADPT US)** announced a partnership to map the immune system and decode it using Microsoft's AI system.
 - **Deep Genomics** (Not listed) uses machine learning to decode genetic disorders and find the most appropriate drugs candidates.
- Empowering the diagnosis will improve the patient experience and increase confidence in the medical system.
- We play this theme in biotechnology / bionics and healthcare M&A certificates through our exposure to **Illumina (ILMN US)**, **Invitae (NVTA US)** and **Guardant Health (GH US)**.
- Beyond diagnosis, AI and sequencing can revolutionize the whole healthcare sector: from health administration to clinical trials, drug discovery and response to drugs (Pharmacogenetics).

SEMICONDUCTORS – IS CHINA READY NOW?

Little pain, lot to gain for the Chinese semis industry

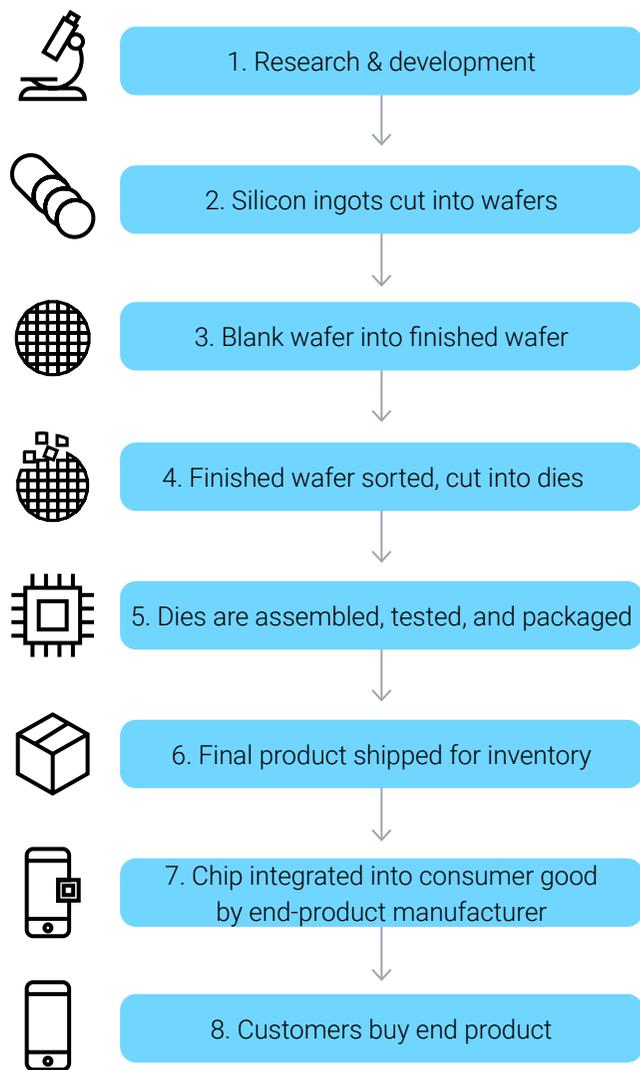
- In the last **Investment Recipes**, we presented our view on the economic decoupling of two tech giants, the U.S. and China. We concluded that:
 - China is **three to five** years behind.
 - The effect of this decoupling will have **wide-ranging repercussions**.
 - We keep a close eye to evaluate a **direct exposure** to Chinese names.
- In this issue, we put under our loupe the Chinese semiconductor industry.
- The **trade war** is having little or no impact at all on Chinese semiconductor economy, and actually more damages are suffered by U.S. semiconductor companies.
 - But it is creating tensions on the semiconductor **global value chain** as the **interdependence** of this industry is really tight. (see chart in the next page)
- We believe that the current situation, despite short-term negative impacts, will **accelerate the development of the Chinese semiconductor industry**.

SOURCES:

<https://www.scmp.com/economy/china-economy/article/3034434/chinas-canton-fair-highlights-changing-nature-nations>



East to west: an interconnected value chain

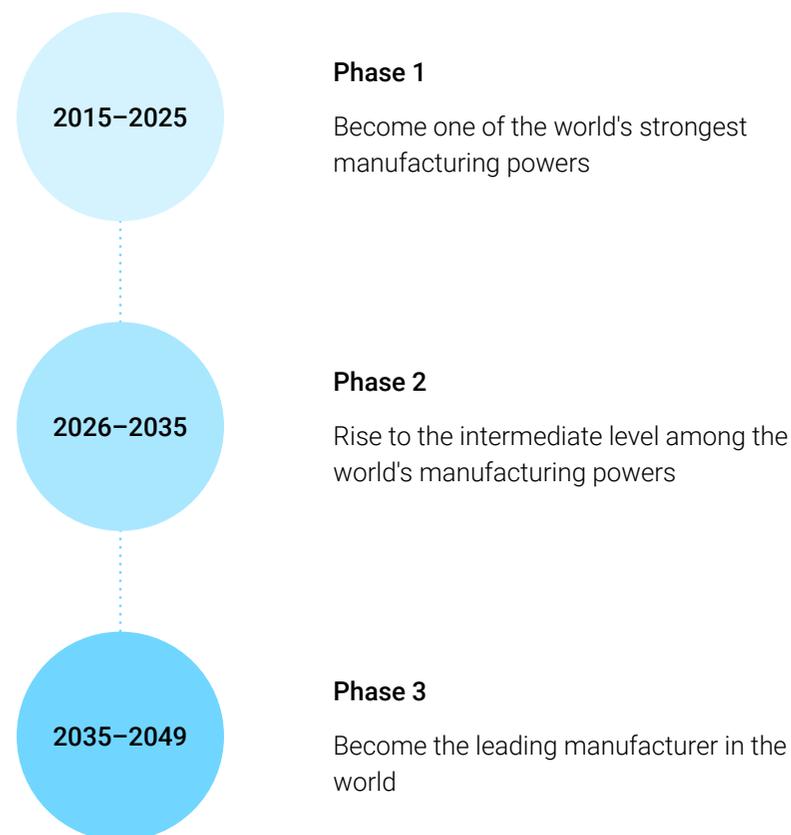


SOURCES:
<https://www.semiconductors.org/wp-content/uploads/2019/03/Trade-graphic-768x392.png>

A new Silicon Valley is possible

- In our opinion, Trump’s administration is underestimating the Made in China plan.
- China is aware that its plan will take-off after having accumulated the following resources:
 - **Talents** to start up the program.
 - **Capitals** to fund the development of the program.
 - **Competences** to build trust in Chinese tech.
 - **Ecosystem** to have an edge and gain traction over Silicon Valley.
- The trade war's short-terms effects on the Chinese semiconductor industry are **inventory problems** and **sales loss** , but on the other side:
 - it is triggering an early boost for governmental **investment** in high tech;
 - it is increasing people awareness of the equation **no semiconductors = no lifestyle modernization**, which is necessary to attract workforce
- The effect is triggering the **accumulation of capital** and **brain-drain reversal**, which is crucial for the development of new talents and core competences within China.

THE MADE IN CHINA PLAN

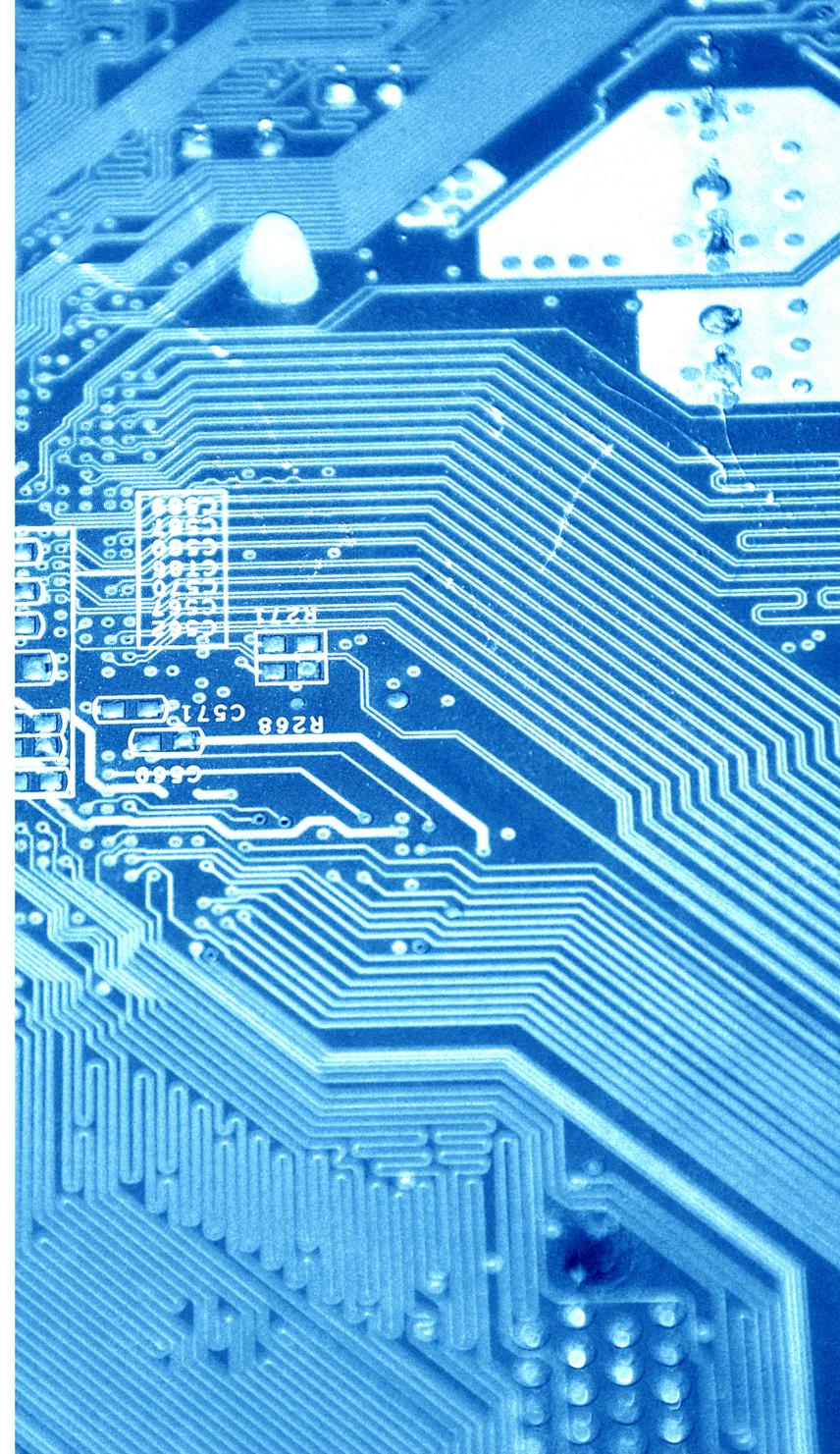


SOURCES:

<https://multimedia.scmp.com/news/china/article/made-in-China-2025/index.html>

Chinese tech leapfrogs

- **Alibaba (BABA:US)** has launched Hanguang 800, its first AI inference chipset that can recognize billions of images in just five minutes, as opposed to an hour with prior technologies .
- **Baidu (BIDU:US)** presented in July its AI chipset called Kunlun, which reaches performances 30 times better than FPGA AI accelerator .
- **HiSilicon** (Huawei – not listed) has recently launched Kirin 990 5G, a very advanced system-on-a-chip (SoC), built on 7 nm node. It contains a CPU, GPU, 5G modem all in one.
- **Gree (000651:CH)** is investing \$2bn in becoming one of the leaders of the Chinese chipset landscape. These intelligent chips will first find their way in smart appliances and then they will be deployed elsewhere.
- **Cambricon** (not listed) is one of the few semiconductor unicorns developing AI chipsets. Cambricon 1M is used for cloud-based services and reaches performance of 5 Tops/watt (number of operations per energy consumed, higher is better) , a number that is 15 times larger than an Nvidia Tesla T4 GPU.



Catalysts:

- **Trade war.** Trump's decision to tax Chinese goods is accelerating Chinese plans to improve its own semiconductor industry .
- **Downstream investment.** Chinese downstream companies (Alibaba, Baidu) have been successful in chip design and are outbeating their western GAFAM rivals.
- **Awareness.** The Chinese population is becoming more aware of the role of tech in the modernization of lifestyle. People engagement is growing, and this will gather and foster the skilled workers' need to build competitive competences.
- **Private sector.** The Chinese private ecosystem is ahead of competition, especially when it goes down to the startup environment. Cambricon (not listed) and Horizon Robotics (not listed) are just two among the several Chinese unicorns.

Risks:

- **Talent.** Access to talents was crucial to the development of Silicon Valley. The gravitational forces of the Californian area are still larger than any other country.
- **Over-investment.** Excessive injection of capital has already led to overcapacity, thus limiting the competition of certain companies .
- **Territorialism.** Embittering or prolongation of the US sanction might lead to isolation. According to a KPMG study, this is acknowledged as the 4th risk in terms of importance for semiconductor industry leaders .

Bottom Line:

- China is using the momentum generated by the trade war and sanctions to **speed up its semiconductor development.**
- Industrial leaders have correctly spotted what Chinese tech is missing: **lack of innovation.** This has helped them to target correctly the bazooka of Chinese investments.
- Investments are directed towards **high added value activities:**
 - **Investments in R&D activities** in order to fill the gap with US industries.
 - **Talent creation** and retention,
 - **Refocusing** from low end to high end manufacturing and design

SOURCES:

KPMG – Semiconductors: As the backbone of the connected world, the industry's future is bright
<https://assets.kpmg/content/dam/kpmg/us/pdf/2019/03/kpmg-semiconductor.pdf>

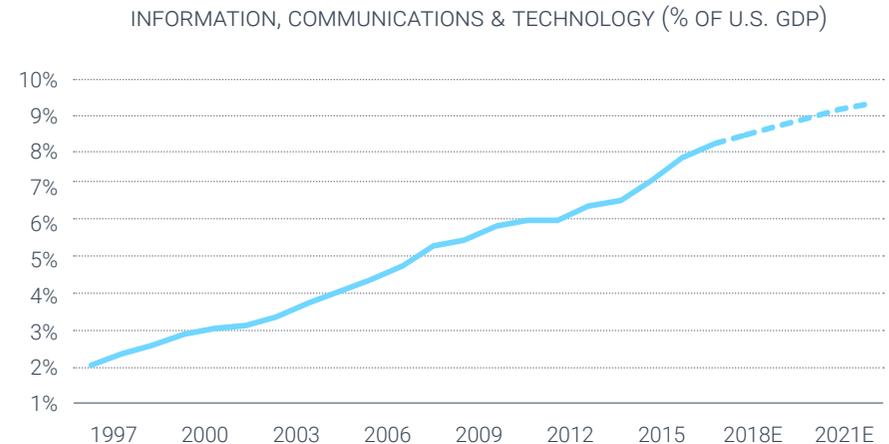
TECHNOLOGY IS TAKING OVER THE WORLD

Growing importance of the digital economy

- The technology industry seems to be **taking over the world**. Among the top-10 stocks by market capitalization, eight are related to the technology industry.
- According to the Bureau of Economic Analysis (BEA), the industries “Information, communications, and technology” accounted for approx. **8% of the U.S. GDP in 2017**. This category represented only 2% of the GDP in 1997.
 - On average, the digital economy has grown **4x faster than total GDP** growth between 1997 and 2018.
 - It contributed for 55 basis points of growth in real GDP in 2017, or **25% of the total 2.2% GDP growth**.
- In terms of employments, 5.1mn jobs were related to these industries in 2017, or only 3.3% of the total U.S. employment.
- Even if the growing importance of the digital economy is clear, we think that the impact of technology is **not fully reflected** in the evolution of the numbers provided by the BEA.
 - The definition of the industries is too narrow. For example, an IT specialist working in a mining company will not be included in the data.
 - Investments in technology generate productivity gains that should also be considered. For example, if a farmer gets a higher crop yield thanks to satellite imagery, this productivity gain should be accounted in the digital economy.

SOURCES:
Bureau of Economic Analysis
AtonRā Partners

LARGEST MARKET CAPITALIZATIONS (OCTOBER 2019)



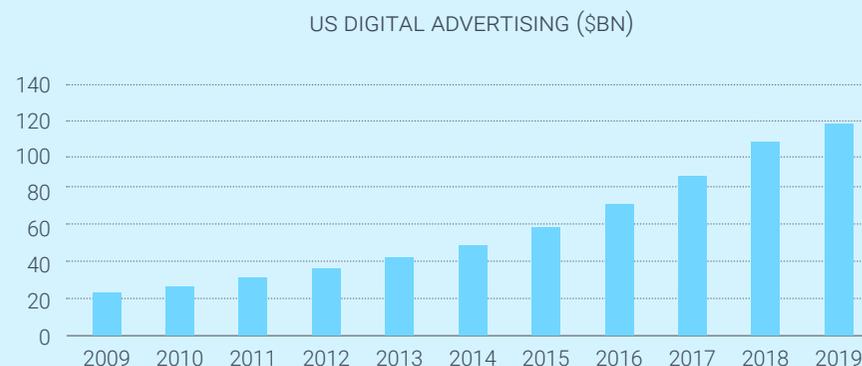
Technology impacts all sectors

Energy – Oil & gas industry

- According to the BEA, technology spending accounted for less than 2% of all spending of oil and gas industries during the first decade of the 2000s. Since 2012, these firms ramp up their IT expenses which account now for more than 5% of all spending.
- Productivity of the sector increased by more than 50% over a decade.
- Drilling evolved from a hit-and-hope process to a precision guidance system that relies on **3D seismic modelling, cloud computing** and **big data**.

Consumer staples – Digital marketing

- Consumer staples companies spend heavily on marketing and advertising. Due to fierce competition, staples' market shares are highly dependent on the amount of advertising.
- **Digital marketing** (internet, mobile phones, display advertising, etc.) crossed the \$100bn mark in 2018 in the United States. Companies are now spending more on digital media than on traditional ones (television, radio, newspaper).



Materials – Digitalization of the forest industry

- **Virtual reality and artificial intelligence** create new opportunities even in forest management. It is possible to visit forests and decide which trees to harvest directly from the office. Better planning increases safety, productivity, and reduces waste.

Consumer discretionary – Travel booking

- Before the advent of comparison websites, travel and hotel reservations usually involved contacting a tour operator or a travel agent.
- **Internet** has revolutionized the way people search, buy and share bookings. The creation of Expedia (EXPE US) by Microsoft (MSFT US) in 1996 paved the way for online travel agencies. Internet bookings accounted for roughly 50% of U.S. hotel booking in the United States in 2018, according to Phocuswright.

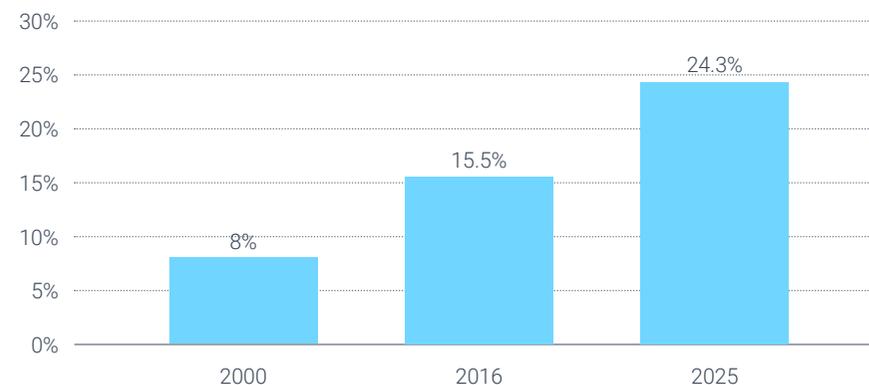
SOURCES:

BEA, BLS, Entropy Economics, RFD Oil and Gas, PwC, Phocuswright

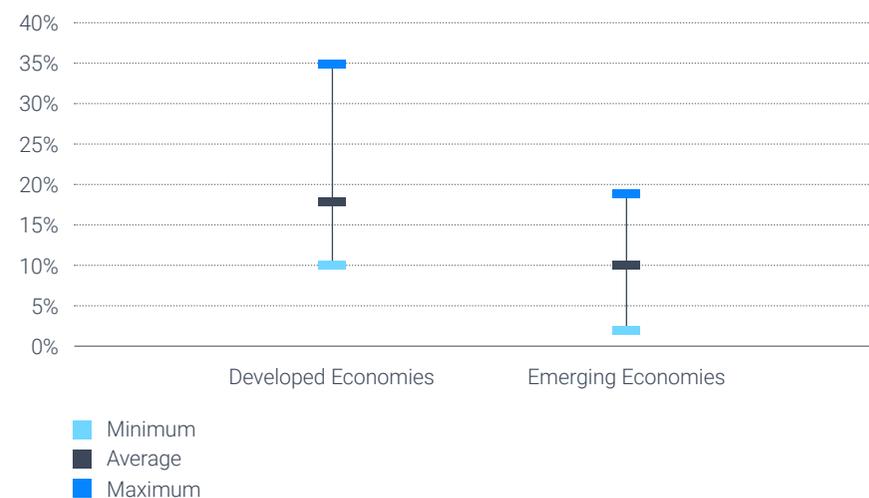
A better model to quantify the digital economy

- Oxford Economics proposed an alternative models to quantify the digital economy.
 - Compared to traditional approaches, they include (1) the stock of digital assets rather than the new investments in digital assets, (2) digital technologies across sectors rather than focusing on the tech industry only, and (3) the productivity gains from the investments in technology.
- Using this methodology, the global digital economy accounted for \$11.5tn in 2016, or **15.5% of the global GDP**.
 - Through 2025 the digital economy will continue to grow faster than the global GDP's, and will represent about one quarter of the global economy.
 - Most of the digital economy growth comes from the productivity gains generated from the use of new technology.
- In developed economies, the size of the digital economy varies from 10% to 35%, with an **average of 18.4%**.
 - Given these numbers, we think the digital economy may reach one third of the global economy within 10–15 years.
- Emerging countries have more room to grow, with an average digitalization at **10.0% of the GDP**.
 - **China leads the way** with a digital economy that matches the average of the developed countries. It used to represent only 4% of the global digital economy in 2000, and now accounts for 13%. We think this long-term trend will continue given the strong incentives to develop technology in the country.
 - The switch to digital technologies can boost the economic productivity of emerging economies, whatever stage of development they may be at.

DIGITAL ECONOMY (% OF GLOBAL GDP)



SIZE OF DIGITAL TECHNOLOGY PER REGION

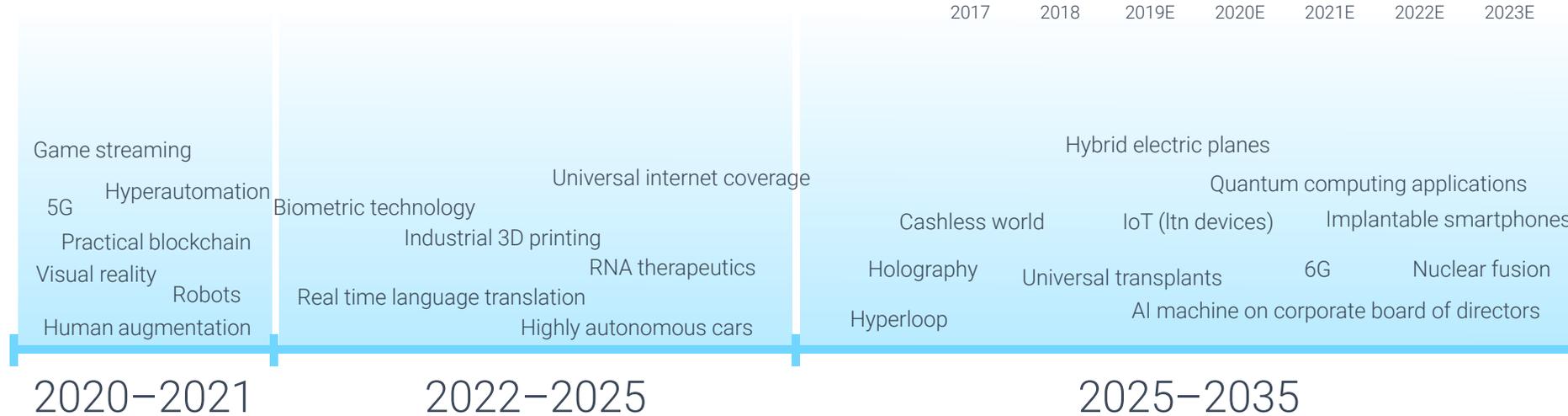
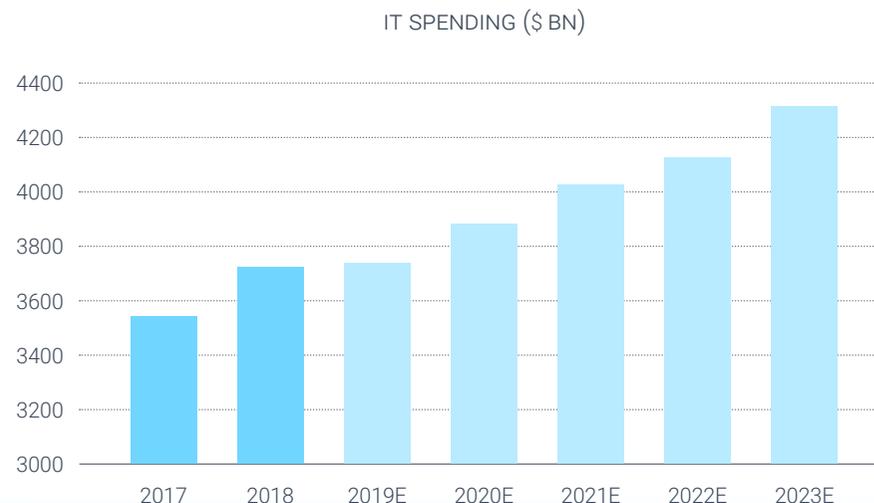


SOURCES:

Oxford Economics & Huawei – Digital Spillover | AtonRâ Partners

The digital future is tomorrow – are your ready for it?

- **Important IT spending** is still necessary to accompany the digitization of the world.
 - Gartner estimates that the world will spend \$3.74tn on IT in 2019. The \$4tn mark should be crossed in 2021.
 - The data center infrastructure is mostly completed and will experience a growth close to 0%, implying a phase of replacement CAPEX.
 - The overall software industry is expected to grow at a CAGR of 10% until 2023. It is the only broad sub-section that has a double-digit growth rate.
 - IT services and communication services account for almost two third of the total IT spending.
- These investments will fuel the **undergoing digital transformation** of the world. They will also facilitate the commercial deployment of new technologies:



SOURCES:
Gartner
AtonRā Partners

Catalysts:

- **Computing power.** The increase in computing power will make it possible to program much more detailed and sophisticated models of technologies. Moreover, this processing power will grow exponentially if quantum computers become a commercial reality.
- **Artificial intelligence.** The accumulation of data on cloud-based solutions facilitate the development of machine learning. The automation of many functions of the economy is in progress.
- **5G & internet access.** Low-latency, high speed internet will pave the way for the next wave of technology innovation. In parallel, internet access in developing countries is improving.

Risks:

- **Electricity.** According to the Semiconductor Industry Association, the demand for electricity to power the computers is expected to skyrocket. Energy efficiency improvements and a significant increase in electricity generation will be needed.
- **Political framework.** The digitization of the world will be possible only if government policies around the world favor investments in infrastructure and provide incentives to private sector research. The regulatory framework must also be clear, with effective competition and rules for the use of data.
- **Societal impact.** Some scholars are worried that a digital world will lead to unemployment. However, such “technological unemployment” remains to be proved.

Bottom Line:

- The **digital economy** is significantly contributing to global GDP.
- The digital economy is increasing its size over the traditional economy. As the world is being digitized, this trend is likely to continue in the mid- to long-term.
 - Developed countries have an advantage thanks to their **stock of digital assets** and the United States are likely to keep the lion's share of the digital economy.
 - Emerging countries are catching up. **Investments in technology** can be made at any stage of development.
- Our **growth strategies** are well-positioned to benefit from this opportunity.
 - For instance, semiconductors, the engine that powers the computing revolution, represent approx. 50% of our *AI & Robotics* portfolio.

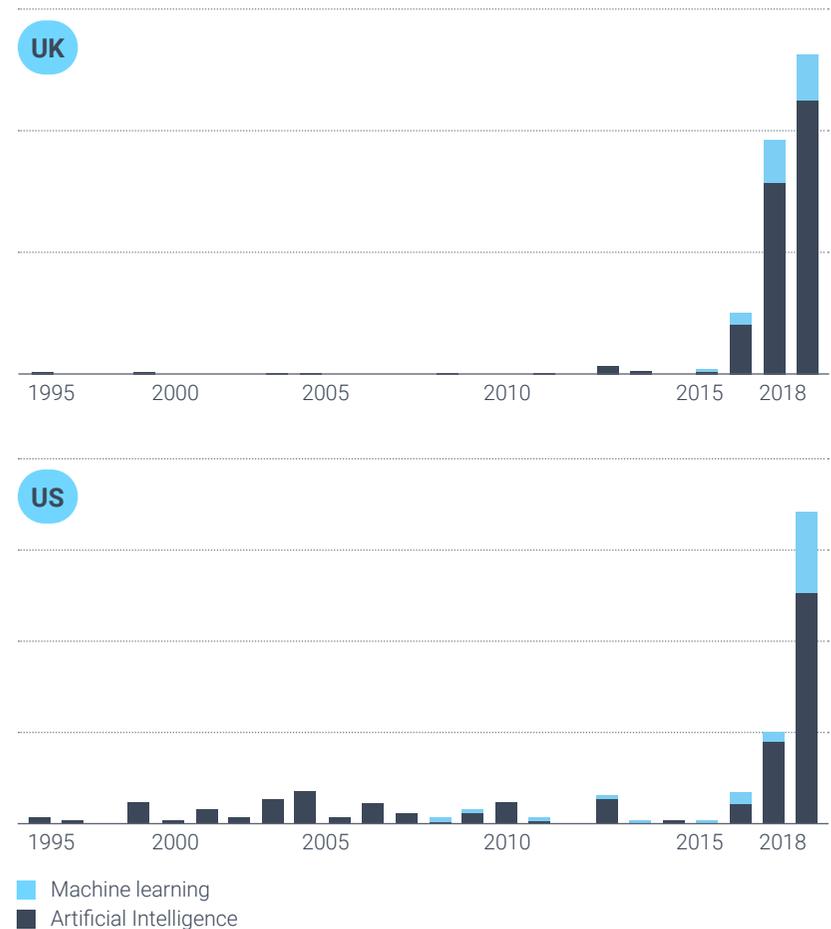
CHARTS FOR THOUGHTS

Is Artificial Intelligence going mainstream?

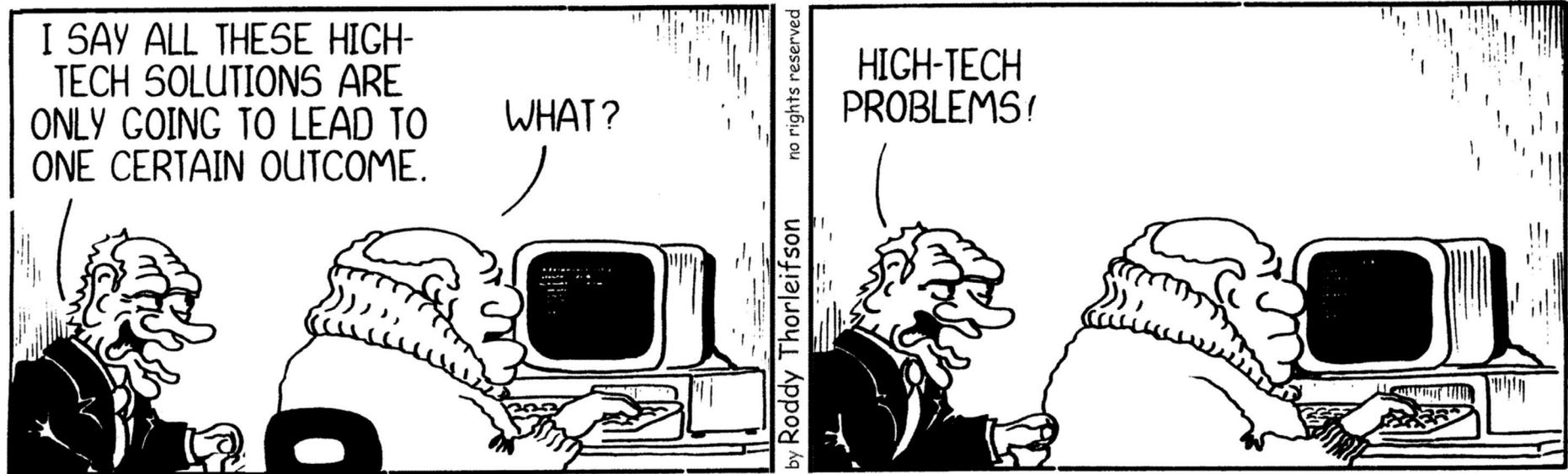
- Technology has always developed fast throughout human history.
 - Innovators bring new ideas to the market, test and refine them as they get adopted by a wider audience.
- Regulations usually follow with some delay.
 - New technologies need to reach and impact a significant chunk of the population before they are recognized as politically significant.
 - As long as they remain confined to a niche corner and interest a few geeks, nobody will bother.
- As the chart shows, AI and Machine Learning, are reaching the tipping point of political relevance at a furious pace.
 - Beyond U.S. and U.K., the political debate is already reaching an international stage as G7 members like France and Canada are calling for an “international panel”.
- But the political debate just shows the strategic importance of having AI or being left behind.
 - Leaders in deployment of AI and ML technologies like the U.S. and even more so, China, are motoring ahead, while others try to play catch-up.

SOURCE:
<https://www.technologyreview.com/s/612582/data-that-illuminates-the-ai-boom/>

MENTIONS OF ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING
IN OFFICIAL POLITICAL DEBATES



CASUAL FRIDAY



SOURCE:
<https://mooselakecartoons.com/science-tech/ovjxhtqwp9h5duzh84hhku6xxn1t7>

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AI AND
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MOBILE
PAYMENTS



BIONICS

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