

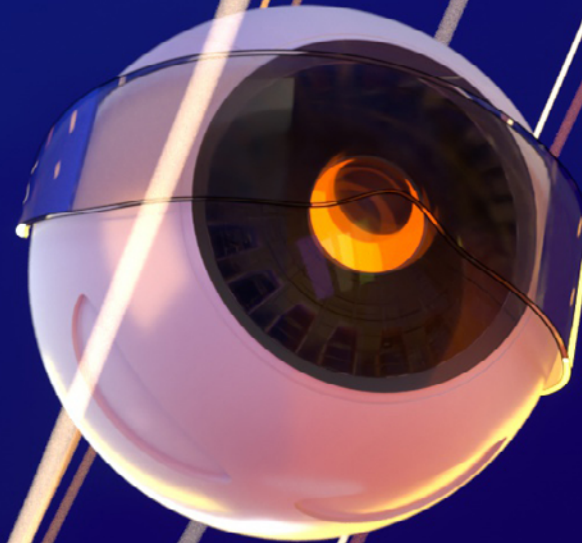
Investment Recipes

by  AtonRā Partners

SPECIAL ISSUE

**2019 Review and
2020 Outlook**

20 DECEMBER 2019



As we approach the end of 2019 and AtonRâ Partners achieves its 15th anniversary, our thoughts and gratitude turn to those who supported us throughout the year.

After a period of significant growth, 2019 has been for AtonRâ Partners a year dedicated to consolidating its operations and strengthening its foundations:

- This summer, we received the authorization from the Swiss Financial Market Supervisory Authority (FINMA) to act as an asset manager; approval from the Luxembourg Financial Authorities is in the final stages as well.
- Our team was strengthened by hiring highly-skilled talents in our Investment, Engineering, and Commercial departments and believe they all bring tremendous value to our customers as well as to the company.
- We have resumed publishing a regular bimonthly Investment Recipes report along with our one-off reports, which underpin the work done by engineers and portfolio managers.
- We are also thrilled to have built a world-class Tech Advisory Board made up of outstanding individuals from various professional backgrounds, including scientific, corporate, intellectual property, asset management, and private equity.

Heading towards 2020, we are going to launch “The AtonRâ Fund,” which is to group all our investment themes into a single portfolio.

Also, one additional investment theme will likely be launched, expanding our portfolio.

Furthermore, we are continuously working to develop and deploy further services for our customers.

Last but not least, we will keep focusing on AtonRâ’s core values, which proved themselves over the years, and stick to our motto “Knowledgeable, Independent, Focused”. We are looking forward to providing the best possible value-added services to our customers.

We hope that 2020 brings joy and prosperity to all.

Your AtonRâ Partners Team

20 DECEMBER 2019

SPECIAL ISSUE

AtonRâ Partners SA
www.atonra.ch

research@atonra.ch
+41 22 906 16 16

7, rue de la Croix d'Or
1204 Geneva | Switzerland

On the Menu

2019 Review & 2020 Outlook

Editorial

page • 4

Global Macro: Does The Longest Bull Market In History Still Have Legs?

page • 6

Sustainable Future: Could You Afford Not Being Invested?

page • 12

Biotechnology: Towards A Rerating In 2020?

page • 26

AI & Robotics: Automation Is Just The Beginning

page • 39

Fintech: On Its Way To Mass Adoption

page • 52

Security & Space: When Sky Is Not The Limit

page • 65

Bionics: All Stars Are Aligned

page • 78

Editorial

The purpose of this special issue of **Investment Recipes** is to recap our investment themes, assess their results, and check if the catalysts we foresaw unfolded as expected or if any adjustment is needed going forward.

While this is a work that we perform continuously within AtonRâ, through this document we take the opportunity to step back from the daily routine and bring a more global view of the essential objectives underscored throughout our bimonthly and ad-hoc research reports. We strongly believe that this document will also serve as a valuable guide for our customers to review each of the themes they are invested or interested in, and to provide further transparency on the work that we perform.

When launching our first investment themes, we wrote that increased use of technologies and innovations were going to bring more positive than negative effects such as the more efficient use of the Earth's resources, but also a risk of exacerbating inequality if wealth redistribution was not wisely thought.

Five years after, we can say that this is even truer now. Technology is pervasive across many sectors and, through automation and increased productivity, is helping and boosting the global transition from the fossil-fuel era towards renewables, improving people's health, and making this a much safer world and a world that is more and more connected and informed.

At the same time, these changes run deep, and similar to tectonic plate shifts, they are exerting formidable pressure on the international geopolitical landscape and transforming whole branches of industries.



As a result, a number of questions are being raised: should technology and robots be taxed? Should corporations pay taxes not only within their country of residence but also where products are sold? Are healthcare innovations reasonably priced and accessible to all? Can corporations keep up doing business in any part of the world as they have to respect stricter CO₂ emission standards?

Answers to these questions will have deep implications, including on how investments will perform.

We are also witnessing a significant shift among the millennials, where words such as sustainable, honest, local, responsible, healthy, fresh, environment, social etc. are resonating daily not only within the media and social networks landscape but are acting as a formidable game-changer for the world's economies and politics.

We believe that with digital economy making up 18% of the world's global GDP, and expected to surpass 25% by 2025, the weighting of every investment portfolio should reflect this fundamental observation.

The way we construct portfolios (blend of top-down and bottom-up analysis) is to capture the long-term value (3 to 5 years) of companies benefiting from emerging trends in Technology, Healthcare and related to Climate Change. As most of our clients already know, we tend not to change the portfolio's composition too often, keeping stocks' rotation at between 10% to 30% per year, depending on the specific theme.

While we might miss out on some of the micro-trends, we firmly believe that a focus on the critical trends (and changes) of an industry is the best way to create value for our investors.

Our investment themes revolve around technology, in its different forms and applications. In the following pages we'll delve into the specific impact for each of them.



GLOBAL MACRO: DOES THE LONGEST BULL MARKET IN HISTORY STILL HAVE LEGS?

Investors Are Wary Of Equity Markets

- We're in the 10th year of an equity bull market in the US, and by looking at cash levels in addition to investors' exposure towards the equity's asset class, it is quite clear that many are not buying into an 11th year of positive performances.
- Money market funds have seen the steepest increase in AuM since 2008, followed by Bond funds.
- Equity funds have seen a negative growth despite a positive price effect throughout 2019.
- As if it was not enough, during the summer of 2019, we witnessed some rotation out of growth stocks into value ones, which did hurt some of the highest beta names we have in our different themes.
 - Most notably in Biotech, Fintech, and Mobile Payments.
- In our view, the key factors that will impact 2020 from a macro-economic point of view are threefold:
 - US Presidential elections
 - Trade tensions, driven by the US-China spat
 - Central bank policies

FUND FLOWS



SOURCE:
Bloomberg | AtonRā Partners

Global Macro: Key Factors For 2020

US Presidential elections in 2020

- In the US, we're heading into an election year: if history is any guide when a US President is re-elected (and since the 2nd WW it has occurred all but 2 times), the stock market tends to do well (on average 10%).
- The logic behind is straightforward; we know who's in office, and investors don't need to deal with uncertainties.
- Does it also apply to Mr. Trump? The Democrat-led ongoing impeachment represents merely a headline risk as there's close to zero chance any of GOP senators will vote against Mr. Trump in our view.
- Did the markets learn the lessons from the past (Brexit and Trump's win the most notable) of not putting too much trust in opinion polls? We believe that despite latest polls showing that every prospective Democrat is to beat Mr. Trump, the market won't take such an outcome for granted until much closer to the real vote.

Year	Party	President
1944	Democratic	Franklin D. Roosevelt
1948	Democratic	Harry S. Truman
1952	Republican	Dwight D. Eisenhower
1956	Republican	Dwight D. Eisenhower
1960	Democratic	John F. Kennedy
1964	Democratic	Lyndon B. Johnson
1968	Republican	Richard Nixon
1972	Republican	Richard Nixon
1976	Democratic	Jimmy Carter
1980	Republican	Ronald Reagan
1984	Republican	Ronald Reagan
1988	Republican	George H. W. Bush
1992	Democratic	Bill Clinton
1996	Democratic	Bill Clinton
2000	Republican	George W. Bush
2004	Republican	George W. Bush
2008	Democratic	Barack Obama
2012	Democratic	Barack Obama
2016	Republican	Donald Trump

SOURCE:
 Wikipedia, https://en.wikipedia.org/wiki/United_States_presidential_election

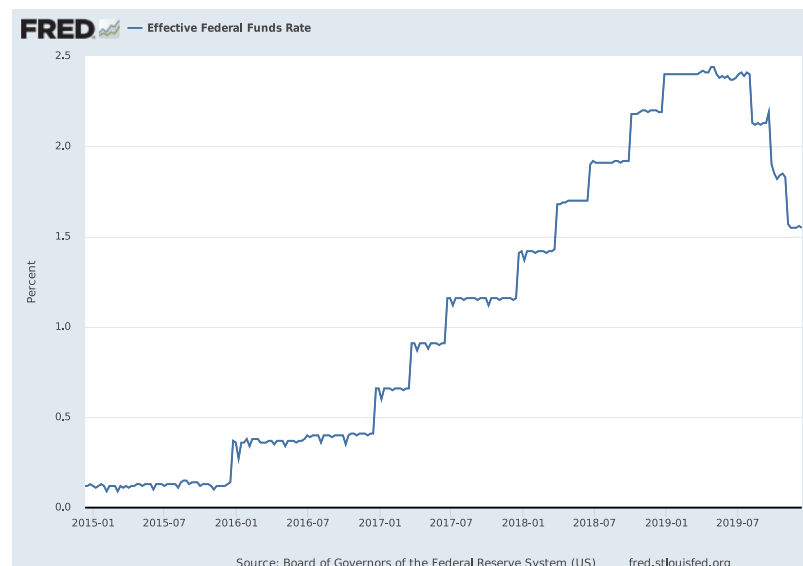
GLOBAL MACRO: DOES THE LONGEST BULL MARKET IN HISTORY STILL HAVE LEGS?

Trade Tensions

- Trade tensions between the US and China and between the US and some of its allies (Europe, Mexico, Canada, Brazil most notably) harmed business confidence, and manufacturing tumbled to levels not seen since 2009.
- On the positive side, such tensions reversed the course of the FED's tightening cycle started in December 2015. The central bank did cut its rates three times in a row this year (cumulatively by 0.75%), and it has already said to be on hold going into next year.
- A Chinese/US deal, even though a mini-one, might reignite business confidence and growth in manufacturing going into 2020. Q4-2019 might very well be the weakest quarter of the negative manufacturing cycle as companies have reduced inventories and cut-back on investments throughout 2019.

Central Banks

- Together with the FED this year, the ECB followed by restarting its QE program. The Bank of Japan signaled a strong commitment to maintaining ultra-low interest rates. The BoJ might even cut its rates going into 2020 if the increase (from 8% to 10%) of the VAT enacted in October deters domestic demand.
- Emerging markets' central banks cut interest rates several times this year, making the most extended easing cycle for emerging central banks since 2013.
- Not only global recession concerns appear overblown, but in our opinion the risks worth closely monitoring are rather labor costs and productivity in addition to industrial capacity utilization for a clue on the future direction of interest rates. While we are at a 50-years low in terms of US unemployment, and despite tariffs are not showing an impact on inflation, there is a risk that heightened trade tensions might shift this equilibrium and reduce the deflating impact globalization (and technology) have.



SOURCES:

Board of Governors of the Federal Reserve System (US), Industrial Production Index [INDPRO], retrieved from FRED, Federal Reserve Bank of St. Louis; <https://fred.stlouisfed.org/series/INDPRO>, 12/16/2019.

Board of Governors of the Federal Reserve System (US), Effective Federal Funds Rate [FF], retrieved from FRED, Federal Reserve Bank of St. Louis; <https://fred.stlouisfed.org/series/FF>, 12/16/2019.

Portfolio Allocation: Reviewing 2019

- We repeatedly wrote in our research reports that the most significant risk for growth strategies, like the ones that we manage, lies in interest rates.
 - If interest rates were to rise sharply, it would be more difficult for corporations that are growing fast and not generating enough cashflows to raise capital.
- During the fall and winter of 2018, we had a brutal wake-up call, when all of a sudden, the markets started to question if the rising cycle of US interest rates (together with trade tensions and geopolitical issues) which began in December 2015, was not jeopardizing the global economic recovery.
 - While this impacted many names in the technology sector, it was (without exceptions) equally negative for most other sectors.
 - This example shows how the risk-reward is currently still favoring technology overall, and growth vs. value.
- We often wrote that technology (and automation) plays a significant role in keeping inflation in check as the more the automation and the more the efficiency and productivity of a corporation.
 - We have countless examples proving this correct, but what's even more interesting (for those thinking that automation brings away jobs) is that many of the employees that see their jobs automated get transferred towards upskilled roles carrying higher wages and additional satisfaction.
- Throughout 2019, investments in companies that were the most exposed to the enterprise cycle (**Broadcom, Temenos, Xilinx**, etc.) did not enjoy as much of a rally as those more linked to consumers (**Apple, Lattice Semi, Micron**). We believe that as manufacturing PMI's tumbled across the world, the markets positioned accordingly by overweighting business-to-consumer related companies.



Portfolio Allocation: Key Drivers For 2020

- Going into 2020, we believe that the equity markets will keep their upward trend. We believe that business sentiment might stabilize and even reverse into a more optimistic mood if any positive signs are coming from the trade and geopolitical issues.
 - With this in mind, enterprise business might pick-up swiftly and benefit the most those companies exposed to this business vertical.
 - Emerging markets should also lead this rebound as they are most affected by investment cycles.
- We believe that the 5G (and IoT in general) ramp-up and increased automation during 2020 might also play as positive catalysts for an enterprise-driven recovery, which would have a heightened impact on the global economy.
- Throughout 2018 and 2019, we increased our Chinese exposure (notably into the Artificial Intelligence & Robotics theme) and are likely to keep on raising its weight in the technology and healthcare portfolios as:
 - on one side we believe that the trade issues with the US made clear that China needs to shift its focus on high-quality growth,
 - on the other hand, China is stepping up its efforts in the Biotechnology space, which combined with Artificial Intelligence (faster development of drugs pipeline) and changed regulations (now more in line with those of the US and Europe), should increase the awareness (and the market potential) of Chinese companies as shown by the latest approval of **Beigene's** Brukinsa cancer drug.



Catalysts

- **Improved business sentiment.** Likely to lead to a rerating of B2B plays across the board.
- **5G (and related IoT) ramp up.** As the roll-outs start, related investment is likely to be spurred by the available technological upgrade.
- **China.** We expect a shift in perceptions regarding Chinese technology, as it will be more and more clear that it will have mostly closed any existing gap with the western one.

Risks

- **Interest rates.** A reverse in policy, and resuming a tightening cycle remain the main risk for high growth (and high beta) stocks.
- **Global trade tensions.** Should the US-China trade war escalate, the impact on business sentiment will be immediate and be reflected by a reigning-in of Capex.
- **Trump's impeachment.** Should the Democrats succeed, the uncertainty surrounding the American political scene is likely to reverberate globally and affect dramatically the investment cycle.

Bottom Line

- We expect the equity markets to keep positive momentum.
- Technology and innovation will continue to drive GDP growth, and 5G and China are likely to be the key drivers across sectors. If manufacturing momentum picks up again, a shift towards B2B exposure is likely to follow.
- All in all, the different themes we are exposed to are likely to benefit from these key drivers. Spreading across different sectors will allow investors to focus their exposure to these drivers while keeping a well-diversified approach.

SUSTAINABLE FUTURE: COULD YOU AFFORD NOT BEING INVESTED?

Grid Parity Triggering Faster Upgrades

- Since the launch of our Sustainable Future Theme in October 2018, we highlighted the following points:
 - **Solar and wind energy are becoming cheaper** and can now be considered as cost-competitive technologies for electricity generation (compared to other sources such as coal or natural gas).
 - We expect significant growth in the deployment of wind and solar energy all around the world.
 - The **transport sector is entering its “cleanup” phase** with the growing integration of clean technologies.
 - The electric vehicles market is still in its infancy but is facing exponential growth.
 - Hydrogen vehicles hold some great potential, but the technology itself is not yet mature and needs additional R&D efforts.
 - Driven by the taxation system, both the Marine and Aviation industries are working to improve their environmental footprint passing to cleaner fuel and more efficient engines.
 - **Energy storage** is a crucial link to enable both the deployment of renewables and electric vehicles.
 - Distributed energy resources foster the need for **power grid upgrades** and the integration of **smart grid** technologies.
- In retrospect, the solar industry (particularly solar inverter providers), as well as the wind industry (turbine manufacturers and wind farm developers), had impressive performances, which drove the theme in 2019.
- On the other hand, the electric vehicle segment, along with Li-Ion batteries and fuel cell manufacturers, did not perform particularly well throughout the year.

SUSTAINABLE FUTURE



Outlook 2020 (1/4)

• Booming Offshore Wind Industry:

- The offshore wind industry is at the beginning of its growth phase, and next year will mark its inflection point.
- Technology advancements lead to larger rotor sizes with enhanced performance, improving the competitiveness of offshore power generation prices.
- The U.K., which originally committed to source 30% or 30GW of its electricity (10GW today) from offshore wind by 2030, has already raised its target to 40 GW following Boris Johnson's victory (global offshore wind installed capacity was 23GW in 2018).
- Ambitious targets are also being set for the Eastern part of the U.S., totaling more than 19GW of new offshore wind capacity through 2035, as well as Germany with 15GW by 2030, Korea with 13GW by 2030, and many others.
- Some of the world-leading, European-based, offshore wind turbines manufacturers and developers are likely to benefit from this growth trend.

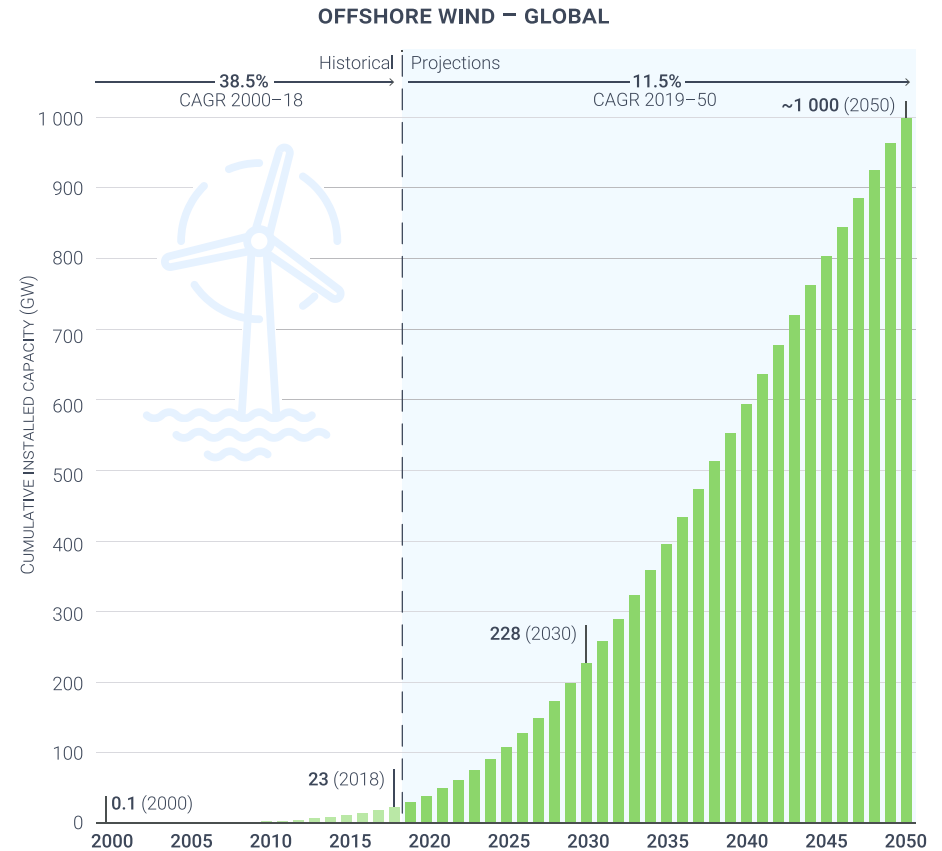
• More cleantech investments from Oil majors:

- Big Oil & Gas companies are under **increased pressure** driven by a consumers' mindset shift and growing interest in impact investing.
- Additionally, **uncertainty on fossil fuel prices** (geopolitical events, oil supply cuts expiring March 2020, etc.) forces those companies to diversify their investments to promising cleantech industries.
- Next year will likely be marked by new investments & acquisitions of Oil majors into cleantech markets such as e-mobility, renewables, energy storage, etc., boosting the whole clean sector.
- Particular attention must be paid to **Repsol (REP SM)**, which recently committed to net-zero emissions target by 2050. To achieve this, the company aims to transform its business model towards more renewables and invest massively into carbon offsetting technologies.

SOURCES:

Future Of Wind, IRENA 2019 | BNEF

<https://www.bloomberg.com/news/articles/2019-09-04/shell-leads-big-oil-in-the-race-to-invest-in-clean-energy-tech>



Outlook 2020 (2/4)

- **Move from Feed-In-Tariffs to Competitive Auctions:**

- Renewable technologies such as Solar PV and Onshore Wind, are reaching today a tipping point where they do not rely on subsidies anymore to be cost-competitive.
- We expect to see more and more countries cutting subsidies and favor auction-based models where project prices are determined by competitive bidding and not fixed by policymakers.
- China, for instance, is expected to further cut its renewables subsidies next year, notably by reducing its feed-in tariffs for solar projects.
- Despite this leading to a potential fall in Chinese demand for solar panels, the technology is already mature enough to benefit from subsidy-free growth.

- **Evolving U.S. Regulatory Framework:**

- With the upcoming U.S. elections, climate change is emerging as being one of the most important issues for constituents. To satisfy the constituents' opinion, we wouldn't be surprised to see the implementation of new supportive policies towards clean technologies.
- The expiration of the **Production Tax Credit (PTC)** for wind power projects planned for 2021 will likely boost the U.S. wind market next year with as developers are eager to benefit from the tax credit before its phase-out.
- On the other hand, the **Investment Tax Credit (ITC)** for Solar PV projects will be reduced next year from 30% to 26%. While an extension remains possible, we believe that the Solar industry's forecasts have already integrated the reduction of ITC.

SOURCES:

"Impact of anthropogenic climate change on wildfire across western US forests", Abatzoglou (University of Idaho) and Williams (Lamont Doherty Earth Observatory), PNAS, October 2016

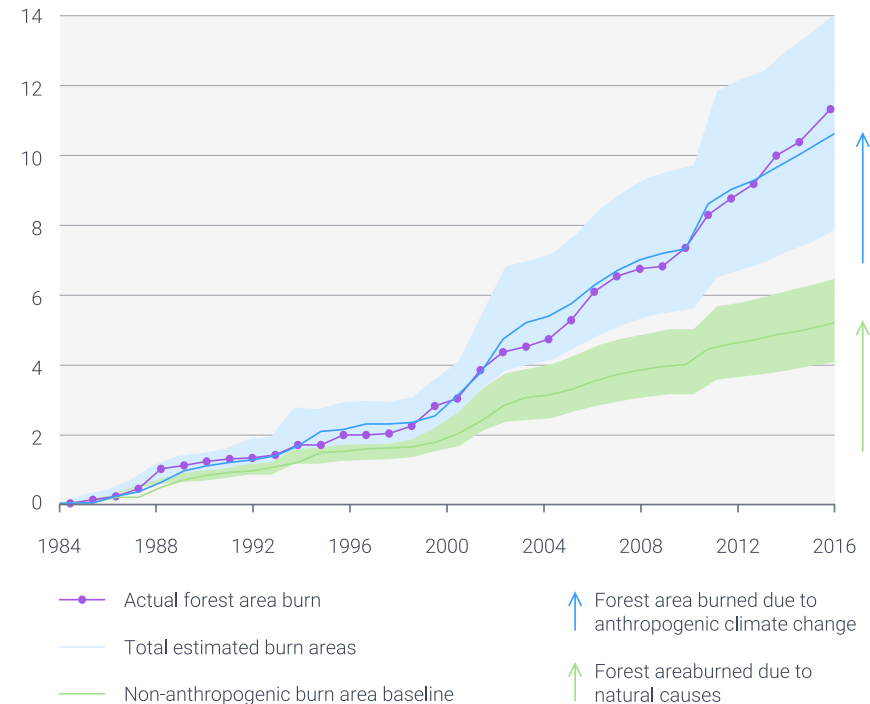


Outlook 2020 (3/4)

• Breakthrough in the battery market.

- Climate change will likely cause new and more frequent US wildfires, triggering more power outages, and paving the way to backup power technologies, i.e., Solar and Batteries.
- The market for stationary (fixed) batteries is poised to boom in the near term owing to increasing demand for residential, industrial, and utility-scale storage, combined with lower costs of technology.
- Several U.S. energy storage mandates have emerged over the past year (e.g., New York & Arizona target for 3GW of energy storage by 2030), and we expect this trend to continue in 2020.
- Backup power growth is poised to accelerate after a possible approval of the Energy Storage Tax Incentive and Deployment Act (submitted in April 2019) aimed to provide tax credits for investment in energy storage technologies.
- The California Public Utilities Commission recently released a proposal to unlock by 2024 a **\$613mn** budget for subsidizing at \$1 per watt-hour all-new home batteries of customers living in high wildfire risk areas or with low-income (this covers almost 100% of batteries' upfront costs).

CLIMATE CHANGE RESPONSIBLE FOR A DOUBLING OF BURN AREA
MILLIONS OF HECTARES OF US FOREST FIRES, CUMULATIVE



SOURCE: Abatzoglou and Williams. 2016. Shaded areas are 95% confidence intervals.

SOURCES:

"Impact of anthropogenic climate change on wildfire across western US forests", Abatzoglou (University of Idaho) and Williams (Lamont Doherty Earth Observatory), PNAS, October 2016

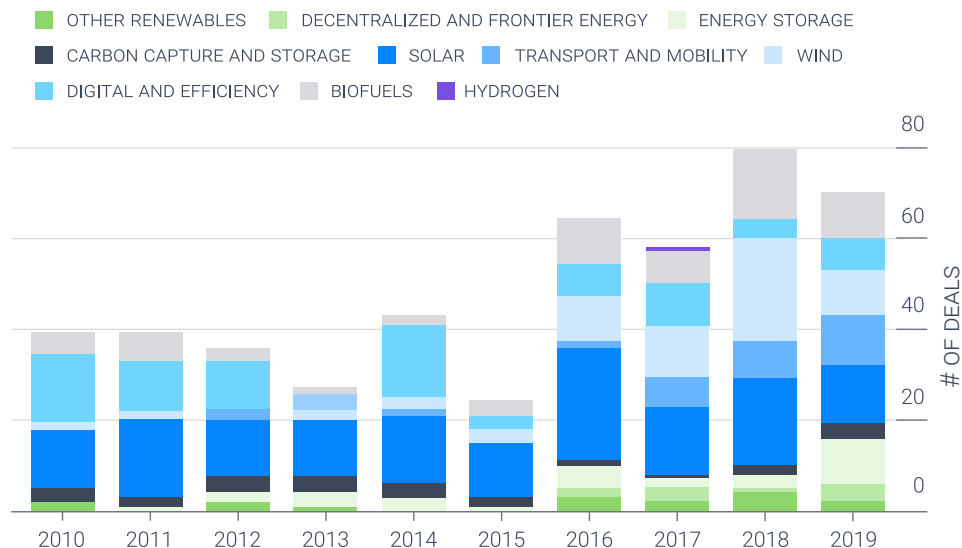
Outlook 2020 (4/4)

• Big steps toward clean transportation.

- The transportation sector is transitioning towards cleaner technologies, and major policies are likely to be implemented in the coming years.
- The International Maritime Organization will implement the **IMO 2020**, a regulation limiting Sulphur Oxide (SOx) emissions from ships, forcing them to either use **cleaner fuels** or install **scrubbers** to remove particulates from exhausts.
 - The price spread between IMO2020-compliant low sulfur fuel oil (LSFO) and high sulfur fuel oil (HSFO) determines the profitability of scrubbers (enabling the use of HSFO but incurring infrastructural costs).
 - The price spread is now above 250\$/ton, bringing the payback of a scrubber to less than 18 months.
 - We can expect such price spread to stabilize through 2020, driving shipowners' demand for scrubbers and benefiting key manufacturers such as **Alfa Laval (ALFA SS)**.
- The Carbon Offsetting and Reduction Scheme for International Aviation (**CORSIA**), adopted by 65 countries adding up to above 90% of the aviation activity, is aiming for **carbon-neutral growth** from 2020 onwards; a big driver to the adoption of **sustainable aviation fuel (SAF)**.
 - Accounting for about 0.1% of the total aviation fuel today, the IEA's Sustainable Development Scenario expects SAFs to account for 10% of the aviation fuel demand by 2025.
 - To achieve these targets, cost-competitiveness needs to be improved, and SAFs will require additional support through new subsidies or carbon taxes.

- The Electric Vehicles market will be in the spotlight next year, driven notably by **more stringent CO₂ taxation** for new cars in Europe and a growing product offering from automakers..
- Setting the new carbon target at 95g/km (vs. previous 130 g/km) should incentivize automakers to sell more EVs.
- On the other hand, subsidies on Chinese' New Energy Vehicles (essentially EVs and plug-in hybrids) may further decline next year as the government seeks to promote fair competition and avoid an industry bubble.
- Being the world's biggest EV market, China may hamper the EV growth in the short term.

FINDING OTHER INVESTMENTS



SOURCES:

Future Of Wind, IRENA 2019 | BNEF

<https://www.bloomberg.com/news/articles/2019-09-04/shell-leads-big-oil-in-the-race-to-invest-in-clean-energy-tech>

2019 – A Glance In The Rear-View Mirror (1/3)

PG&E (PCG US), the Californian utility, filed for bankruptcy protection (Chapter 11) after devastating wildfires ignited from its infrastructure and potential liabilities rising to as much as \$30bn.

- PG&E is learning climate change the hard way, with this event being a great example of the impact climate change has on traditional industries and more importantly a strong catalyst for distributed generation.

Shell (RDSA LN) acquired Sonnen (not listed), the German manufacturer of home lithium-ion batteries.

- This acquisition reflects the general trend of big Oil majors shifting their business model in anticipation of a future relying less on fossil fuel and more on renewables and electrified transports. It followed similar moves from other majors such as **Total (FP FP), BP (BP LN), Eni (ENI IM)**, etc.

IMPACT



January – April 2019

IMPACT



Release the U.S. Green New Deal, a broad list of resolutions aiming to address climate change and bringing the topic on the center stage.

- Several surveys showed that the Green New Deal and more generally the climate questions benefit from bipartisan support as people's awareness is rising. ([read our research note for more details](#)).

European Parliament and Council adopted the regulation EU 2019/631 which sets new caps on CO₂ emissions for cars & vans to 95g CO₂/km (from previous 130g/km) starting from 2020.

- Penalties will be applied to manufacturers exceeding the cap at a rate of €95 for each g/km. **Such penalties are likely to boost the deployment of EVs since costs incurred in the development of new EV models compensated carbon penalties.**

2019 – A Glance In The Rear-View Mirror (2/3)

Trade war, 25% tariffs on imported Chinese goods including power inverters, a key component to solar systems.

- Since most inverter manufacturers have part of their supply chain based in China, the escalation in tariffs forced some key players to move part of their manufacturing to other countries (South America, South-East Asia).

Northvolt (not listed), the Swedish startup manufacturing car lithium-ion batteries, secured a \$1bn equity capital raise which included among others: VW (VOW3 GR), Goldman Sachs (GS US), BMW (BMW GR), the Swedish pension fund and the IKEA group.

- It shows the European ambition to compete with Asian players on the competitive but highly promising battery market. Experts expect the European lithium-ion manufacturing capacity to reach 198 GWh by 2023 (up from 18GWh today).

IMPACT



May – August 2019

IMPACT



Elections of the European Parliament were highlighted by the unexpected success of Green parties which are emerging as important actors for any coalition.

- Green parties are gaining importance in Europe which will likely result into more decarbonization policies in European countries.

Norway's Government Pension Fund Global (GPF), a \$1tn fund, officially divested from Oil and Gas exploration and production (E&Ps) companies as FTSE Russel industry classification standards.

- This represents a total divestment of \$13bn which was associated with a new investment of \$20bn into renewable energy projects and companies. Political pressure is increasing on Oil & Gas companies, forcing them to modify their business activity.

2019 – A Glance In The Rear-View Mirror (3/3)

Generac (GNRC US), a U.S. provider of backup power generators, entered the solar inverter market through the acquisition of Pika Energy (not listed).

- While a “short” report associated with this event drove down the shares of the two U.S. market leaders for residential solar inverters, **SolarEdge (SEDG US)** and **Enphase (ENPH US)**, Generac hasn’t yet gained any noticeable market share. ([read our article for more details](#)).

IMPACT



September – December 2019

IMPACT



China has cut by half the subsidies it provides to the purchase of New Energy Vehicles, including battery electric vehicles, plug-in hybrid vehicles, and hydrogen fuel cell vehicles.

- The Chinese government fears a bubble. In fact, hundreds of EV startups raised billions of dollars following Chinese's supportive policies. The subsidies cut is aimed to avoid a possible bubble and let the industry rely on fair market competition rather than government's help. This event has negatively affected the sales of new EVs in the country for the remainder of the year.

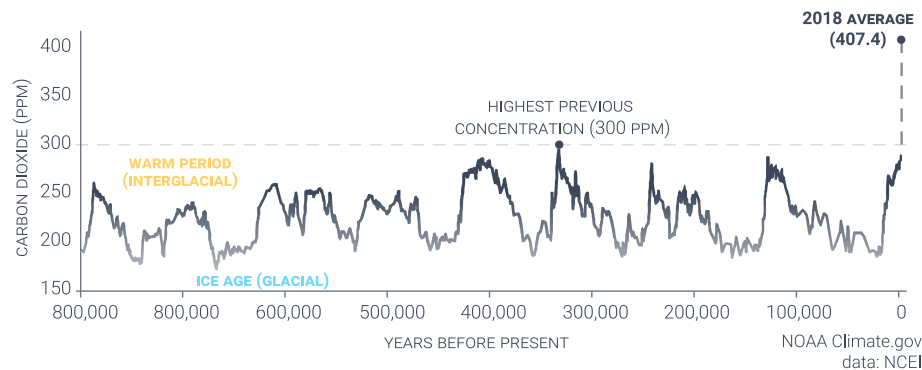
The European Investment Bank announced that it will stop financing fossil fuel energy projects starting in 2022 and unlock €1tn of investments in climate action and environmental sustainability through 2030.

- This represents a major paradigm shift from the world's biggest multilateral financial institution which will soon prioritize clean projects over traditionally-accepted fossil fuel financing. It goes in line with the recently announced “E.U. Green New Deal”, a 30-years plan by the European Commission aiming for 40% emissions cut by 2030 (from 1990 levels) and net-zero emissions by 2050 within the whole European Union.

Structural Trends (1/4)

- Climate change and its consequences are the primary trends underpinning this theme.
 - An intensification of **extreme weather events** can be noticed, including flooding, droughts, as well as heatwaves and associated wildfires, resulting in huge human and economic losses.
 - **Carbon dioxide (CO₂) level** in the atmosphere keeps on **increasing** and has reached an all-time high above **410 ppm** (up 150% from the pre-industrial level in 1750).
 - **Sea level has been rising** by an average rate of **5 mm/year** over the past five years, significantly faster than the average of 3.2mm/year since 1993.
 - 2015–2019 is on track to be the **warmest five-year period ever** recorded, 0.2°C higher than 2011–2015.

CO₂ DURING ICE AGES AND WARM PERIODS FOR THE PAST 800,000 YEARS

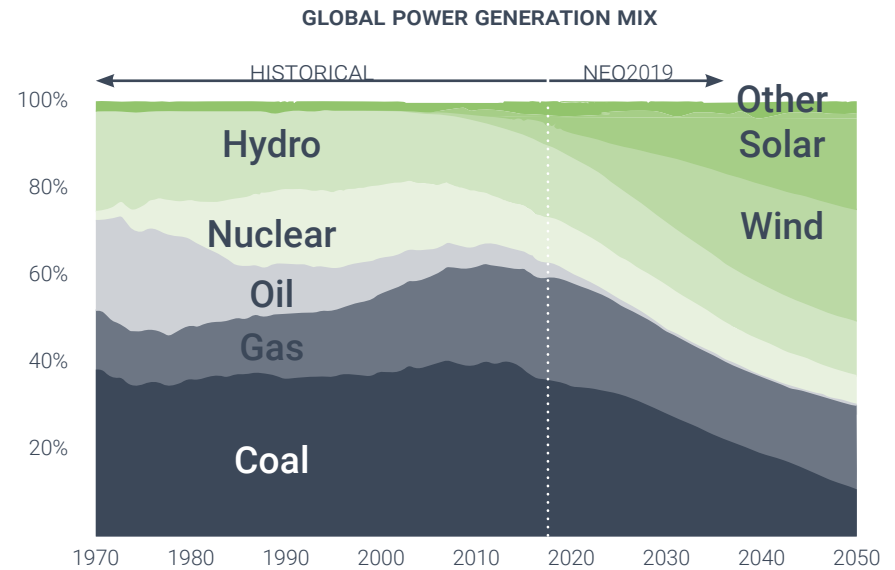


SOURCES:

World Meteorological Organization , The Global Climate 2015-2019 | National Centers for Environmental Information
BNEF, New Energy Outlook 2019

Structural Trends (2/4)

- **Growing Electrification:** electricity demand keeps on increasing and is expected to grow by **62% by 2050**.
 - According to experts, **\$13.3tn** of new investments will be spent into new power generation assets by 2050, among which **77% going to renewables** with **\$5.3tn in Wind** and **\$4.2tn in Solar power**. Additionally, **\$840bn** will be spent on **batteries** and **\$11.4tn** on **grid infrastructure**.
- The biggest winners of the growing electricity demand are **Solar Photovoltaic (PV)** and **Wind**, which are expected to grow from 7% to 20% of the power generation mix by 2050. Key drivers of rising electricity demand include:
 - Changing weather conditions (hotter summers and colder winters resulting in increased need for heating and cooling equipment);
 - Population growth, expected to rise by 0.9% per year reaching 9.7bn in 2050;
 - Urbanization, rate of people living in urban areas (vs. rural) rising from 54% in 2016 to 66% in 2050;
 - Electrification of transport, expected boom of electric vehicles growing from about 5mn today to more than 550mn by 2050.



SOURCES:

World Meteorological Organization , The Global Climate 2015-2019 | National Centers for Environmental Information

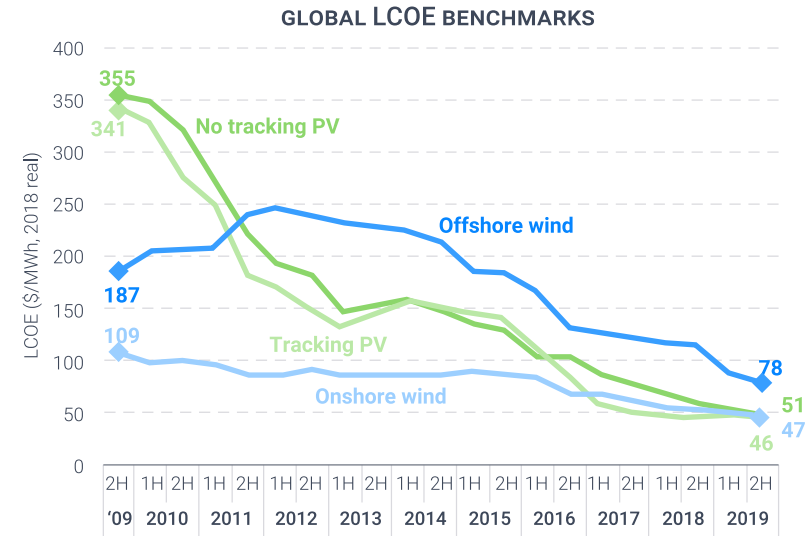
Sources: BNEF, New Energy Outlook 2019

<https://www.climate.gov/news-features/understanding-climate/climate-change-atmospheric-carbon-dioxide>

<https://about.bnef.com/blog/solar-wind-batteries-attract-10-trillion-2050-curbing-emissions-long-term-will-require-technologies/>

Structural Trends (3/4)

- **Grid parity:** the price of major renewable technologies, measured in “Levelized Cost of Energy” (the metric used to compare the present value of different power sources), has been on a constant decrease over the past decade:
 - **Solar PV** costs (both with/without tracking systems) decreased by more than 85%;
 - Wind energy costs (both onshore and offshore) decreased by more than **55%**;
 - Grid parity is reached when electricity generated from renewable sources becomes cheaper than electricity generated from conventional sources (such as coal, gas, etc.)
 - According to a recent study conducted by BNEF, grid parity (without subsidies) has already been reached for new solar and onshore wind in some parts of Europe (France, Italy, Spain, etc.), China, the U.S., and many other countries.
 - Thanks to **improving efficiencies, capacity factors** (ratio of actual electricity production over the maximum possible electricity output), and systems lifetimes, LCOEs are set to decrease further, and eventually, grid parity will be reached for renewables combined with energy storage (notably batteries).



SOURCES:

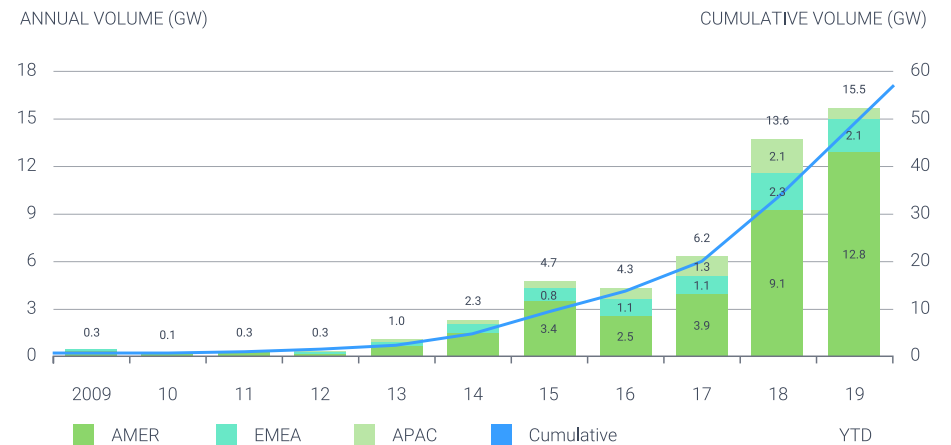
BNEF 2019

<https://www.pv-magazine.com/2019/11/01/solar-electricity-can-retail-for-0-027-0-036-kwh-as-renewables-close-in-on-global-grid-parity/>

Structural Trends (4/4)

- Rising Corporate PPA volumes:** We are currently witnessing a big trend in corporations signing power purchase agreements (PPAs) to increase their share of renewables in the electricity they consume.
 - 216 companies have already signed the RE100 initiative, a commitment to use 100% renewable electricity by 2050, among them: **Google (GOOG US), Amazon (AMZN US), AT&T (T US), Microsoft (MSFT US), Facebook (FB US)**, etc.
 - Driven by increasing pressure from customers and investors, big corporates see renewable electricity as a simple & accessible way of improving their environmental footprint.
 - The importance of Impact/Sustainable/ESG investments is rising and many influential institutions (such as the European Investment Bank, or pension funds) are directing their investments towards companies showing a positive impacts on the environment.
 - Most of the PPAs are attributed to solar and wind installations and are developed by utility companies.

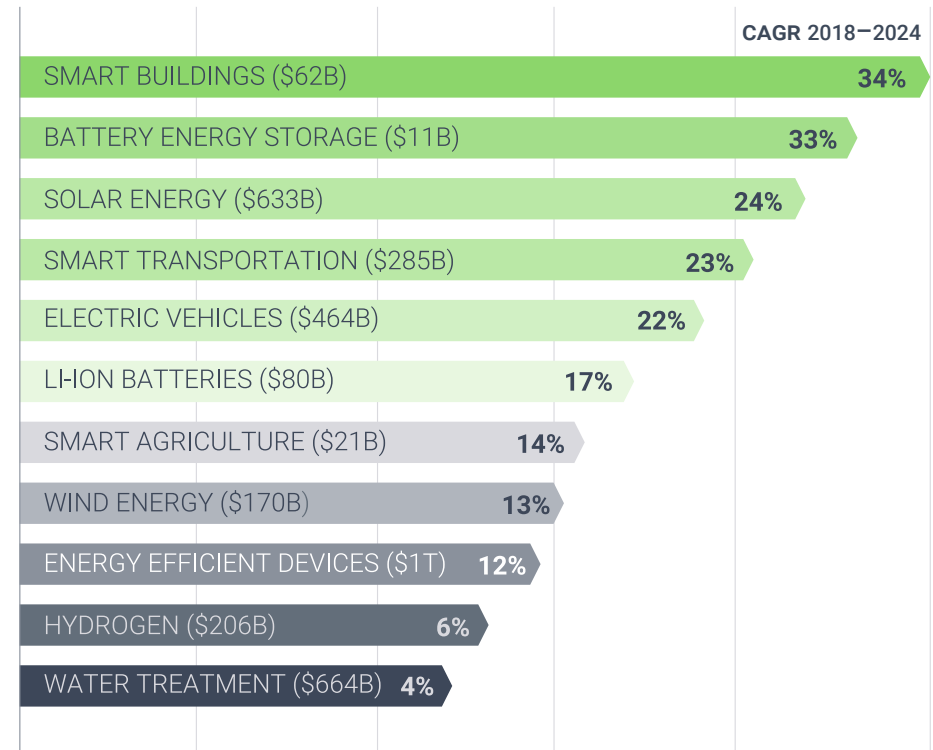
GLOBAL CORPORATE PPA VOLUMES BY REGION



SOURCES:
BNEF 2019

Sustainable Future's ABC

- **Climate change**, a **growing world's population**, and increasing **global electrification** have started to spark major changes in our living habits and the adoption of sustainable behaviors.
- Sustainable development is defined as “development that meets the needs of the present without compromising the ability of future generations to meet their own needs”.
- To grow sustainably, and as a response to the climate change threat, our society has no choice but to develop technologies aimed to adapt to and mitigate climate risk.
- Our **Sustainable Future** theme captures the growth (estimated above 20% on average) in all industries benefiting from the sustainable development of our planet.
- We invest in pure players in **renewable energies**, **energy storage**, **clean & smart transportation**, **water & wastewater treatment**, the **digitalization of energy systems**, and the integration of **smart technologies** aiming to improve **energy efficiency**.



SOURCE:
AtonRā Partners

Catalysts

- **More commitments to clean energy.** Countries, states, power utilities, and big corporates are all moving towards carbon-free electricity, driving penetration of renewables in the power mix.
- **Grid Parity.** Major technological improvements enabled renewable technologies to become more efficient, while economies of scale provided the cost reduction required to reach grid parity.
- **Growing Resilience Needs.** The rising number of extreme weather events is driving the need for distributed renewable power, energy storage, and resilient technologies.

Risks

- **A slowdown in Government's Subsidies.** The reduction & expiration of the government's subsidies on key technologies can potentially impact the growth forecasts in the short-term.
- **Fossil fuel prices.** Decreasing fossil fuel prices, could negatively impact the cost-competitiveness of renewables.
- **International Tensions.** Escalating tensions result in higher import tariffs and therefore reduce the affordability of cleaner technologies.

Bottom Line

- Our **Sustainable Future** theme encompasses a broad set of sub-sectors & technologies, all related to climate change response and benefiting from the global transition toward a more sustainable society.
- **Global electrification** is underway with, over the past decade, 153 million people gaining access to electricity every year.
- Thanks to decreasing costs and improved efficiencies, **renewable energy is becoming the technology of choice.**
- Our investment universe comprises players operating in different value chains and in **high growth potential markets** of varying sizes (expected average annual growth of above 20%).
- The Sustainable Future certificate features a **high level of diversification** (sectoral and geographical) combined with **substantial market visibility** (thanks to various government's policies and targets) and **significant growth potential.**

BIOTECHNOLOGY: TOWARDS A RERATING IN 2020?

A Rich Pipeline Coming To Maturity (1/2)

- Biotechnology companies underperformed the global markets year-to-date as **political uncertainties have weighed on the sector**.
 - In 2015–2016, the pharmaceutical market was facing competition from biosimilars and generics. Development pipelines were under scrutiny.
 - In 2017-2018, the approval of next-generation drugs like CAR T-cell therapy brought excitement.
 - This year, manufacturing issues for gene therapy companies and political noise contrasted with major advances on the clinical side, e.g., RNA and DNA-based gene therapies approvals (especially on rare diseases), and large M&A deals.
- A different story could happen in 2020.
 - **Volatility will remain** important as Republicans and Democrats continue releasing proposals on drug pricing. However, each day a bipartisan act is getting more likely, and a consensus might be found ahead of the 2020 presidential election.
 - FDA is adjusting clinical trial designs, aiming to **accelerate approvals** thanks to the use of real-world data, among others.

A Rich Pipeline Coming To Maturity (2/2)

- Smaller biotechnology firms are expecting several approvals and may attract pharma companies' interest in 2020, after a 2019 driven by large-scale M&A transactions.
 - Major clinical results and expected approvals in the next few years should restore investors' appetite for **neurology, rare diseases, and metabolic diseases** – e.g., NASH and cholesterol.
- Technology is also expected to drive the biotech market in 2020, as artificial intelligence, machine learning, and genome sequencing will continue to transform healthcare, more particularly the discovery of new molecules.
- **China** is gaining importance on the biotech scene. The growth rate of the Chinese healthcare industry is expected to be twice as higher as the U.S market, driven by the “Healthy China 2030” plan.
 - The Chinese government has made several regulations to promote innovation and biotech (China FDA, CFDA, new regulatory frame).
 - Clinical studies in collaboration with the United States and/or Europe are more and more frequent.
 - IPOs of Chinese pharma and biotech firms in the US or on the HK/ Shanghai stock exchanges are boosting their visibility.



Outlook 2020 (1/2)

All therapeutics areas mentioned below are driven by new technologies, such as DNA and RNA gene therapies. Also, the 38th annual J.P. Morgan Healthcare Conference to be held at the beginning of January 2020 will set the tone for the rest of the year (12 January–16 January).

NASH: 2020, FINALLY, THE YEAR OF AN APPROVED DRUG?



CLINICAL DATA

Intercept (ICPT US) – Ocaliva: the PDUFA date, deadline to approve a drug, is 26 March 2020. Ocaliva could become the first treatment for NASH, the fatty liver disease.

CONFERENCES

The first quarter will be decisive with one big conference, the EASL/ILC - European Association for the Study of the liver and the International Liver Congress from 15 April 2020 to 19 April 2020.

Several companies from **Genfit (GFT FP)** to Intercept will present their latest data during this congress.

OTHER METABOLIC DISEASES: NEW DRUGS FOR LIFESTYLE DISEASES.



CLINICAL DATA

Esperion (ESPR US) has the PDUFA date for its drug Bempedoic acid, on 21 February 2020. Ahead of the potential approval, the company could become an M&A target.

Other M&A candidates include **RegenxBio (RGNX US)**, which develops a gene therapy treating high blood cholesterol levels, and **Amarin Corporation (AMRN US)**, focusing on cardiovascular health.

CONFERENCES

ACC – American College of Cardiology (end of March 2020).

IAC – International Academy of Cardiology meetings (end of July 2020).

AHA – American Heart Association (mid-November 2020).

BLOOD DISEASES: A BRIGHT FUTURE AHEAD



CLINICAL DATA

Bluebird Bio (BLUE US) is expected to submit a Biologics license application ("BLA") to the FDA by the end of 2019 on Transfusion-dependent β -thalassemia and severe sickle cell disease.

After the first gene therapy approved in Europe on β -thalassemia in 2019, next year could see the first gene therapy on hemophilia. Who will win the battle?

Biomarin (BMRN US), Roche (ROG SW), Spark Therapeutics (ONCE US), Pfizer (PFE US), Sangamo (SGMO US), and UniQure (QURE US) all have late-stage compounds. Next year, they will all report relevant data.

Global Blood Therapy (GBT US) received accelerated approval for its sickle cell drug. The company will have to show more data on a follow-up study next year. If the potential of the drug is confirmed, the company could be an M&A target.

CONFERENCES

Gene Therapy for blood disorders on 3–5 March 2020.

American Society of Hematology Annual Meeting (5–8 December 2020).

SOURCES:
Companies reports, Conferences websites

Outlook 2020 (2/2)

CNS: REGAINING INVESTORS' CONFIDENCE



CLINICAL DATA

New hope on Alzheimer's. **Biogen (BIIB US)** is planning to re-submit Aducanumab for approval in January 2020, after a shutdown in 2019. The company kept collecting and analyzing data together with the FDA despite the study's termination. A positive FDA decision on Aducanumab will restore enthusiasm into the neurodegenerative sector.

Several CNS biotech such as **Cortezyme (CRTX US)**, **Neurocrine Biosciences (NBIX US)**, or **Sarepta Therapeutics (SRPT US)** could become M&A targets in 2020.

Voyager Therapeutics (VYGR US) will present in 2020 additional data on its gene therapy programs (DNA/RNA) on Huntington's disease, Friedreich's ataxia, Parkinson's diseases, and other neurodegenerative diseases. The company has significant collaborations with **AbbVie (ABBV US)** and **Neurocrine (NBIX US)**.

SOURCES:
Companies reports, Conferences websites

CONFERENCES

APA – American Psychiatric Association and AAN - American Academy of Neurology, end of April 2020.

AAIC – Alzheimer's Association International Conference, end of July 2020.

ANA – American Neurological Association, at the beginning of October and CTAD Clinical Trials on Alzheimer's disease in December 2020.

RARE DISEASES: PERFECT TARGETS FOR DNA/RNA GENE THERAPY



CLINICAL DATA

PTC Therapeutics (PTCT US) and **Roche (ROG SW)** have their PDUFA date for Risdiplam (on Spinal Muscular Dystrophy) on 24 May 2020, under a priority review designation.

Ultragenyx (RARE US) has its PDUFA date for UJ007 (genetic acid Oxidation fatty disease) on 31 July 2020.

Alexion (ALXN US) will report data on several P3 rare diseases trials in H1 2020.

Orchard Therapeutics (ORTX US) is expected to file on Metachromatic Leukodystrophy (MLD), a rare disease, in Q1/Q2 2020.

On Duchenne Muscular Dystrophy, **Solid Bioscience (SLDB US)**, **Pfizer (PFE US)**, and **Milo (Not listed)** will try to catch up after Sarepta's recent approval.

CONFERENCES

4th Annual Gene Therapy for Rare Disorders (30 March to 2 April 2020).

Annual SMA Conference (11–14 June 2020).

ASGCT - American Society of Gene and Cell Therapy (12–15 May 2020).

NACFC - North American Cystic Fibrosis Conference (22–24 October 2020).

TARGETED THERAPY AND IMMUNOTHERAPY TO TREAT CANCER



CLINICAL DATA

Blueprint (BPMC US) has its PDUFA date for Avapritinib (a genetic form of GI cancer) on 14 February 2020. It could be extended due to data requested from a Voyager trial.

Incyte (INCY US) has its PDUFA date for Pemigatinib (cholangiocarcinoma) under a priority review on 30 May 2020.

Nektar (NKTR US) P3 data on NKTR-214 + Opdivo, in advanced melanoma, will be presented in H2 2020.

Seattle Genetics (SGEN US) topline data on a P2 study on metastatic cervical cancer expected in H1 2020.

Chinese biotech companies will be in the spotlight in 2020 after **Beigen's (BGNE US)** first US approval in 2019: **Zai Lab (ZLAB US)** will submit an NDA to the FDA for GIST (Gastrointestinal Stromal Tumor) during H1 2020.

CONFERENCES

Advances in Liquid Biopsy (13–16 January 2020).

ASCO "American Society of Clinical Oncology" conferences: gastrointestinal cancers (23–25 January 2020),

SITC immuno-oncology (06–08 February 2020), Genitourinary cancers (13–15 February 2020), the main ASCO event (29 May–02 June 2020).

ESMO (the European one) on 18-22 September 2020.

Society for Immunotherapy of Cancer (11–15 November 2020).

2019 – A Glance In The Rear-View Mirror (1/4)

M&A & COMPANIES DATAPOINTS

Many big transactions occurred in the oncology space towards the end of 2018 and the beginning of 2019. Companies remain eager to invest in this therapeutic area as scientific advances have catalyzed the development of drugs. This reflects a general trend of developing immune and targeted therapies to treat cancers in a more personalized way.

- GlaxoSmithKline (GSK US) acquired Tesaro (TSRO US) for \$5.1bn
- Bristol-Myers Squibb (BMY US) acquired Celgene Corp (CELG US) for \$74bn
- Eli Lilly (LLY US) acquired Loxo Oncology (LOXO US) for \$8bn

Gene therapy is a hot topic, and M&A is a way for pharma companies to enhance their pipeline. After the 2018 acquisition of AveXis by Novartis (NOVN SW), Roche (ROG SW) is showing interest in gene therapy companies.

- Roche acquired Spark Therapeutics (ONCE US) for \$4.8bn.

The Brammer Bio (not listed) acquisition by Thermo Fisher (TMO US) confirmed our view that cell and gene therapy research is booming. Scientific tools companies must attempt to meet demand on the manufacturing side.

- Thermo Fisher, the laboratory equipment supplier, agreed to acquire Brammer Bio for \$1.7bn. Brammer Bio supports the industry by making viral vectors that are used to transport DNA into the nucleus of defective cells.

IMPACT



End of 2018 / January 2019

February 2019

March 2019

IMPACT



REGULATIONS

The beginning of the year was a turning point for gene and cell therapy in treating neurological disorders, blood diseases, and cancers. Bluebird (BLUE US), BioMarin (BMRN US), or Amicus Therapeutic (FOLD US) are all active in this space.

- The FDA announced new policies for cell and gene therapies. The agency also provides special recommendations for inherited blood disorders, neurodegenerative diseases, and the manufacturing of CAR-T cells.
- The FDA anticipated getting more than 200 New Drug applications (INDs) for cell and gene therapies per year by 2020, which will allow 10-20 of these therapies to be approved annually by 2025.

The end of the first quarter marked the beginning of discussions around drug pricing in the US, bringing some volatility on healthcare stocks. Rebates between biopharma companies and Pharmacy benefit managers ("PBMs"), i.e., intermediaries between drugmakers and insurers/retail pharmacies, were at the center of discussions.

- Seven big pharmaceutical companies – Sanofi (SAN FP), Johnson & Johnson (JNJ US), Merck (MRK US), AbbVie (ABBV US), Pfizer (PFE US), Bristol-Myers Squibb, and AstraZeneca (AZN LN), defended their drug pricing strategy in front of the US Senate committee. The key question from the committee was: "if rebates go away, would drugmakers reduce list prices by the amount given as rebates?"

SOURCES:

AtonRā Partners, Companies reports, FDA

BIOTECHNOLOGY

2019 – A Glance In The Rear-View Mirror (2/4)

M&A & COMPANIES DATAPOINTS

Some biopharma companies are turning to contract development and manufacturing organizations (CDMOs) for vectors' supply. In gene therapies, the supply chain is complex, and it is worth noting that 80% of the standard review time during clinical trials is spent on manufacturing and quality issues. For smaller biopharma, outsourcing could be a solution. As we mentioned previously in our research, CDMOs is still a highly fragmented market. Catalent (CTLT US) and Lonza (LONN SW) are potential consolidators or M&A targets in this activity.

- **Catalent** acquired a gene therapy manufacturing expert, **Paragon Bioservices (Not listed)**, for \$1.2bn.

Pharma companies are looking for M&A opportunities to reduce their reliance on their blockbuster products facing generic / biosimilar competition.

- **AbbVie (ABBV US)** agreed to buy **Allergan (AGN US)** for \$63bn. It is the second mega-deal of the year.
- **Pfizer (PFE US)** acquired **Array (ARRY US)** for \$11bn.

The approvals of two permanent gene therapies showed that the FDA / EMA is willing to support the development of next-generation treatments.

- The EMA approved Zynteglo, **Bluebird Bio (BLUE US)** gene therapy. It treats people with transfusion-dependent beta-thalassemia, a rare and inherited blood disorder.
- **AveXis / Novartis (NOVN SW)** gene therapy, Zolgensma, was approved by the FDA for Spinal Muscular Atrophy.

IMPACT



April 2019

May 2019

June 2019

IMPACT



Despite several good news on clinical and M&A sides, the pharma industry was under pressure during the second quarter. Discussions related to drug pricing escalated. Ahead of the 2020 U.S. presidential elections, certain candidates made extreme propositions.

- Senator Bernie Sanders introduced a new version of his "Medicare for All" bill, which was a keystone of his 2016 presidential campaign.
- "Medicare for All" calls wobbled the sector during this quarter and could further represent a risk if Democrats were to win the next US Presidential election. They pursue to mimic the European model, with drugs approved not only on efficacy but also on pricing.

SOURCES:

AtonRā Partners, Companies reports, FDA

BIOTECHNOLOGY

2019 – A Glance In The Rear-View Mirror (3/4)

M&A & COMPANIES DATAPOINTS

During the third quarter, several bad news from clinical trials impacted the industry and highlighted manufacturing and safety risks.

- **Nektar Therapeutics (NKTR US)** had to face two crises during the summer:
 - Due to manufacturing issues, Nektar administrated inactive doses during its clinical trials. These inactive doses were used in several cancer trials in combination with **Merck's (MRK US)** Keytruda.
 - Following the current opioid crisis in the U.S., the FDA postponed opioid experts' committee meetings. This delayed the review of NKTR-181, a potentially less addictive opioid for treating chronic pain.

- The FDA rejected the accelerated approval of Golodirsen, developed by **Sarepta Therapeutics (SRPT US)**, for the treatment of Duchenne muscular dystrophy.

IMPACT

July 2019

August 2019

September 2019

IMPACT

REGULATIONS

The Healthcare sector has faced headwinds during the Q2 and Q3 2019, making it the worst-performing industry of the first half of 2019 in the S&P 500 Index. One reason for this underperformance is the focus of US politicians and Presidential candidates on lowering drug prices.

- After the failure of two recent proposals, the Trump administration is under pressure to reach an agreement before the 2020 elections. A bipartisan bill from Trump's administration on drug pricing was proposed during the summer. It suggested capping drugs' price increase at the rate of inflation in parts B and D of Medicare.
- Whenever a proposal was too aggressive for drug manufacturers or PBMs, it did fail.

SOURCES:

AtonRā Partners, Companies reports, FDA

BIOTECHNOLOGY

2019 – A Glance In The Rear-View Mirror (4/4)

M&A & COMPANIES DATAPOINTS

Several positive clinical data were presented during Q4, re-boosting the biopharma sector.

- **Medicines Co. (MDCO US)** and **Orchard Therapeutics (ORTX US)** released additional positive data on their DNA and RNA gene therapies.
- **Acadia Pharmaceuticals' (ACAD US)** treatment for dementia-related psychosis (Nuplazid) met its primary endpoint in phase 3 and stopped the trial earlier for positive efficacy. It is likely to be approved by the FDA next year.
- The FDA gave two quick approvals on **Vertex's (VRTX US)** drug on Cystic Fibrosis and **Alnylam's (ALNY US)** drug on rare liver disease. The FDA is also showing its willingness to approve drugs more quickly where there is an unmet need. Fewer FDA restrictions and faster approvals in the Rare Diseases space are likely to attract a lot of M&A attention
- **Sarepta's (SRTP US)** drug on Duchenne Muscular Dystrophy was finally approved after its rejection in August. The confidence is back on rare diseases and next-generation therapies such as RNA antisense.

IMPACT



Three acquisitions occurred in two hot therapeutic areas: RNA-drugs and next-generation oncology treatments.

- **Novartis (NOVN SW)** acquired The Medicines Company for \$9.7bn. Novartis is entering into the RNA therapeutics space, confirming the high potential of this new class of drugs.
- **Sanofi (SAN FP)** is renewing its pipeline outside its historical franchises (diabetes and cardiovascular) by acquiring **Synthorx (THOR US)** for \$2.5bn. The company focuses on the hot immuno-oncology area with the next generation IL-2 asset.
- **Merck (MRK US)** agreed to buy **ArQule (ARQL US)** for \$2.7bn. It confirms the strong appetite for BTK inhibitors, following the recent approvals of Astrazeneca and **BeiGene's (BGNE US)** drugs.



October 2019

November / December 2019

REGULATIONS

Obtaining a bipartisan agreement ahead of the 2020 U.S. election is not a utopia anymore. Any deal would likely remove uncertainty about pricing that has negatively impacted biopharma stocks for so long.

- The bill proposal by Nanci Pelosi was less aggressive than expected. President Trump supported price reform. Once the uncertainty over pricing disappears, investor sentiment will significantly improve.
- We deep dived into this subject through our research: "Get ready for a bipartisan agreement over drug pricing" and "The battle over drug pricing: Finally a consensus".

IMPACT



Healthcare companies might strongly rerate ahead of the 2020 presidential election.

- The Trump Administration targeted hospitals and insurers' pricing, leaving the pharmaceutical industry out for a while. The plan would force hospitals for more transparency of the rates negotiated with insurers by 2021.
- After several months of debates among democrats, they finally agreed on a common bill on lowering prices. To become a law, the bill still needs to be validated by the US Senate. A bipartisan agreement is closer than ever.

SOURCES:

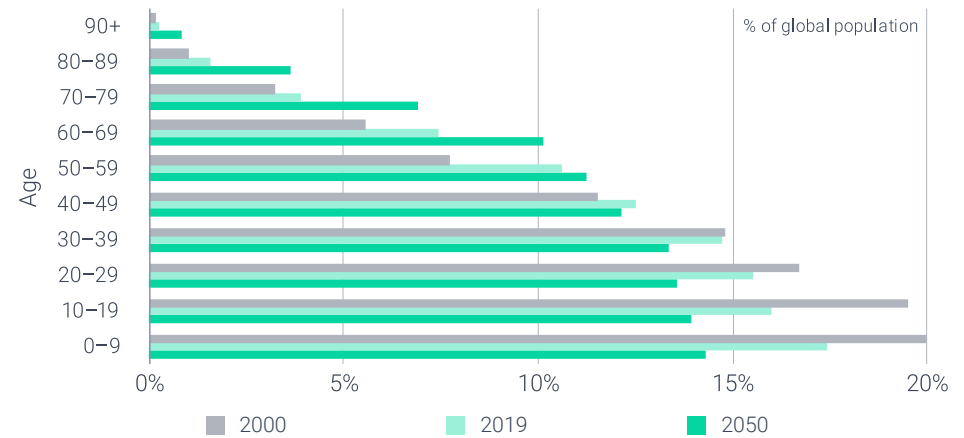
AtonRā Partners, Companies reports, FDA

BIOTECHNOLOGY

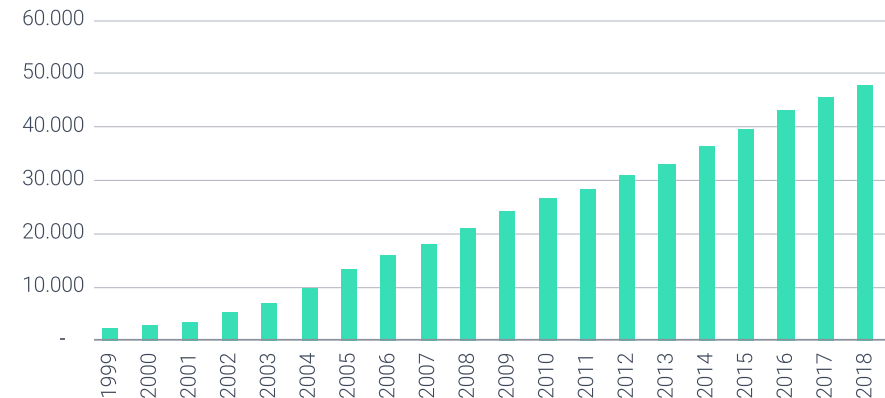
Structural Trends (1/3)

- **Aging and economic development** are the two drivers for healthcare consumption.
 - Age-related diseases, including dementia, Parkinson’s, rheumatism, cancers, and metabolic disorders, will be on the rise.
- **Bad nutrition habits** contribute to more than 660’000 deaths each year in the U.S. Adult obesity is more common globally than under-nutrition.
 - Over the last thirty years, obesity rates have doubled in adults and tripled in children.
 - According to the World Health Organization, 650mn adults were obese in 2016. Should this trend continues, the 1-billion mark could be crossed by 2025.
- Advances in technology, along with **important discoveries** in biology, help fight against the consequences of these demographic trends.
 - Multi-disciplinary approaches involving biochemistry, molecular biology, genetics, immunology, microbiology, pharmacology, etc. are benefiting all areas of biotechnology.
 - CAR-T cell therapy, RNA-based drugs, and DNA gene therapies are examples of novel biotechnologies that are changing the world.
 - Personalized medicines and diagnostic solutions are emerging, thanks to genome sequencing and artificial intelligence.
- Many of the drug candidates are still in the early development stage, but encouraging results are driving strong R&D activities.
 - In gene therapy, promising developments are in oncology, blood diseases, eye disorders, or rare diseases such as Duchenne muscular dystrophy, among others.
 - RNA-based gene therapies are exhibiting impressive data, leading to a growing interest from big pharma, who are buying innovative biotech products in this field.

GLOBAL POPULATION IS AGEING



NUMBER OF CLINICAL TRIALS REGISTERED BY YEAR GLOBALLY

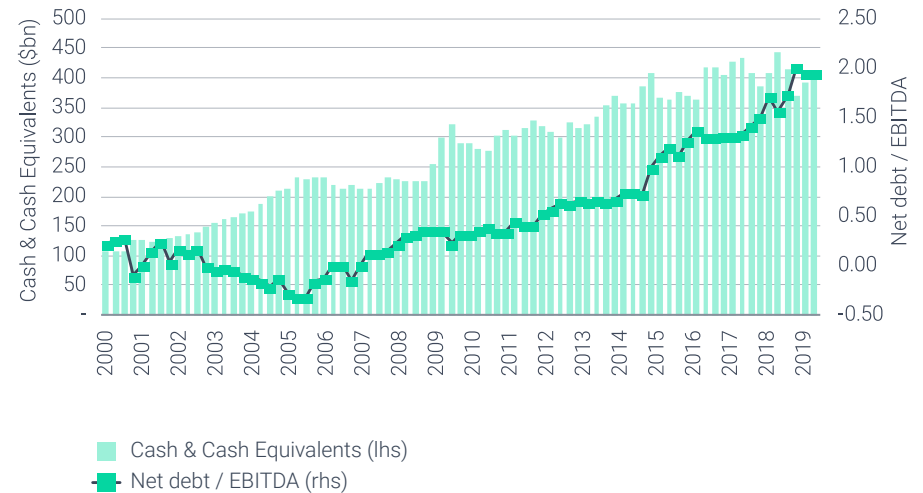


SOURCES:
 United Nations, worldobesity.org,
 WHO International Clinical Trials Registry Platforms

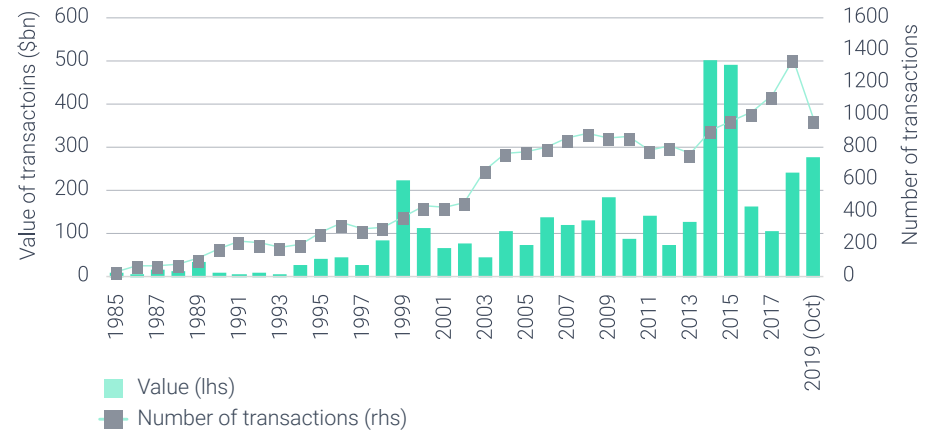
Structural Trends (2/3)

- 2019 has been an outstanding year in terms of **M&A activities** in the biotech/ pharma sector.
 - Between 2016 and 2018, we saw primarily a lot of small deals. In 2019, large-scale acquisitions have been driving the market.
 - The companies involved in these mega-mergers might have less M&A appetite in the short-term until they digest the targets.
- This intense M&A activity betrays the necessity to get a continual flow of **new medicines and patents** for well-established biotech and pharmaceutical firms. It is supported by the strong fundamentals of the industry leaders.
 - Years of high profitability have created a war chest that is deployed to finance external innovation.
 - The capital structure of pharmaceutical companies has evolved, reflecting the low-interest-rate environment. Net debt/EBITDA levels remain manageable and below most other industries.
- **Oncology** was again the center of attention in M&A deals.
 - According to PwC, the global oncology market will reach \$200bn in 2022, up from \$133bn in 2017.
 - In the oncology market, big pharma are not only looking for an innovative pipeline but also data sources, digital platforms, and manufacturing capabilities.
- On the **IPO scene**, the number of newly listed companies (70) and the total capital raised (\$8.7bn) in 2019 is so far slightly below 2018.
 - Venture capitalists are still eyeing the huge potential returns of innovative biotech firms.
 - Major newly listed companies include **10X Genomics (TXG US)**, **Shanghai Henlius Biotech (2696 HK)**, and **Livongo (LVGO US)**.

CASH LEVEL – MSCI WORLD HEALTHCARE COMPANIES



M&A IN BIOTECHNOLOGY AND PHARMACEUTICALS



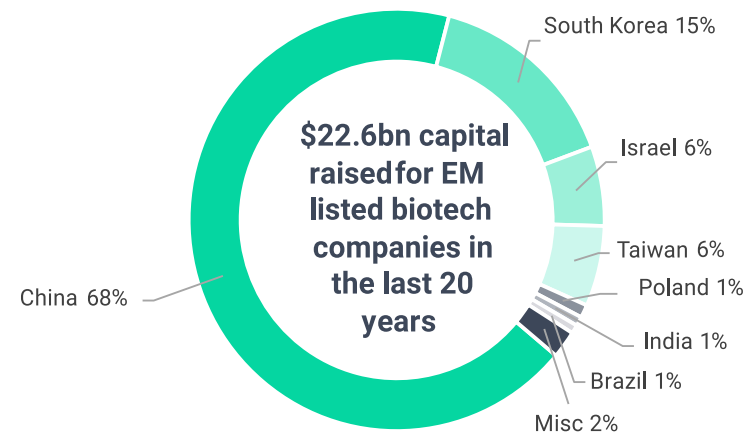
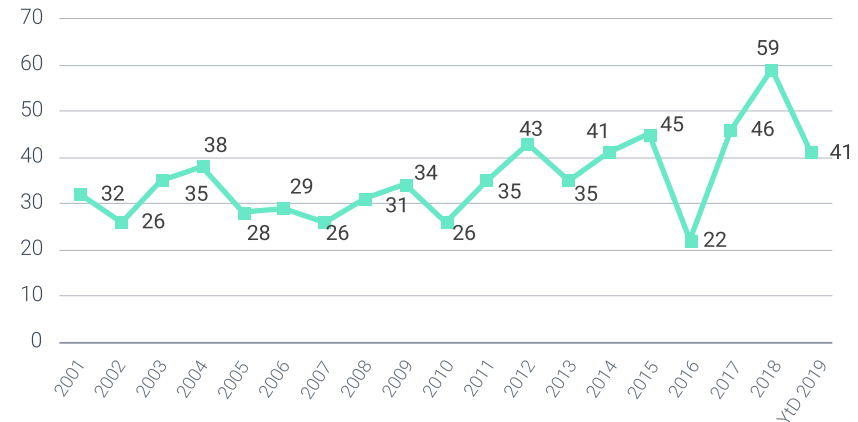
SOURCES:

Bloomberg | Institute for Mergers, Acquisitions and Alliances | AtonRâ Partners. All data as of 28 November 2019

Structural Trends (3/3)

- The FDA's approved **new drugs** are on a rising trend despite a softer 2019 (41 vs. 59 in 2018)
 - Looking at the all-time high of 2018, the depressed decade of 2001-2010 seems far away.
- This trend is supported by technological development, new drug classes (e.g., RNA-drugs), and softer clinical trial rules for rare or orphan diseases.
 - Under the orphan drug program, drugs can be developed on smaller cohorts, and tax benefits are provided to the companies to encourage such R&D activities.
 - In 2018, 56% of new drugs were approved under the orphan drug program. Year-to-date, 41% of new drugs have been recognized under this designation.
- In **Emerging Markets**, local approval and regulatory agencies are also providing tailwinds to the biotech industry. Although the US remains the largest market in the world (\$170bn in 2017), it is likely to experience lower growth rates than its emerging peers.
 - Obesity rates and the aging population are rising, leading to an increased incidence of chronic diseases (such as cancers, cardiovascular diseases).
 - China launched several programs – “Made in China 2025”, “Healthy China 2030”, etc. to develop its biotech industry. The country aims to rely less on imports of US drugs to meet rising internal demand.
 - In India, the government is trying to diversify its healthcare industry, which is currently highly exposed to the production of generics. Incentives are put in place to increase the sector sales from \$7bn in 2016 to \$100bn by 2025.
 - Biotech companies in emerging markets can focus on both local demand and the development of medicines for industrialized countries with larger markets.

NEW DRUGS APPROVED BY THE FDA



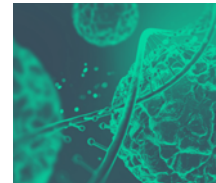
SOURCES:

FDA | Bloomberg | AtonRā Partners. All data as of 28 November 2019

Biotech's ABC

«Biology is the most powerful technology ever created. DNA is software, protein is hardware, cells are factories.»

- **Biotechnology** involves the use of living organisms or their products (e.g., bacteria or enzymes) to manufacture drugs.
 - Thanks to a better understanding of the underlying causes of many diseases, more effective and safer drugs are appearing.
- Our Biotechnology portfolio focuses on **tomorrow's new generation of drugs** that could revolutionize the future of biotechnology.
 - Such technologies include RNA-based drugs, cell, and DNA-gene therapies, and cancer vaccines.
 - These medical innovations, as well as the emergence of artificial intelligence, big data, and genome sequencing, will allow for more personalized treatment and better diagnosis.
- We look at companies that address unmet medical needs, which means **huge untapped markets** waiting to be exploited.
- Research and development, through partnerships or M&A, will continue to be strategic for companies looking for **innovation**.
- Finally, these medical innovations are getting **support from authorities** such as the FDA, which encourages this new generation of drugs by recruiting specialized teams and establishing specific approval guidelines.



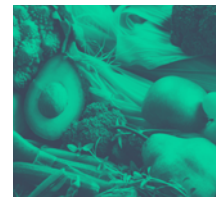
ONCOLOGY

Biotech are developing targeted therapies and immune-oncology treatments. Genome sequencing and AI tech will lead to personalized treatment and better diagnostic tools.



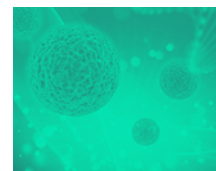
CENTRAL NERVOUS SYSTEM (CNS)

There is an unmet medical need in CNS diseases. Discoveries on how diseases are working will pave the way for new working drugs from genetic diseases to degenerative diseases.



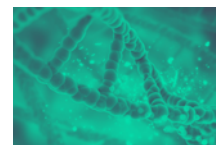
LIFESTYLE DISEASES

Shift in lifestyle and consumption of bad food have contributed to an increase of these diseases: they include cardiovascular / metabolic diseases, certain forms of diabetes, liver diseases (NASH), many types of cancers.



RARE DISEASES

An attractive space with strong governments' incentives. Innovation continues in the space of rare diseases in several therapeutic areas from oncology to neurology and rare blood diseases.



GENE AND CELL THERAPY

Approvals and additional positive data in gene and cell therapies increase the confidence in these potentially curative treatments.

Catalysts

- **M&A will remain an important driver for the biotechnology industry in 2020**, most likely during the second semester. Cash-rich pharma giants with portfolios in gene/cell therapy, immuno-oncology, and targeted therapies, CNS, or diagnosis will continue their M&A shopping spree.
- **Drugs agencies' incentives.** The FDA is more than present today to support biotech companies in developing innovative medicines, especially for rare diseases. Next year, many biotechs in this field will present additional data to support their potential approvals.
- **The biotech industry is opening-up to new markets.** The recent approval in the US by the FDA of **BeiGene's (BGNE US)** drug on a rare form of blood cancer was a big catalyst for the Chinese biotech market. This is the first time that the U.S. approval of a drug is based on clinical trials conducted in China.

Risks

- **Pricing pressure.** The high cost of developing new treatments is reflected in the high selling price of such drugs.
- **Clinical trials.** Many innovative approaches are still at the clinical trial phase, with no guarantees that an effective drug will hit the market someday. The probability that a drug goes through the entire clinical trial process is below 10%, on average.
- **Ethical issues.** Genes and genomes are based on a code of just four DNA letters – A, C, T, and G. As gene therapies and synthetic biology emerge, some people are worried that altering the code of life may yield to unexpected consequences.

Bottom Line

- The developments in biotechnology of the last 40 years represent a **major advance in modern healthcare**. This trend is here to stay.
 - Solutions appear for many diseases considered yesterday as “incurable”. Proofs-of-concept have been established, and many clinical trial results are encouraging.
- Diseases with unmet medical needs offer a **huge market opportunity**. Investors are willing to support quality R&D on innovative drugs, given the upside potential.
- Future growth will come from **Emerging Markets** that are affected by similar demographic trends as the ones for developed countries.
 - Healthcare spending in China accounts for only 6% of the GDP vs. 18% in the United States.
- **Exciting, scary, fascinating, risky**, etc. – A diversified portfolio giving exposure to a variety of tomorrow's treatments is necessary to mitigate the binary risk of clinical trials.

AI & ROBOTICS: AUTOMATION IS JUST THE BEGINNING

Converging Toward Pervasiveness (1/2)

- Since the launch of the AI & Robotics certificate back in 2015, the key trends that we had anticipated have confirmed themselves and even exceeded our expectations.
- Since the inception of the certificate, we have identified **data centers** as one of the most interesting playgrounds for AI & Robotics and this hypothesis has been corroborated this year by the acquisition of **Mellanox (MLNX US)** by **NVIDIA (NVDA US)** and of **Cray (CRAY US)** by **Hewlett Packard Enterprise (HPE US)**.
- In Q4 2017, we shifted the weight of our AI hardware exposure to programmable and dedicated chipsets, like **FPGA**, and this move kept paying us back throughout 2019.
- At the end of 2018, we anticipated that **automation** would have been a long-term trend in every single industry. We believe, given how this has been constantly repeated in many conferences, that this will continue in 2020: it is the number one priority for a vast majority of companies across several sectors.



Converging Toward Pervasiveness (2/2)

- On the miss side, our good call on **Mobileye** in 2017 made us slightly too enthusiastic about the convergence of AI and the **automotive sector**: the development phase has taken longer than expected, but we believe that this trend is about to ripen.
- We also wrote last year about increasing our exposure to China. We still maintain this view (more in the following pages) as the easiness to access data and the investments going on in the country will continue providing fertile ground for the AI sector.
- We see three main trends unfolding in 2020 for this sector.
 - Artificial Intelligence will start to pervade our life, thanks to the convergence of the Internet of Things (**IoT**) and Edge computing.
 - The market will require more sensors for the Industrial Internet of Things (**IIoT**) and the automotive sector.
 - Artificial Intelligence will progressively reinforce its presence within the **Healthcare sector** (testing, diagnosis, monitoring, ...).

Outlook 2020 (1/2)

- The Chinese AI company **Megvii (not listed)** will begin trading on the Hong Kong stock market in 2020.
 - The IPO has been delayed because the company was blacklisted by the US government earlier this year.
 - The Chinese company is the largest open-source computer vision platform. It is expected to become the first Chinese AI startup to go public.
- DeepMind, the AI company owned by **Alphabet (GOOGL US)**, will be operational in its new London headquarter by the first half of 2020.
 - The company is pioneering the way **reinforcement learning** is carried on. Its hit-and-trial error differentiates itself from supervised and unsupervised learning, the other two machine learning (ML) approaches. Its advantage is not to require historical data, one of the bottlenecks for the other ML methods.
 - Reinforcement learning allowed researchers of **InSilico Medicine (not listed)**, to go from molecular design to animal testing in just 46 days - a remarkable time-saving in compounds development.
- Elon Musk said that the **Neuralink** device would be ready to implant into a first human patient before the end of 2020.
 - **Neuralink (not listed)** is an American neurotechnology company that develops implantable brain-machine interfaces.
 - The **connection between the brain and technology** is not so far away. It could, first of all, help solve mental issues such as autism and schizophrenia.

SOURCES:

<https://www.insider.com/elon-musk-neuralink-wont-solve-autism-schizophrenia-2019-11>



Outlook 2020 (2/2)

- The **European Investment Fund** will make \$100mn available to investments in AI and blockchain in 2020.
 - The fund was launched in early 2019.
 - Investment levels in this field across Europe have been lower than in the U.S. and in Asia up to date. The Fund aims at increasing investments at the national level to make Europe attractive for startups.
- The Organization for Economic Co-operation and Development (OECD) will make operative the **OECD AI Policy Observatory** from 2020.
 - It aims at monitoring and helping countries with "responsible development of trustworthy artificial intelligence".
 - The Observatory will put together resources from OECD and countries to provide research on policy AI-related issues.
- The **Chinese AI market** is gaining traction as the access to data is facilitated in the country, and data is the key to AI.
 - According to a recent study by IDC, the Chinese AI market accounted for 12% of the global AI market in 2019, and it is expected to grow more than 50% in the next few years.
 - We have been steadily increasing exposure towards Chinese names in our AI & Robotics portfolio, and are likely to continue during 2020.

SOURCES:

<https://ec.europa.eu/digital-single-market/en/news/eu-artificial-intelligence-and-blockchain-investment-fund-invest-100-million-euros-startups>

<https://www.oecd.org/going-digital/ai/>



2019 – A Glance In The Rear-View Mirror (1/2)

The China-U.S. trade war characterized the year 2019. Beginning in May, announcements of the escalation of tariffs by China and the United States intensified.

- U.S. President Trump changed the world's geopolitical landscape by heightening tariffs on Chinese imports. On 10 May, Trump levied the previous tariffs of 10% to 25% on 200bn worth of Chinese goods. All over the year, other tariff hikes from both sides come into effect.
- **Huawei (not listed)** is the flagship of the technological ban the USA is imposing on China. Concerns about the company date back to 2011, when Huawei sent an open letter to the U.S. government to deny the security concerns it was accused of, and to ask U.S. authorities a thorough investigation on them.
- The U.S. does not want to involve Chinese players in the 5G ramp-up for their national network and is pushing other countries to do so. They fear the Chinese government could access to private data through backdoors in the network equipment Chinese companies sell.
- The U.S. government severely restricted many national corporations in doing business with Chinese companies, instituting a blacklist, where **Huawei, HikVision (002415 CN), SenseTime (not listed)**, and others are listed. Technology giants such as **Google (GOOGL)** and **Microsoft (MSFT)**, as well as semiconductors players, were negatively affected by this event.

IMPACT



H1 2019

IMPACT



China continues its process of “De-Americanization”, following its plan “Made in China 2025”. Chinese authorities aim at making the country independent from a technological standpoint.

- The trade war is a short-term threat to China. The country is now even more incentivized to reach their goals and overcome the slowdown caused by being shunned from part of American technology.
- Chinese R&D spending is still behind American's, but catching up fast. Chinese companies such as Huawei announced an increase in R&D investment by around 20% over 2018. Moreover, the Chinese giant is replacing U.S. components.

2019 – A Glance In The Rear-View Mirror (2/2)

Google (GOOGL US) announced to have achieved the so-called quantum supremacy in October. Quantum supremacy is about demonstrating that a quantum computer can solve a problem that a classical computer could not.

- Quantum computing performs calculations on a probabilistic setting, rather than the usual 1s or 0s. The American giant says that its processor executed a calculation in 200 seconds, instead of more than 10'000 years a normal computer would need.
- A quantum computer could process huge sets of data in a way not possible before.
- Such technology impacts a variety of industries. From the financial one to the chemical's, going through the tech's, cybersecurity's, and many others.

IMPACT



H2 2019

IMPACT



The debate around using facial recognition for security purposes has intensified, and shows the dicotomy between the western and eastern societies. AI is a data greedy field, and policies regulating data access impact its development.

- Mobile phone users that will register new SIM cards in China are obliged to submit their facial recognition scan. The new rule entered into force in China beginning from December 2019.
- San Francisco (USA) banned city agents from the use of facial recognition technology earlier this May. California lawmakers passed a law for banning the use of cameras deploying facial recognition over the entire state in September.

Structural Trends (1/4)

- As the applicative side is ripening, Artificial Intelligence is not seen anymore as an “if” but rather a “when.”
 - For those companies that have already embraced AI developments, their ROIs increased by 10% or more, according to a recent study by Deloitte, showing that a well-defined AI strategy brings substantial value-added.
 - The critical data points highlighted were the enhancement of products and services in addition to the optimization of the corporation’s processes (automation of internal operations).
- Automation** is drastically changing the way industrial production is carried on.
 - Factory automation can reduce overall production costs.
 - Automation is set to grow at a high-single-digit CAGR during the next five years.
- Artificial Intelligence (**AI**) is **converging with** the Internet of Things (**IoT**) and **Blockchain**. Now that the tools for AI are there, it is time for the technological synergies to be developed.
 - Security and scalability challenge blockchain technologies, while AI needs to deal with privacy concerns. Blockchain can decentralize data and push Artificial Intelligence toward more transparency.
 - The IoT will enable real-time data collection. AI can empower systems to make timely decisions based on such data.
 - AI, IoT, and Blockchain together have huge potential: think about TradeLens, a program led by **IBM (IBM US)** and **Maersk (MAERSKB DC)** to monitor goods that are shipped. It aims at saving billions by tracking goods and significantly reduce the risk of losses.



SOURCES:

CBInsights, AI Trends in 2019 (pag.3)

<https://www.globenewswire.com/news-release/2019/03/29/1788398/0/en/Global-Factory-Automation-Industrial-Controls-Market-Growth-Trends-and-Forecasts-Report-2019-2024.html>

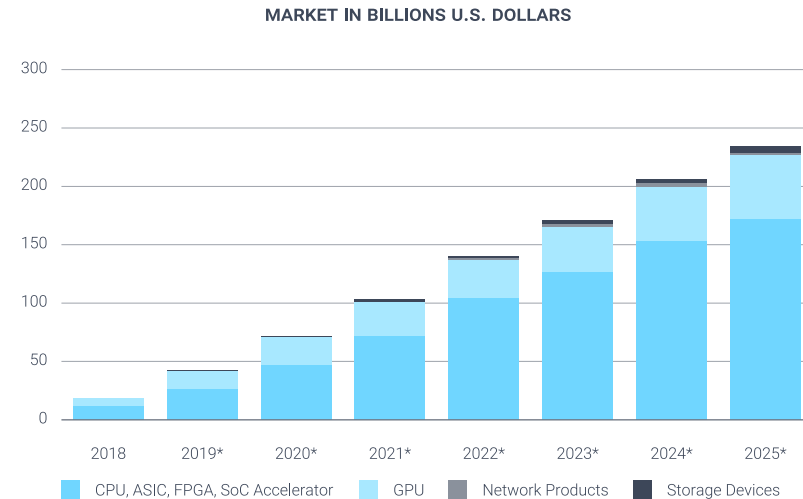
Structural Trends (2/4)

- **Edge computing** is an increasing need. It allows devices to process data locally in real-time and give a prompt response.
 - At the end of last year, we wrote on how “edge computing” was going to be the key focus going into the year. Not only this statement was correct, but it is likely to carry on well into 2020 and the next few years, as a recent study by Forrester highlighted that 54% of the global mobility top management sees edge computing as a very flexible solution.
 - Edge computing is particularly useful for applications where extremely low latency is determinant (autonomous driving), and surrounding environmental conditions may be harsh (military drones). It will enable many Internet of Things applications.
 - 5G coverage will foster the effectiveness of edge computing. The communication protocol allows for fast transmission of data (potential latency < 10 milliseconds) and to expand the network capacity (more devices can be covered at the same time without loss in performance).



Structural Trends (3/4)

- Worldwide data is **growing massively**.
 - IDC states that it will increase by 61% to 175 zettabytes by 2025.
 - 49% of data will be stored in public clouds by 2025.
- Data centers are shifting to **Field Programmable Gate Arrays (FPGAs)**.
 - As we move from AI model training to real-time AI applications, FPGAs are gaining space in data centers.
 - These programmable chips are less power consuming than GPUs (Graphic Process Units).
 - Xilinx (XLNX US)** is the leader in the FPGA field.
- The industry points toward edge computing.**
 - Rising 5G and IoT will increase demand for smaller edge datacenter facilities.
- Adoption of **collaborative robots** adoption is accelerating (CAGR of 50.31%, an expected \$12bn market by 2025), given their high return on investment.
 - They come cheaper than industrial robots, whose growth is approaching maturity. The U.S.-China trade war is taking its toll, as customers are postponing investments. Worldwide new investments in industrial robots peaked \$16.5bn in 2018 and are expected to remain flat in 2019.
 - Teradyne (TER US)** is a key player in the collaborative robots market through **Universal Robots**, a Danish company bought out in 2015.

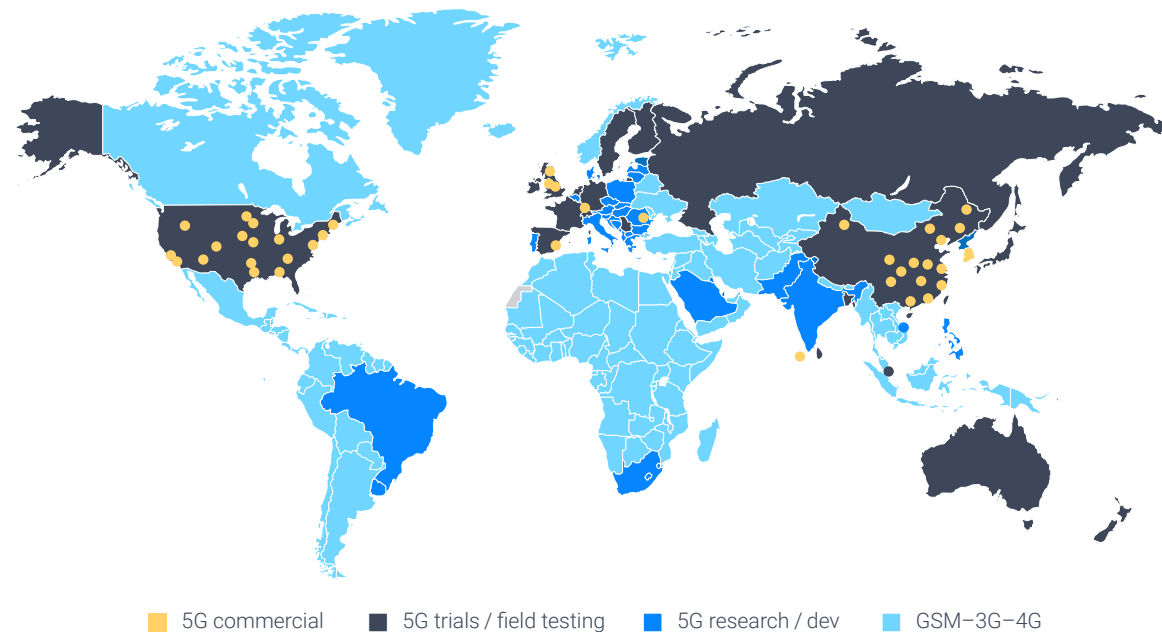


SOURCES:

<https://www.statista.com/statistics/1003895/worldwide-artificial-intelligence-hardware-market-revenues>
<https://www.globenewswire.com/news-release/2019/03/29/1788398/0/en/Global-Factory-Automation-Industrial-Controls-Market-Growth-Trends-and-Forecasts-Report-2019-2024.html>
<https://www2.deloitte.com/content/dam/Deloitte/us/Documents/technology-media-telecommunications/us-technology-tmt-outlook-2020.pdf>
<https://www.marketsandmarkets.com/Market-Reports/collaborative-robot-market-194541294.html>, <https://ifr.org/ifr-press-releases/news/robot-investment-reaches-record-16.5-billion-usd>
<https://www.networkworld.com/article/3325397/idc-expect-175-zettabytes-of-data-worldwide-by-2025.html>

Structural Trends (4/4)

- **5G** is being rolled out on a worldwide basis. Few countries have already begun a commercial deployment (South Korea, USA, UK, China), available in specific cities. Worldwide commercial deployment is expected in 2020.
 - Currently, there is a natural pause in spending patterns for 5G, as many players are deploying in 2H19 what was bought during the first half of the year.
 - 5G is about connecting billions of devices faster, almost anywhere. It will enable the takeoff of the **Internet of Things** (IoT).
 - **Xilinx (XLNX US)** is largely exposed to telecoms for 5G (more than 30% of revenue) and data centers ramp-up. Its technology works to address capacity, connectivity, and performance issues.



SOURCES:
<https://www.worldtimezone.com/5g.html>

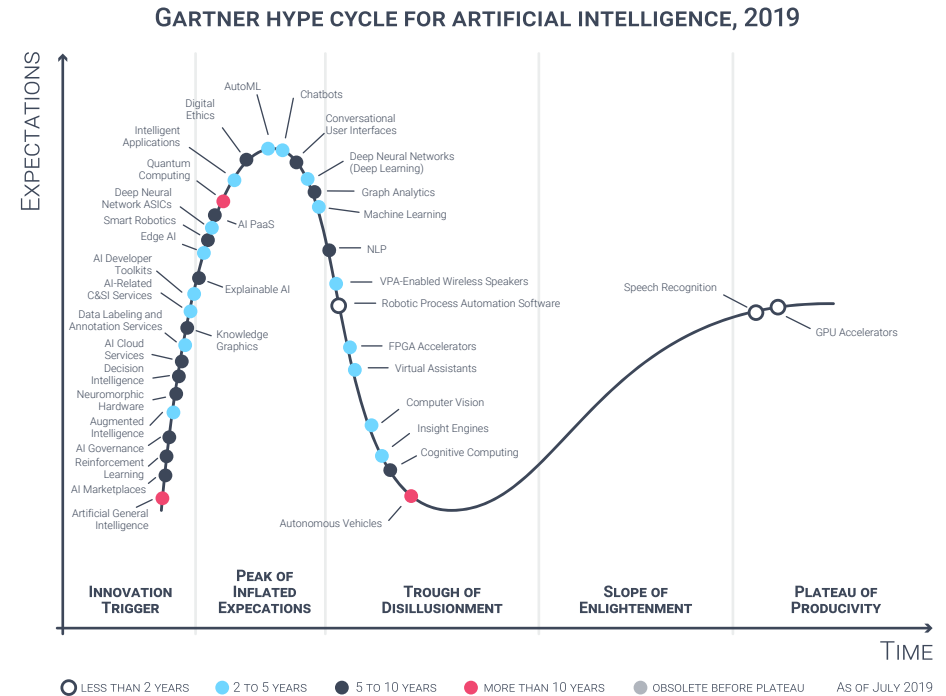
AI & Robotics' ABC (1/2)

- Artificial Intelligence (AI) is a technique that enables **machines to mimic human behavior**. It is embodied in the form of robots and enables them to perform everyday tasks which so far needed human intervention: driving cars, stocking warehouses, taking care of people, advising on purchases, analyzing patients' tests.
 - AI aims to replicate the human thought process into mechatronic devices.
- Artificial Intelligence finds application within our everyday life.
 - Handwriting, speech, and face recognition are recurring in personal devices (personal computers, smartphones), security systems, and many other fields.
 - Smart robotics, chatbots, and autonomous vehicles are a further step into automating what was human responsibility before.
 - The biggest benefits will be perceived where a huge amount of data needs to be processed and interpreted: machines can make it faster than humans.
- Data-rich industries** (banking, healthcare, etc.) are the aptest to embed AI's potentialities. Efficiency and improved operations are the goals.
 - The technology will help doctors identify cancer cells, security systems to prevent threats and manufacturers to save billions by anticipating maintenance on machinery.
 - Winners will be both companies (cost reduction, improved data processing, new AI-powered devices on the market) and users.
- AI has still a long way to go for bringing to maturity many of its applications: autonomous vehicles, artificial general intelligence, and quantum computing are still far from being widely developed and adopted.

SOURCES:

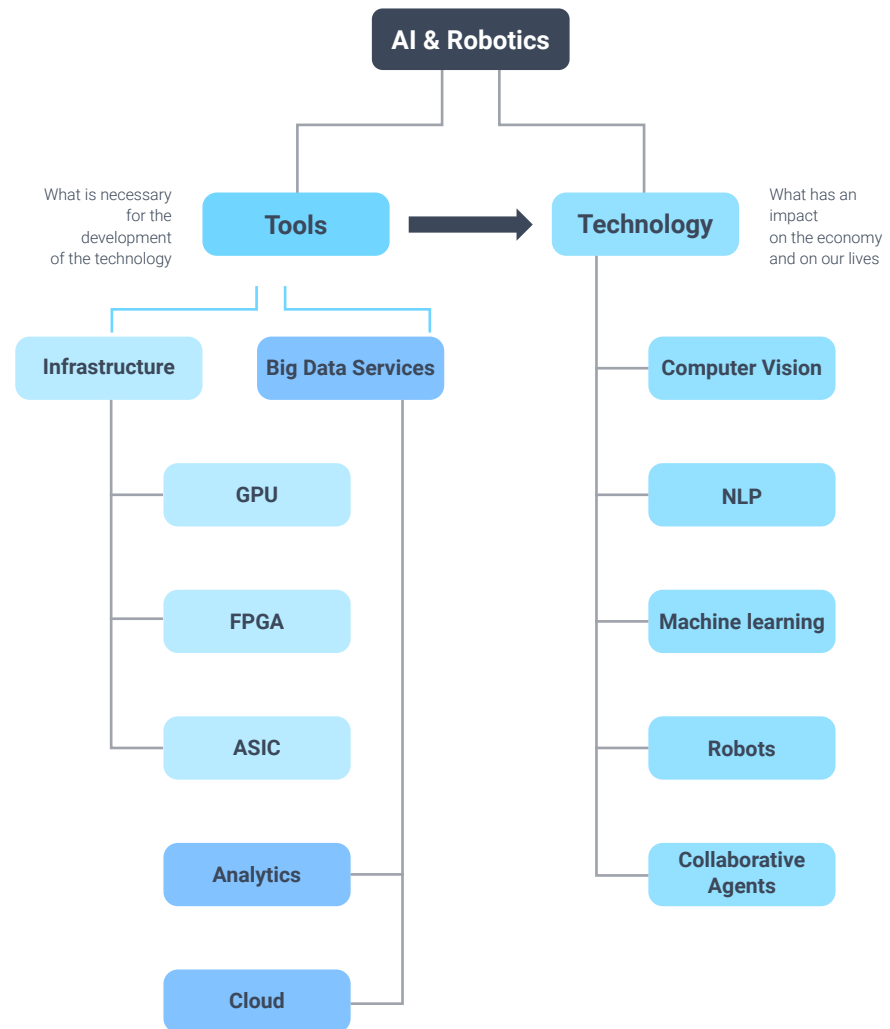
<https://www.gartner.com/smarterwithgartner/top-trends-on-the-gartner-hype-cycle-for-artificial-intelligence-2019/>

<https://www.gartner.com/en/newsroom/press-releases/2019-11-13-gartner-forecasts-worldwide-public-cloud-revenue-to-grow-17-percent-in-2020>



AI & Robotics' ABC (2/2)

- The AI & Robotics theme will evolve according to the maturity of the phases underpinning each segment's development. While the infrastructure side has already seen a massive capex buildup that is not over yet, the applicative side is still in its infancy and offers huge potential.
 - The first big wave concentrates on building up the **tools** needed to support the upcoming technology.
 - The second step revolves around the pure **technology** that applications are built upon.
 - The two phases are not completely sequential, but rather partially overlapping. Their maturity will be reached at different times.
- The tools category can be split up into two main branches: **infrastructure** and big **data services**.
 - The former encompasses the processors and integrated circuits (IC) part of the intense capital expenditure. Data centers capex has been driving the theme even though in 2019, we witnessed slower growth.
 - The latter refers to the data analytics and cloud services necessary to work on data. All industries are moving toward the cloud and implementing data analytics systems to optimize their processes.
- The technology component refers rather to the **applicative side** of the theme.
 - Co-bots are gaining the fastest growth in the automation of factories, whereas growth in industrial robots slowed down this year.
 - Computer vision is extending its reach through facial recognition and applications in the security and automotive space.



Catalysts

- **Full commercial 5G deployment.** Next year 5G will extend its reach worldwide. Asia is the most advanced, and China expects to launch full commercial 5G deployment by beginning 2020.
- **The Industrial Internet of Things (IIoT) ramp-up.**
 - Factory automation will resume its growth after having slowed down during 2019.
 - Semiconductor players see security, automotive and industrial automation as a secular channel of growth for their industry. Connectivity will be another hot topic within the field.
- **Revamping the automotive sector.** The year 2019 has fallen short of expectations for this industry. Though, we found semiconductor players bullish on this sector going into 2020. Our participation in tech conferences and Semicon in Munich confirmed this perception. Sensors deployment on vehicles will fuel the demand for chips and AI-related technologies.

Risks

- **Extended trade war.** The ongoing trade war has slowed down capital expenditures due to the uncertainty it brought in. The risk that a prolonged unfavorable setting may defer investments remains high.
- **Data breaches.** New cyberattacks would decelerate the deployment of interconnected solutions. If data are not securely stored and managed, fewer investments into the Internet of Things will take place. On the other side, AI-enabled attacks are becoming more advanced, as bad actors may use AI to carry on cyber-attacks.
- **Stringent regulation and ethics controversies.**
 - The use of techniques such as facial recognition may be banned for certain purposes. For instance, applying biometric surveillance control is forbidden over some jurisdiction.
 - Some countries are implementing practices to oversee Artificial Intelligence from an ethical standpoint. This could limit its usage and defer some of its end applications (e.g., fully autonomous vehicles).

Bottom Line

- AI will strengthen its **synergies with Blockchain and the Internet of Things**. The interactions between these technologies will remove deficiencies they show if working independently.
- AI will increasingly penetrate **Health practices**. How the monitoring, examining, and acting on patients is undergone will be reshaped by the possibility to add the intensified data analysis conducted by AI to the medical practice.
- Cloud requires investments in **data centers**. The capital expenditure to build the infrastructure is likely to resume its growth in 2020 and 2021.
- **Trade war** shook the semiconductor industry. The commercial threats spread uncertainty, delaying investments, and making it more difficult for international players to collaborate.
- **Automotive, security, and the Industrial Internet of Things** will be a growing trend in 2020. Semiconductor producers expect the automotive sector to recover from the 2019 slowdown. The Industrial Internet of Things will pull the growth by requiring investments in security and connectivity.

FINTECH: ON ITS WAY TO MASS ADOPTION

Big Players Are Stepping In

- The Fintech portfolio is built on one main conviction: **technology and digitization are completely reshaping the financial industry.**
- The **ascent of fintech** is only starting.
 - A new wave of applications and software is going to offer improved digital services and user experience, yielding to mass adoption.
 - In 2020, long-awaited IPOs of key industry players will expand our investment universe.
 - Discussions for issuing Central Bank Digital Currencies (“CBDCs”) are ongoing worldwide.
- For **mobile payments**, the consolidation game started in 2018 is likely to continue. The industry – especially for payment processors, remains fragmented and needs to diversify its offering, e.g., cross-border payments and B2B payments.
- The fintech industry continued its growth throughout 2019.
 - Our portfolio benefited mostly from exposure to mobile payment companies. We have seen some short-term headwinds affecting players in emerging markets, but no structural changes have altered our view.
 - Financial institutions’ investments in financial software have continued steadily. Companies in this market brought stability to our portfolio.
- We wrote last year about the opportunity that tech giants would have in entering the digital banking ecosystem.
 - **Facebook (FB US)** announced the Libra project together with its partners in June.
 - **Apple (AAPL US)** launched a credit card in partnership with **Goldman Sachs (GS US)** in August.
 - **Alphabet (GOOGL US)** revealed that it will offer U.S. consumers bank accounts next year.



FINTECH

Outlook 2020 (1/3)

Partnerships among Fintech.

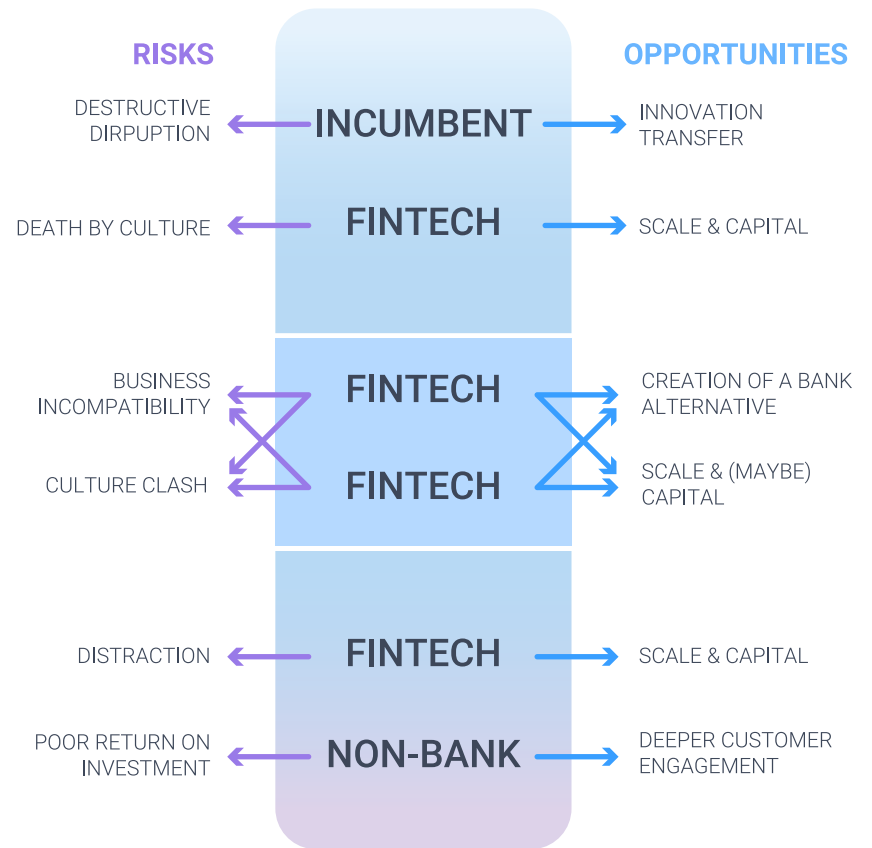
- The next evolution of fintech is going to be partnership driven. Established fintech firms and incumbents offer startups a level of scale they wouldn't be able to access in a short time.
- Tech giants (FANG) will use their deep pockets to get access to regtech, insurtech, proptech after having taken a leading role in the trillion-dollar global payment market.

2020 will be a year full of IPOs.

- **Ant Financial (not listed), Avaloq (not listed), Klarna (not listed), Lemonade (not listed), Sofi (not listed), and Interswitch (not listed)** are some of the fintech companies that should arrive on the public market.

Collaborations between banks and fintech startups.

- Banks, in particular, will be obliged to engage with FinTech through M&A to achieve digital transformations. Larger institutions will lead this process as they have the resources internally to identify, vet, and enter into partnerships. The small ones will either follow or disappear.



SOURCES:
EY Global FinTech Adoption Index 2019

Outlook 2020 (2/3)

- **Robo-Advisory to gain ground.**

- As consumers' awareness and understanding increase on how Robo-advisors work, trust becomes less important as a barrier for adoption. We expect proper regulation to become a key driver for the success of robo-advisors next year.
- **Goldman Sachs (GS US)** will offer **robo-advisory services** to individuals with as little as \$5,000.
- **Wealthfront**, a pioneer in robo-advice that just a few months ago began offering savings accounts, will expand into brokering mortgages.

- **Increased focus on Regtech.**

- Thanks to the recent addition of Artificial intelligence (AI) to the RegTech toolbox enabling better identification of frauds, efficient transaction monitoring, and money laundering (ML) detection and improved behavioral monitoring, we expect even a more profound interest around the globe on Regtech companies.

- **Apple (AAPL US) has confirmed plans to roll out Apple Card in other countries next year.**

- UK should be the first one after the U.S.

- **AtonRâ will participate in a few Fintech conferences around the world next year.**

- Worth mentioning the Seamless Asia 2020 in Singapore and Money2020 in Amsterdam both in June and the AI in Finance Summit in New York in September.

SOURCES:
EY Global FinTech Adoption Index 2019

Outlook 2020 (3/3)

More regulation on Cryptocurrencies and Blockchains will speed up the introduction of these technologies:

- Switzerland will discuss a proposal to change the regulation on blockchain in 2020. The aim is to make the legislative environment more reliable and structured, to facilitate the use of distributed ledger technology (DLT) for applications in various sectors and to reduce the risks associated with the use of the blockchain (security/fraud/money laundering /etc.).
- The deadline for the 5th Anti-Money Laundering Directive to come into force in Europe is on the 10th of January 2020. This is a step forward in trying to regulate the blockchain world.
- Wyoming (USA) appears to be the only state in the U.S. to have developed a legal framework regarding the blockchain. They have eight new laws in this regard that need to be discussed for 2020.

Decentralized Finance (DeFi).

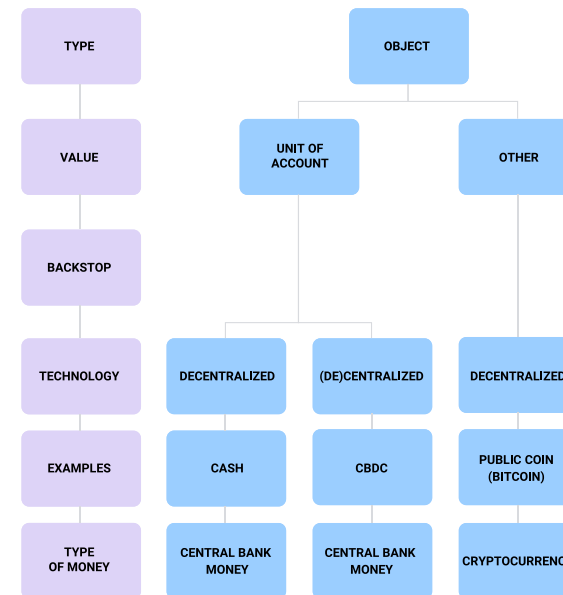
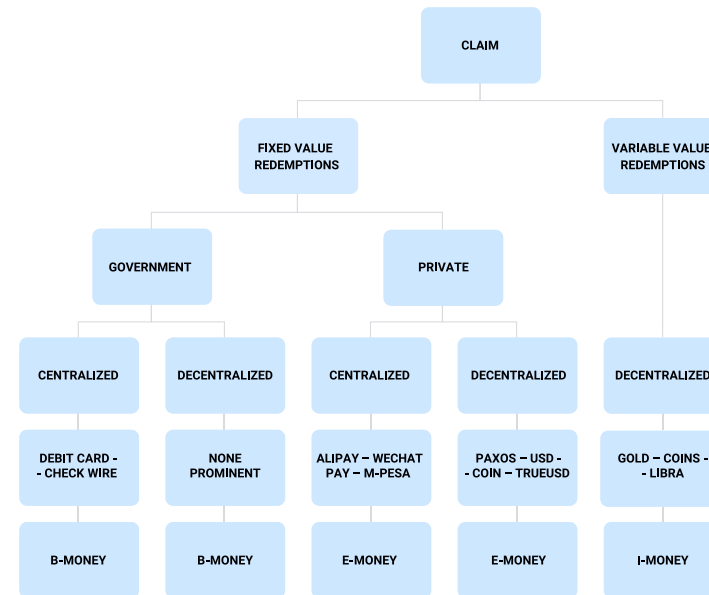
- Open-source networks that allow anyone to create applications that enable financial activity to take place without the involvement of centralized institutions have fast-emerged as one of blockchain's more promising offerings. We are going to see a huge increase in investments in new decentralized financial solutions.

Central Bank Digital Currency – an important driver for payments processors:

- ECB is considering launching a CBDC for retail payment solution (this would help even more the "unification" of Europe), but no specific date for the project was announced.
- FED says they are looking into issuing a CBDC, but no deadline is forecast.
- Hong Kong and Thailand will release in 1Q20 research on CBDC.

Digital lenders and Lending-as-a-service (LaaS) platforms.

- LaaS will continue to provide automation and intelligence in a sector still hang onto people with an established history.



SOURCES:
IMF, AtonRā Partners

2019 – A Glance In The Rear-View Mirror (1/2)

On 30 January 2019, Wirecard (WDI GR) shares plummeted as the Financial Times (FT) claimed that people in the company were suspected of falsification of accounts and money laundering in their Asian subsidiary. Reputational risk for Fintech companies is high. If the charges were confirmed, it may represent a short-term headwind for the industry.

- Wirecard is a German tech company operating as an electronic payment transaction processor.
- Wirecard's accounting practices in Asia are under investigation by Singaporean authorities. The company denied allegations related to how revenue is recorded and about fictitious invoicing.
- We decided to sell our position in the company as investigations came out (see "[PagSeguro & Wirecard stocks under fire](#)")

Apple (AAPL US), Goldman Sachs (GS US), and Mastercard (MA US) issued a joint credit card, the Apple Card. It was announced at the Apple Special Event (March 2019).

- To incentivize adoption, the card features a cash-back reward program: 3% for purchases from Apple's Retail, Online, and App stores. Besides, it offers zero fees, lower interest rates, flexible repayments, etc.
- This event mainly confirms two points: the road to a cashless society has still room for improvement, and big tech companies are there to capture the growth this market offers.

IMPACT



1H 2019

IMPACT



Libra was announced to the world on 18 June. After more than one year of development, the project looking to empower unbanked communities through cheap and immediate means of money transfer was out. Though a clear indication of the industry's trend, it may hamper pure mobile payment players, as big tech companies like Facebook already have a vast user base.

- The Libra Association is behind the new stable coin. Initially, 28 members of the likes of **Facebook (FB US)**, **PayPal (PYPL US)**, and **Andreessen Horowitz (not listed)** were backing the project.
- The world community raises plenty of doubts about Libra. The regulatory side is the most stringent and reluctant. Consequently, some high-profile backers such as **PayPal** and **MasterCard (MA US)** left the project.
- We deep-dived into the subject through our research: "[Libra... And now what for fintech and mobile payments?](#)", "[Libra \(un\) chained](#)", and "Kill Cash, Vol. 1 – A Libra sequel".

2019 – A Glance In The Rear-View Mirror (2/2)

The final deadline for the Payment Services Directive 2 (PSD2) to be implemented was on 14 September 2019. Many elements of the new directive came into force across the European Union already in early 2018.

- The PSD2 introduces privacy-related security requirements for electronic payments, opens the EU payment market to competition, and increases consumers' rights.
- Customers will be able to use services from different providers (to analyze their spending, paying bills, etc.) while leaving their money into their bank accounts. Banks are forced to create a system of open Application Platform Interfaces (APIs) to give access to accounts.
- It aims to boost consumer confidence in online purchases, fighting online fraud and making services accessible to everybody regardless of their residence in the European Economic Area (EEA): a clear catalyst for the Fintech ecosystem.

IMPACT



2H 2019

IMPACT



Public authorities worldwide are supporting cashless solutions and mobile payment adoption.

- Japan raised its consumption tax from 8% to 10% in October 2019. To offset the negative effect the decision would have on taxpayers, consumers will be eligible for a 5% rebate on purchases made by electronic payments at smaller retail shops.
- Italy introduced the obligation for VAT identification number holders to accept cashless payments and incentives to accept electronic transactions small in amount. The measure will come into force in 2020.

2019 M&A And IPOs

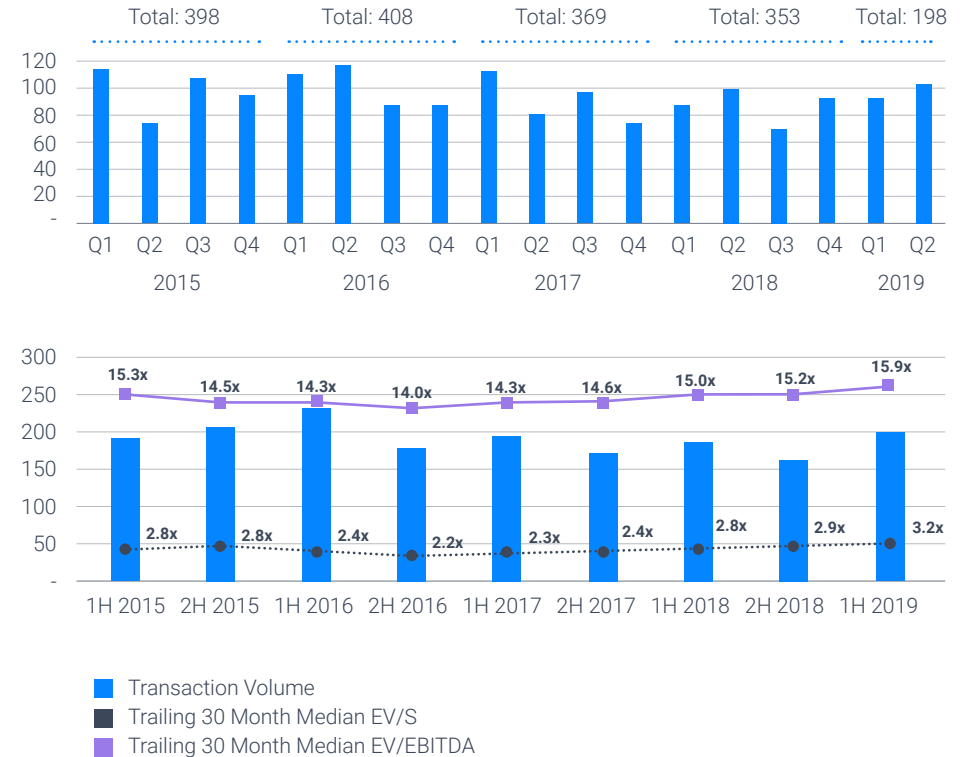
- **The activity in capital markets was intense all over the year. This confirms M&A as a secular trend in the payment industry.**
- We commented most of these deals on our [website](#) and in our bi-weekly e.g., “[Tailwinds for the banking industry](#)”

SELECTION OF MAJOR FINTECH DEALS IN 2019

Date	Target	Acquirer	Deal size	Comment
01/19	First Data (FDC US)	Fiserv (FISV US)	\$21.8bn	Consolidation in the industry
02/19	WorldFirst (not listed)	Ant Financial (not listed)	\$700mn	Milestone in accessing Western markets
03/19	Worldpay (WP US)	FIS (FIS US)	\$35bn	Expected EBITDA synergies at \$900mn
05/19	Total System Services (TSS US)	Global Payments (GPN US)	\$22.2bn	Merger— Created a pure play giant in payments technology
08/19	Kony (not listed)	Temenos (TEMN SE)	\$559mn	Strengthened presence in US (+ earn-out \$21mn)
11/19	Honey (not listed)	PayPal	\$4bn	Additional step into the customer’s shopping journey

SOURCES:
 EY Global FinTech Adoption Index 2019
<https://data-economy.com/fintech-mega-deals-top-120bn-in-1h2019-setting-new-all-time-record-for-ma-transitions/>

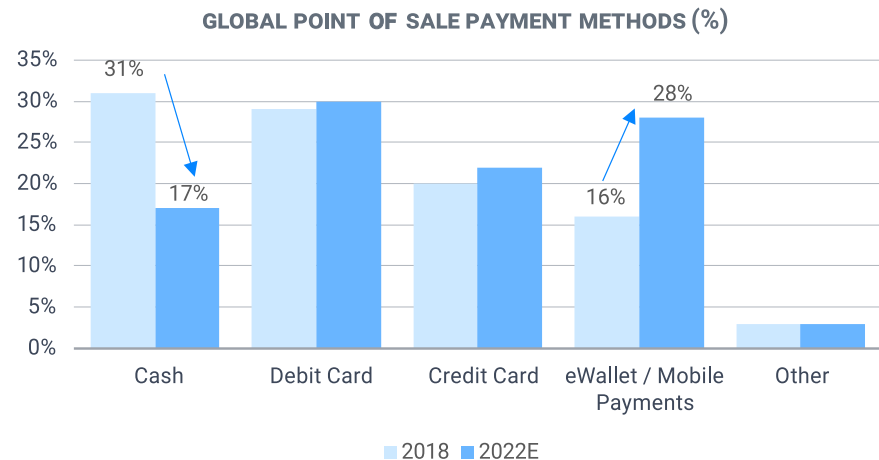
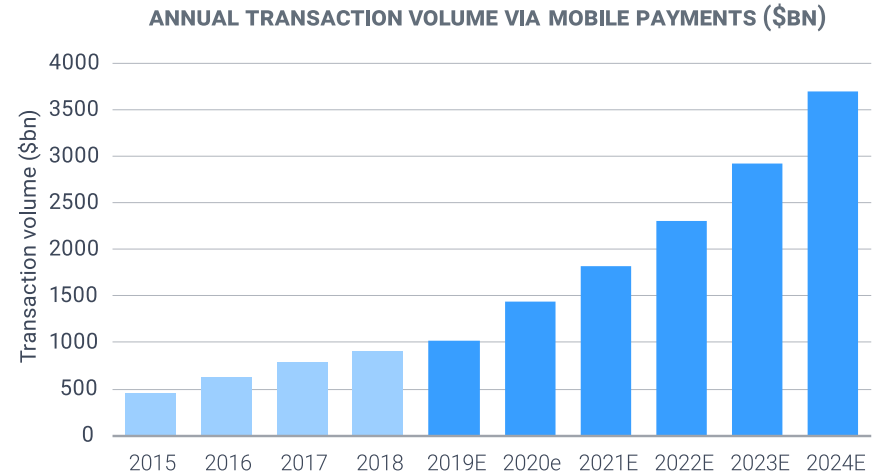
FINTECH M&A TRANSACTIONS



All totals and median values refer to the entire period unless otherwise stated. Median multiples plotted in the graphs refer to the 30-month period prior to and including the half year.

Structural Trends (1/4)

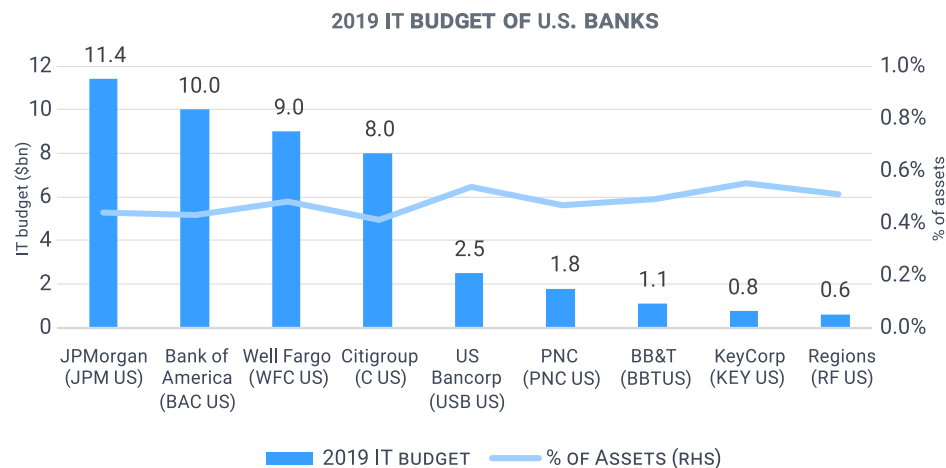
- The emergence of **mobile payments** accelerated the pace of innovation in fintech. The annual transaction volume via mobile payments is expected to cross the \$1tn mark in 2019.
- Transaction volume will jump in the coming years as these means of payment are of payment is reaching the masses.
- Penetration rates** are increasing globally, according to eMarketer.
 - Asia-Pacific, an early adopter of mobile payments technology, remains the leading region in the world. Close to 55% of smartphone users will use their mobile to make payments by 2022.
 - North America and Europe have a higher margin for progress; the number of mobile payment users in these regions should increase from 23% to 32% and from 14% to 23%, respectively, between 2017 and 2022.
- According to Worldpay, more people are using their mobile phones to initiate payments; the **use of cash is decreasing**.
 - By 2022, mobile phones will be more frequently used than credit cards at physical point-of-sale.
 - Credit and debit cards should experience almost no growth globally.
 - E-commerce is booming as people are changing their consumption habits. Mobile payments and e-wallets will represent the most commonly used mean of payments by 2022.
- More and more people are using **e-Wallets**.
 - In China, WeChat and Alipay are getting close to 1bn active users.
 - PayPal (PYPL US)** is one of the rare players that has been able to build a global presence. The company has now close to 300mn active users.
 - Certain companies, e.g., **Starbucks (SBUX US)** or **Walmart (WMT US)**, have developed their own e-Wallets to be used at their stores only.



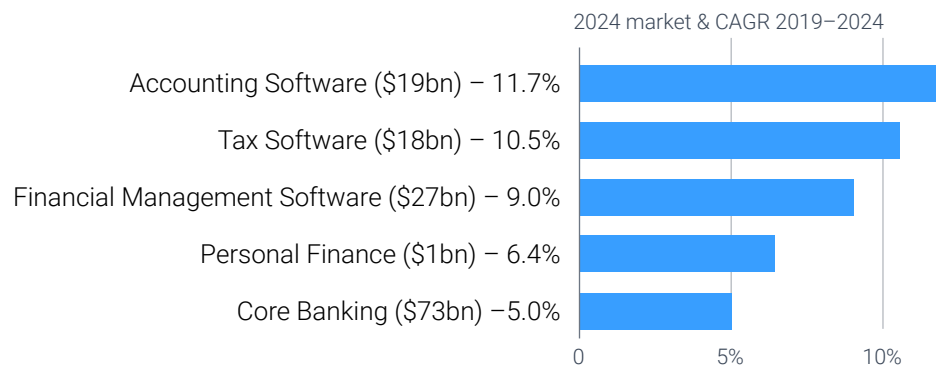
SOURCES:
Mordor Intelligence, Statista, eMarketer, Worldpay, AtonRā Partners

Structural Trends (2/4)

- Banks are investing billions to pursue a **digital transformation** and survive.
 - According to UBS Evidence Lab, the IT budget of U.S. banks was estimated at \$67bn in 2019.
- Although a fortune is spent on maintaining and updating the in-house legacy systems, some investments aim to improve services and **develop the offering**.
 - For instance, the rise of robo-advisors allows the mass affluent to have access to wealth-management solutions that were historically offered only to high-net-worth individuals.
- However, third-party developers of **banking software** are gaining market share over in-house solutions.
 - Packaged banking solutions allow financial institutions to reduce costs, increase spending on innovation, and reduce time to market for new products.
 - New regulations force financial institutions to improve their anti-money laundering and compliance processes. Regtech companies offer automated solutions that reduce human interventions, hence costs.
- The **financial software** market is expected to reach \$138bn by 2024, growing at a low double-digit rate. Fintech companies and new technologies are giving a second life to this mature industry.
 - Thanks to cloud computing and machine learning, accounting software is now able to recognize and book data directly from a photo of a receipt.
 - Tax software simplifies the life of millions of users and reduces the need to hire fiscal experts in many cases.



SELECTION OF FINANCIAL SOFTWARE SEGMENTS



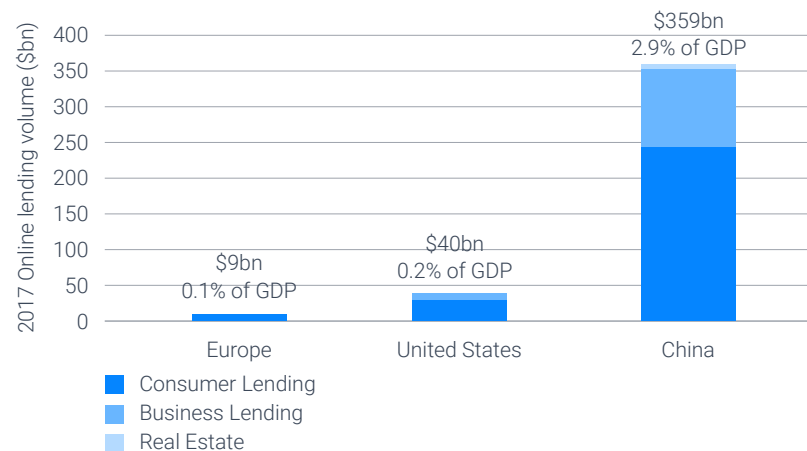
SOURCES:

UBS Evidence Lab, Temenos, Allied Market Research, Market Watch, Transparency Market Research, Market Report Gazette

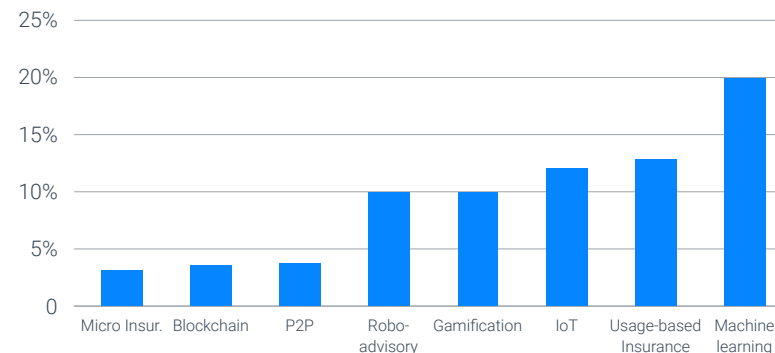
Structural Trends (3/4)

- The entry of new players into the financial markets is disrupting the usual **credit channels**.
 - The first online platforms to originate loans between peers emerged in the mid-2000s.
 - Since then, this activity has become more professional. Online lending platforms are calling the traditional capital markets to get funding or are re-routing their volume to banks in need of business.
 - China has already a mature online lending industry that is in a consolidation phase due to risky practices. In developed countries, there is a lot of room for growth.
- These lending services are particularly appealing to **millennials** and the “underserved” people or businesses. The formers are looking for a user-friendly experience; the latter does not meet the wealth or turnover criteria to get traditional lending services.
 - **PayPal (PYPL US), Amazon (AMZN US), Square (SQ US)**, and their peers are lending billions of dollars annually to small businesses. The data accumulated on the activity of their clients reduce the risk of delinquency and simplify the loan application process to a few clicks.
- Banks are not the only financial institutions to be impacted by this technological wave. Insurance companies must also adapt to the digitization of their offerings to keep their clients and attract new ones.
 - Insurtech companies develop apps to simplify and speed up the insurers’ activities.

2017 ONLINE LENDING MARKET OVERVIEW



INSURTECH ADOPTION OF NEW TECHNOLOGY AND CONCEPTS

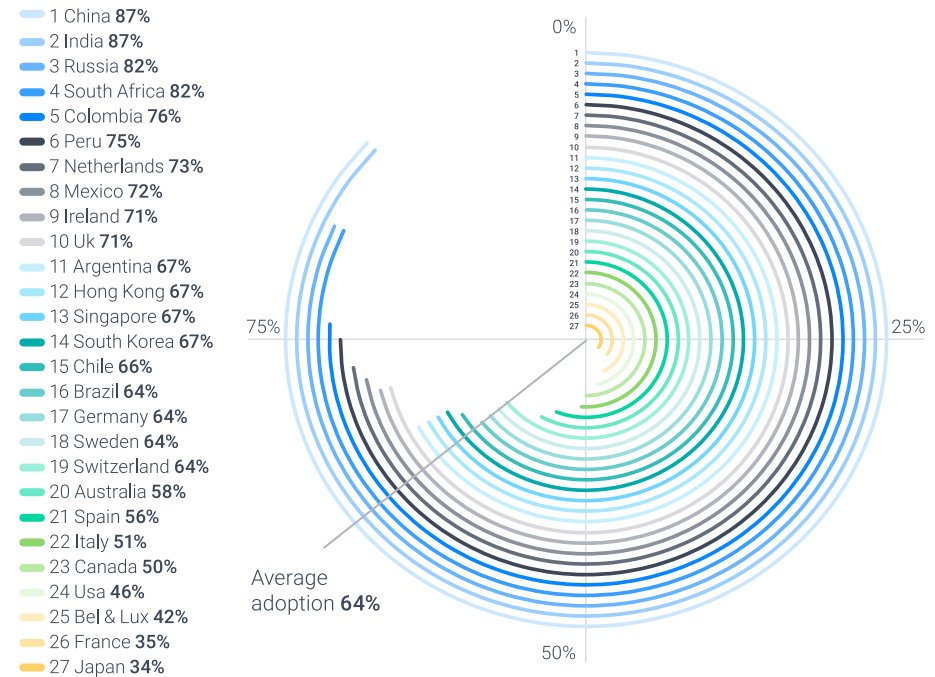


SOURCES:
University of Cambridge, PwC, AtonRā Partners

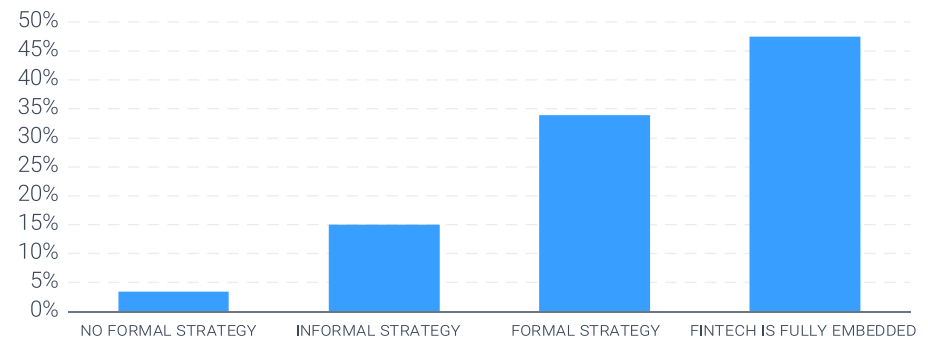
Structural Trends (4/4)

- Countries around the world are unequal regarding the **adoption rates of fintech**.
 - Emerging markets confirm their status of early adopters.
- In developed economies, consumers seem to be slower to adopt the latest fintech trends.
 - This will change with the next wave of applications, which will improve the user experience and be more user-friendly.
 - The total addressable market and user base will increase, if fintech solutions continue to propose fees on a downward trend, at a discount to traditional players.
- According to PricewaterhouseCoopers' latest survey, over 80% of financial and technology companies **include fintech in their strategy**.
 - This number was only at 60% in 2016.
- **Political decisions** facilitate the adoption of fintech and the push towards cashless societies.
 - For instance, the status of China as a leader in fintech is not surprising. The government needs supports and collaboration from fintech players to implement its social credit system.

CONSUMER FINTECH ADOPTIONS ACROSS 27 MARKETS (2019)



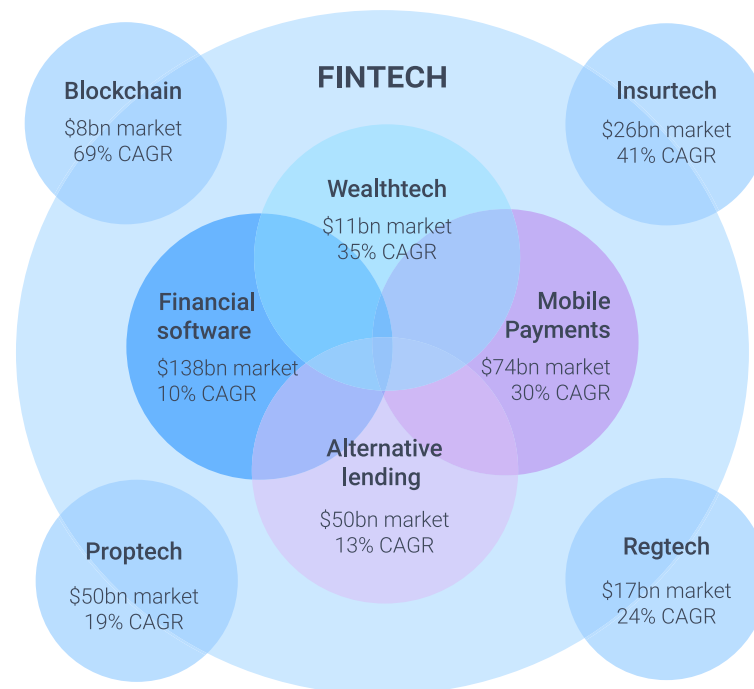
FINTECH IS PART OF THE STRATEGY OF OVER 80% OF FINANCIAL AND TECHNOLOGY FIRMS



SOURCES:
E&Y, PricewaterhouseCoopers, AtonRâ Partners

Fintech's ABC

- Fintech refers to the integration of **technology** into offerings by **financial services companies**.
- To meet the needs of an evolving society, new applications are **reshaping the financial industry**, e.g., robo-advisors, online lending, or mobile banking.
 - These solutions are using the latest technologies, including blockchain, cloud computing, and artificial intelligence, and big data.
- **New entrants**, mainly tech companies, want a piece of the cake. Revenues and margins of traditional financial players are under pressure.
 - Banks and insurers have no choice but to invest heavily to adapt to the new paradigm by increasing automation and digitizing their activities.
- Our fintech **investment universe** is made-up of all the companies that are active in the transformation of the financial industry, e.g., software providers, online lenders, or payment networks, and processors.
 - Financial institutions have activities that often cross the boundaries of pure finance. We include companies that are categorized under a variety of portmanteau words, such as Insurtech, Regtech, Wealthtech, and Proptech.
 - We also monitor private markets, which account for a large portion of the fintech market. Private companies are a source of information, possible M&A targets, or potential risks for established and listed companies.



2024 market & CAGR 2019–2024
Illustrative relationships

SOURCES:

CBInsights, University of Cambridge,
PwC, KPMG, Grand View Research,
Market Watch, AtonRā Partners

Catalysts

- **User-friendly applications and increased trust in technology.** Easier and cheaper digital payments, 24/7 accessibility, and security should give a major boost to the user base, total addressable market, and investments into fintech.
- **Stronger regulatory support.** Numerous regulators support fintech by inviting them to join the regulatory sandbox or by granting special-purpose licenses to hold reserve balances, e.g., the Reserve Bank of India or the Swiss National Bank.
- **Market Globalization and complex regulatory landscape.** Banks cannot comply with new regulations by using their legacy software. The growing number of regulations and users of financial services is forcing financial institutions to acquire or partner with fintech specialist companies.
- **Authorities issuing digital currency.** Governments are dissuading cash transactions, which further increases consumer awareness and trust in fintech solutions.

Risks

- **Cyber-resilience and cyber-security.** The number of cybersecurity breaches has grown at a CAGR of 26% and is continuing to accelerate, shaking consumer's trust in FinTech. 73% of companies that rely on fintech solutions are still not "cyber-ready".
- **Regulatory divergence.** Inconsistent standards between different jurisdictions may hinder interconnectedness between economies leading to the emergence of disconnected fintech hubs.
- **Failure of new technologies.** Young companies offering to digitize compliance, insurance, and real estate, or other fintech startups with interesting solutions may flatline, e.g., the recent failed IPO of **WeWork**.

Bottom Line

- **Countries are pushing toward a cashless society.** Mobile payments offer fast, cheap, and safe transactions. The penetration rate should increase as more people will trust and use these services. Central banks are expected to issue digital currencies and further boost consumer faith in fintech solutions.
- **New fintech technologies and their applications,** e.g., Artificial intelligence and Robotic Process Automation, continue disrupting existing mature industries. The wealth management presented Robo-Advisory, compliance industry – regtech, real estate – proptech. As the world is continuing to be digitized, and investments in technology can be made at any stage of development, the trend is likely to continue in the mid- to long-term.
- Banks must embrace the **transformational changes brought in by fintech.** They need to invest heavily and partner with smaller and disruptive companies to keep the pace of digitalization. The offer of products and services keeps on increasing thanks to technology improvement, boosting the banking software industry growth.

SECURITY & SPACE: WHEN SKY IS NOT THE LIMIT

Launching Towards Maximum Acceleration (1/2)

- The Security and Space sector is in the early stages of its digital and tech transformation.
 - The tech upgrade cycle, with the **boost in capex and government spending** that we anticipated to start this year, **has indeed accelerated** and is projected to last for the next five years.
- **Cybersecurity was a major contributor to performance** thanks to solid earnings by **Splunk (SPLK US)**, **CyberArk (CYBR US)**, and **Fortinet (FTNT US)**. We correctly anticipated that governments and corporations would start to reinforce their security against a backdrop of rising cyber threats.
 - Guided by rising global tensions, and with the Internet of Things acting as an additional catalyst for 2020, we continue to have large cybersecurity exposure in the portfolio.
- **Space exploration is the fastest-growing source of upside.** Commercial human spaceflight is expected to be the next source of growth for this industry. Avionics and navigation are likely to benefit the most from rising demand for launch vehicles and space transportation.

SOURCES:
AtonRā Partners



SECURITY & SPACE

Launching Towards Maximum Acceleration (2/2)

- **In the military sector, we believe governments will continue to provide an extra boost** to explore space-based weaponry.
 - Space is becoming the next step of missile defense, especially after India had unexpectedly launched an anti-satellite missile test early this year.
- **2019** has been a year that set many trends in motion, but also **confirmed existing plans for space and defense industries**.
 - **OneWeb (not listed) and SpaceX (not listed) continue to compete** to build a network of satellites that will offer Internet services to people in remote areas and for IoT applications.
 - **Boeing (BA US) announced initiatives in military aircraft** by unveiling an unmanned, fighter-like jet called the Boeing Airpower Teaming System.
 - A massive \$800mn **contract was signed by data analytics company Palantir (not listed) with the US Army** for the delivery of a comprehensive combat intelligence hardware and software suite.

SOURCES:
AtonRā Partners

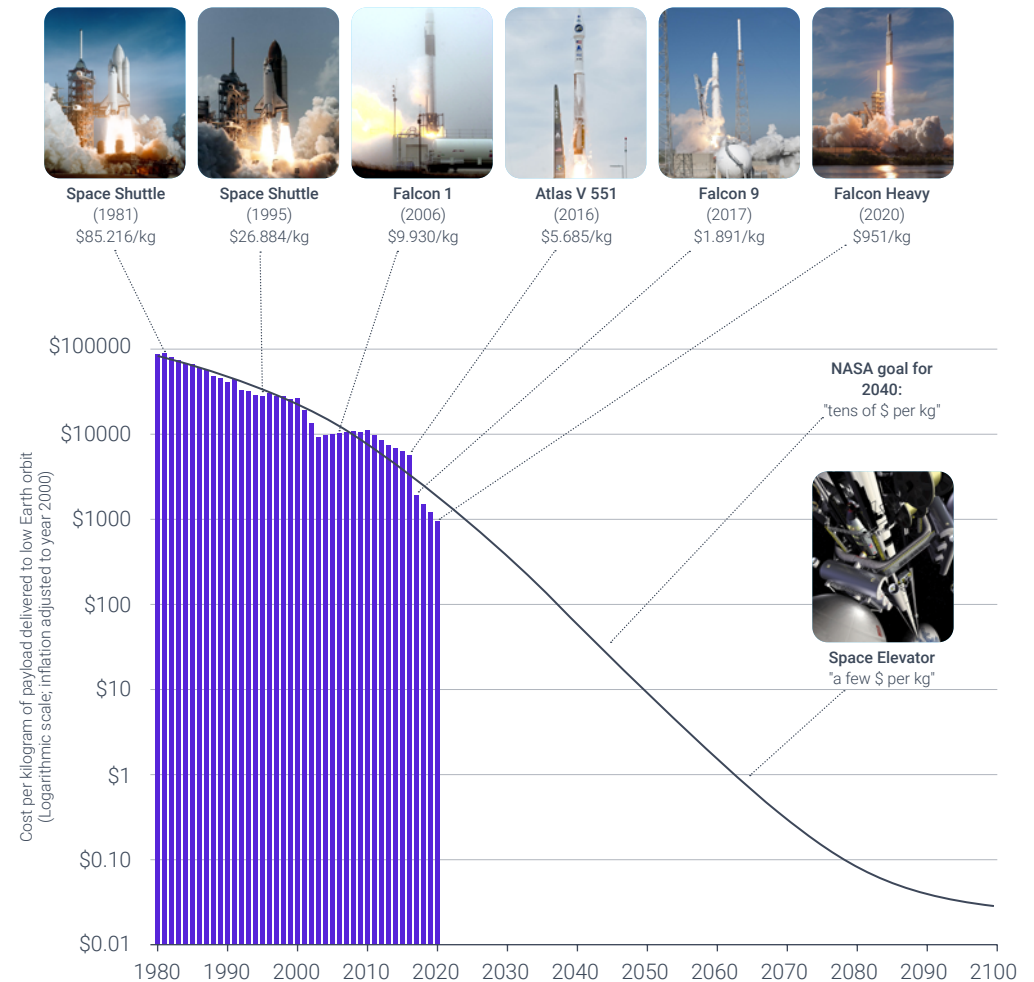
Outlook 2020 (1/3)

- Three main events are expected to happen in 2020 in the commercial space travel sector:
 - **SpaceX (not listed) may send NASA astronauts into Space in 2020.** NASA has been relying on Russian Soyuz spacecraft since 2011. The U.S. has been buying seats on the Russian Soyuz spacecraft at \$80million each. Furthermore, NASA wants American private companies to provide spacecraft to end this dependence.
 - **BlueOrigin (not listed)** is planning to organize the first travel with the New Shepard suborbital spaceship with people onboard in 2020. The company, founded by Amazon CEO Jeff Bezos, is testing commercial space flights. Tickets are expected to cost \$250'000.
 - **Virgin Galactic (SPCE US)** is set to start its space tourism activities in 2020, initially expected in 2019. Tickets prices may drop below the \$60'000 in few years, according to Virgin Galactic CEO George Whitesides.
- Next year will see private companies getting more traction in the field of commercial space travel, with huge investment in this field.
 - Companies will consolidate around these categories: **Exploitation, Space transportation, Sustainable Long-Staying, and Infrastructure development**
- Galileo, the European GPS, is expected to complete its constellation of 30 satellites by 2020.
 - Already operational, it allows more precise positioning than GPS and is under civil control.
- The need for operational responsiveness will drive the development of micro launcher projects to put into orbits smallsats.
 - The commercial sector will drive 80% of the demand.

SOURCES:

Bryce Space and Technology, AtonRā Partners | <https://www.space.com/spacex-may-launch-astronauts-to-space-early-2020.html>
<https://www.space.com/virgin-galactic-spaceshiptwo-ticket-price-increase.html> | The Space Report 2019, Quarter 1: The Authoritative Guide to Global Space Activity, Space Foundation
<https://www.futuretimeline.net/data-trends/6.htm>

LAUNCH COSTS TO LOW EARTH ORBIT, 1980–2100



Outlook 2020 (2/3)

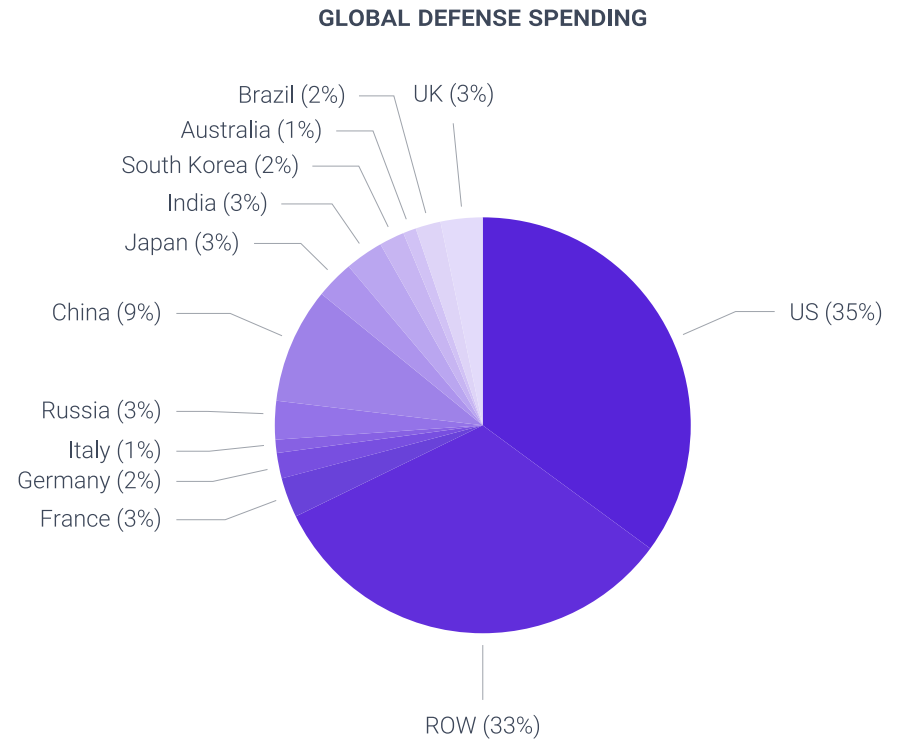
- **Artificial Intelligence and Machine Learning will have an increasing effect on cybersecurity.**
 - Automation of cybersecurity platforms would mean the involvement of ML algorithms to detect, analyze, and containerize threat.
 - Common security tools initially look for a malicious file in the system, when it is often too late. The cybersecurity tool is expected to look over all the user steps and detect misbehavior from the system or the user itself, guaranteeing intervention as soon as necessary.
- **Cyber-attacks on utilities and public infrastructure are expected to keep increasing.**
 - Due to the complex digital fingerprint of the government and its unwillingness to update its infrastructure to adequate cyber defenses due to high costs, public entities remain perfect cyber targets.

SOURCES:

<https://www.pwc.fr/fr/assets/files/pdf/2019/06/fr-pwc-main-trends-and-challenges-in-the-space-sector.pdf>

Outlook 2020 (3/3)

- **Global defense spending remains on an uptrend.**
- **France plans to boost its defense spending by 40 percent by 2025 as it aims to meet the NATO target of “2% of GDP” spent on defense.**
 - France already allocated US\$48bn to the 2019 defense budget, which is a 4.7% year-over-year increase and 1.8% of its GDP.
- **Germany** increased the 2019 defense budget by 10% over 2018 to US\$53bn, the largest increase since the Cold War.
 - The country expects to further increase its budget to \$56.4bn in 2020.
 - By 2024, Germany aims to increase its military spending to 1.5 percent of GDP and achieve the 2% of GDP target by 2031.
- **India continues to increase its defense spending**, with a defense budget of US\$44.6bn for 2019–2020, up 9.3 %.
 - Over the next five years, India plans to spend US\$130 billion to modernize armed forces and strengthen combat capabilities.
- The UK’s defense budget of US\$49 billion stood slightly above 2% of GDP and has declined from about 4% at the end of the Cold War era.
 - However, the UK’s defense committee has been recommending **increasing the budget to 3% of GDP.**



SOURCES:
AtonRā Partners

2019 – A Glance In The Rear-View Mirror (1/2)

New Horizons reached Ultima.

- NASA's New Horizons spacecraft, launched in Jan 2006, reached Ultima Thule, 4bn miles away – a key step to understand the origins of the solar system.

Facebook leaks.

- More than 540mn Facebook users' data was up for grabs on unprotected servers.

First American data breach.

- 885mn sensitive financial records were left exposed by First American on public servers.

"Made in Space".

- The autonomous robotic manufacturing and assembly platform, famous for its 3D printing on the International Space Station, won a \$73.7mn NASA contract to build solar arrays during spaceflight.

IMPACT



1H 2019

IMPACT



China landed on the moon.

- The crewed China's Chang'e 4 mission landed on the far side of the Moon.

The Baltimore Ransomware Attack.

- The city had its servers largely compromised by a new strain of ransomware called RobbinHood

2019 – A Glance In The Rear-View Mirror (2/2)

LeoLabs announced LeoTrack.

- The commercial provider of Low Earth Orbit (LEO) mapping and Space Situational Awareness (SSA), announced LeoTrack, the first off-the-shelf satellite tracking service catered to smallsat and CubeSat operators.

NASA announced new Tipping Point Partnerships.

- The alliance includes 14 companies, including **SpaceX**, **Accion**, and **Astrobotic** for Moon and Mars Technologies, with a combined total award value of \$43.2mn.

Elasticsearch server leaks personal data on Ecuador's citizens.

- More than 21mn user records (including 7mn records about children) were leaked in an unprecedented data breach.

Virgin Galactic to begin trading on the NYSE.

- The first space tourism stock.

IMPACT



2H 2019

IMPACT



Starhopper succeeded its first test flight.

- The SpaceX's low-altitude test vehicle completed its highest test flight, soaring to 150m before safely landing back on its pad.

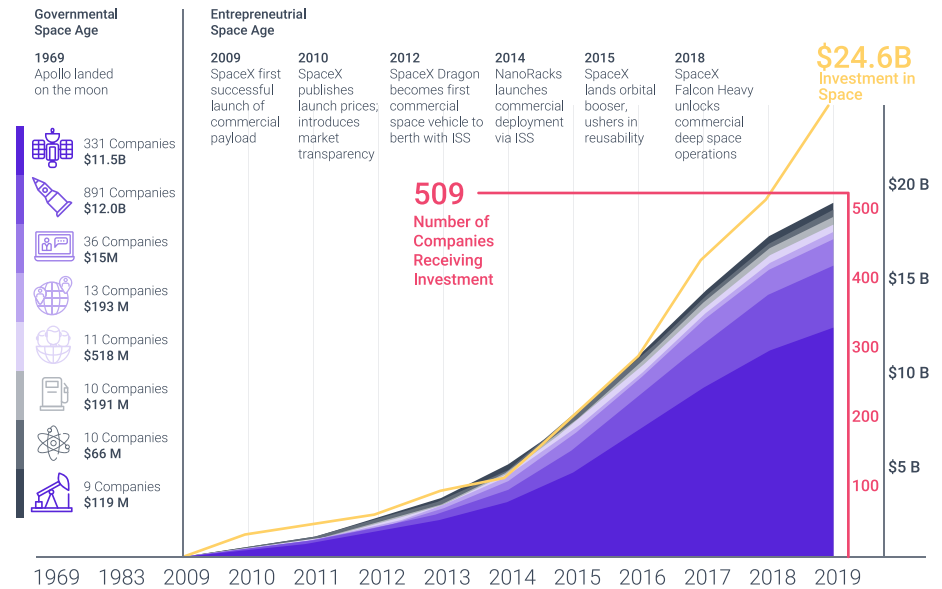
HawkEye 360 awarded.

- The first company to use multiple small satellites working together (Satellite formation flying) to create radio frequency (RF) analytics, awarded Contract to Build Next-Generation Constellation.

Structural Trends (1/3)

- The **satellite industry**, including ground equipment and satellite services, launching and manufacturing, **represents 77% of the overall Space Economy**, and it's growing at a 3% annual rate.
- The commercial space sector is operated by multiple **firms that, besides supplying products to governments, must also compete commercially.**
 - The sector mainly involves space launch, earth observation, communications, space situational awareness, remote sensing, and human spaceflight.
 - **Ground Equipment** is a considerable subsegment with \$125.2bn of revenues registered in 2018. GNSS equipment, i.e., receivers, antennas, and supporting software, accounted for 75% of it.
 - **Most of the investments are poured into technologies** for in-orbit manufacturing (3D printers), satellite refueling, and de-orbiting services and Space Tourism subsectors.
 - Top VCs (Sequoia, Founders Fund, Bessemer, In-Q-Tel, Khosla Ventures, First Round Capital, DFJ), "Space Barons" (Jeff Bezos, Elon Musk, Richard Branson) and late-stage global investors (from Saudi and Abu Dhabi sovereign wealth funds to Softbank in Japan) are now a source of **heavy investments into SpaceTech.**

CUMULATIVE EQUITY INVESTMENTS FROM 2009 TO PRESENT

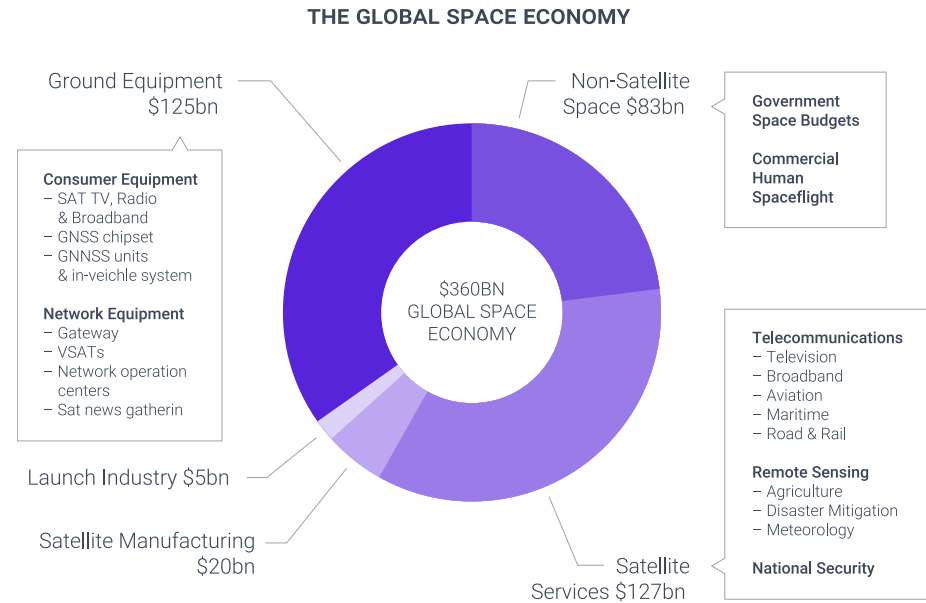


SOURCES:

Bryce Space and Technology
 AtonRā Partners
<https://www.spaceangels.com/post/space-investment-quarterly-q3-2019>

Structural Trends (2/3)

- Although Space has become more commercialized, **space capabilities remain central to many military operations.**
 - This includes missile warning, geolocation and navigation, target identification, and tracking of enemy activities.
 - **The US FY20 DoD budget is strategically-driven by investments in next-generation technology, space, missiles, and cyber capabilities.** At \$738bn, it is the highest R&D budget in 70 years, and its approval by the Senate in July 2019 has set the tone for the defense sector globally.
- **Reusable launchers will lower space exploration costs.**
 - **Pricing pressure in satellite services is rising** due to increased competition in the TV satellites and transponder leasing markets. Services, which is the largest segment with \$126.5bn revenues, reported a 1.7% overall decrease in revenues in 2018. **Today we can find growth only in value-added mobile and broadband verticals.**
 - Satellite Manufacturing, structurally driven by high-value intelligence and military satellites launched in the U.S. and abroad, reported \$19.5bn of revenues in 2018 with a growth of 26% YoY.
 - Launch industry is setting the new record number of commercially procured launches worldwide and is the fastest growing industry vertical at 34% YoY in 2018.

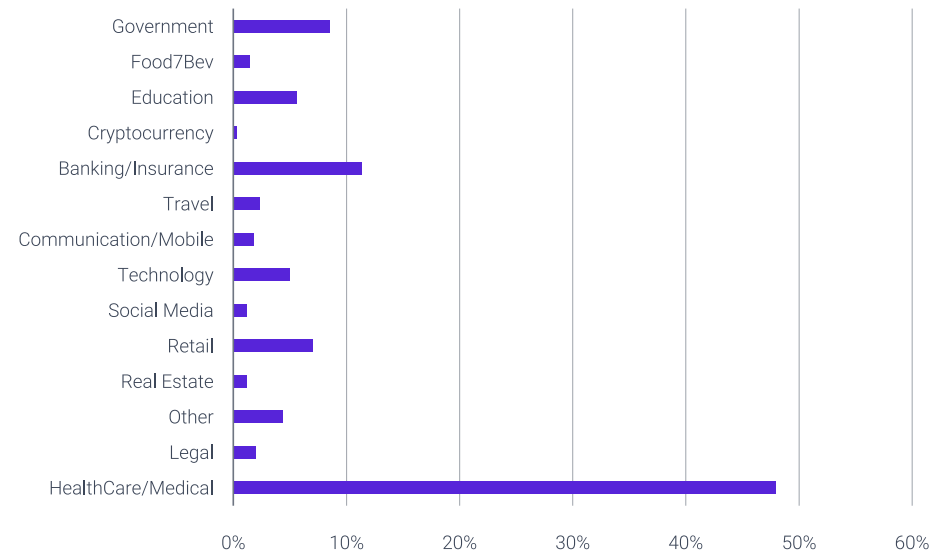


SOURCES:
Bryce Space and Technology, AtonRa Partners

Structural Trends (3/3)

- **Cybersecurity is becoming increasingly important in governments' defense strategies.**
 - According to a Juniper Research report, **Cyber risk is a top concern for corporations and government agencies**, and the annual cost of worldwide data breaches will surpass \$5tn by 2024.
 - The U.S. President proposed for the FY2020 budget to allocate more than \$17bn for cybersecurity and cyber operations, a 5% increase over the 2019 estimate.
- **Cyberattack instead of airstrikes.** In late June 2019, in response to Iran downing a U.S. Global Hawk drone in the Strait of Hormuz, President Trump approved (and quickly canceled) a retaliatory strike. Instead, he ordered a cyberattack on the IRGC and Iran's missile systems.
- **Passenger traffic is set to double by 2035.** This entails a **large demand for innovation in security from airports, ports, and train stations.** Powerful body scanner using AI, Facial recognition, Terahertz screening, behavioral profiling are examples of technologies that are used or in development.
- **The cyber-attack surface is increasing quickly. Fast 5G networks may create new vulnerabilities** by further integrating the internet with physical infrastructure. Moreover, Cloud migration has become imperative for businesses that want to remain competitive obliging enterprises to adopt an effective cybersecurity strategy.
- **Data integrity has never been more critical.** As artificial intelligence and machine learning drive more of our decisions, bad actors see it as a new attack vector, sabotaging training data to disrupt decision-making.

BREACHES BY INDUSTRY – 2019

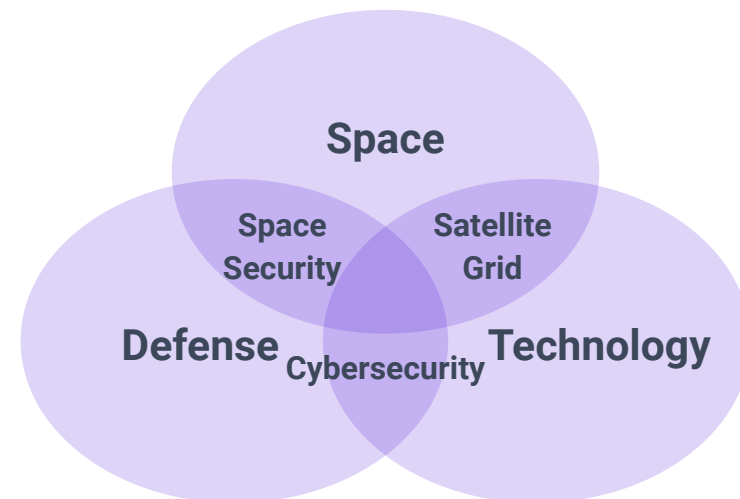


SOURCES:

Bryce Space and Technology, AtonRā Partners | https://en.wikipedia.org/wiki/List_of_data_breaches | https://www.accenture.com/_acnmedia/pdf-96/accenture-2019-cost-of-cybercrime-study-final.pdf
https://pdf.ic3.gov/2018_IC3Report.pdf | <https://www.coveware.com/blog/2019/4/15/ransom-amounts-rise-90-in-q1-as-ryuk-ransomware-increases>
<https://cybersecurityventures.com/cybersecurity-almanac-2019/> | <https://www.rsa.com/content/dam/premium/en/white-paper/2019-current-state-of-cybercrime.pdf>
<https://www.juniperresearch.com/press/press-releases/business-losses-cybercrime-data-breaches>

Space & Defense's ABC (1/2)

- The defense sector, historically taking place in a terrestrial and maritime way, is now heading toward space and digital. Space and Cybersecurity will be the fast-growing sectors of Defense in the foreseeable future.
 - **Global security is increasingly dependent on digital security**, subsequently leading to an increasingly important allocation of defense budgets to cybersecurity.
 - Cybersecurity is the shield against the increasingly frequent non-kinetic attacks to space-based **satellites**. It may prove determinant to avoid vulnerability to attacks and espionage.
 - Information from satellites fuels a substantial part of the technology (GPS, telecommunications, ...) that is pivotal in the Defense environment.
- **Transformative technologies**, often a byproduct of defense and space R&D, are drastically improving human life, but inevitably redefine how we safeguard our privacy and our businesses. In addition to being vital for national security and public safety, **Cybersecurity is a significant economic challenge**.
 - World Economic Forum (WEF) has ranked “Cyber-attacks” and “massive data fraud” among the **top five global risks**.
 - According to the “Cost of a Data Breach Report 2019,” data breaches exposed more than 4bn consumer data records in 2019, a 54% increase vs. 2018. **The average total cost of a single data breach** in the U.S. in 2019 **was more than \$8mn**, a 130% increase since 2006.
- The segments at the junction of Space, Defense and Technology are set to show healthy growth over the next few years.
 - The **space industry** is at a point today comparable to the Internet in the mid-1990s. The sector is rapidly growing and expected **to double in size by 2030**.
 - The Defense sector has steadily grown in 2019 as security threats have intensified, prompting countries worldwide to increase their defense budgets to modernize and recapitalize their armed forces. Consequently, **global defense expenditure** is expected **to grow at a CAGR of about 3%** over the 2019–2023 period to reach US\$2.1tn by 2023.

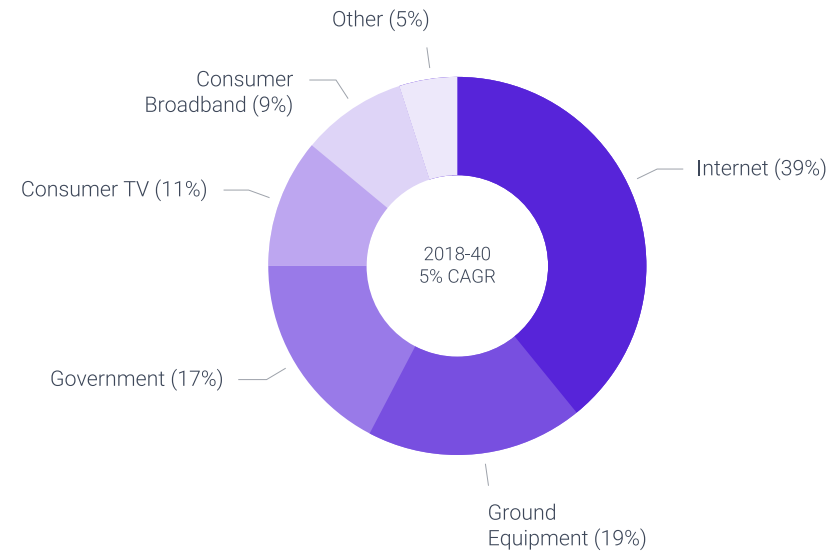


SOURCES:
AtonRā Partners

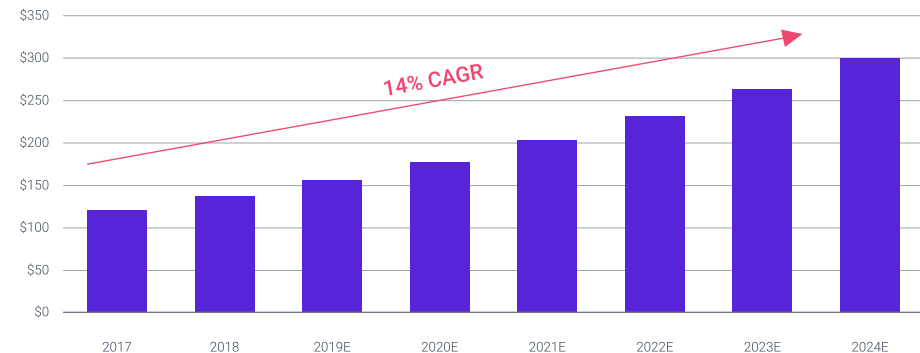
Space & Defense's ABC (2/2)

- The **Space** sector is extending the involvement to private contractors.
 - Space exploration is not a public-only matter anymore. **Public-private partnerships** with companies such as **SpaceX** and **Boeing (BA US)** are intensifying.
 - Private players like **Blue Origin (not listed)** and **Virgin Galactic (SPCE US)** aim to open the Space for commercial trips.
 - Telecommunications rely on space-based **privately-owned satellites**.
- **Cybersecurity** is a top-of-the-list concern for governments as well as for companies.
 - Cybersecurity gets more and more important as technology evolves. A single breach into a system can threaten millions of users' data.
 - Data is the commodity that feeds the technological ecosystem. It is essential for fine-tuning applications, interpreting people's needs, and optimizing operations within industrial settings. Restricting improper access to data is vital for companies' credibility and people's safety.
 - Accessing devices, opening doors, getting into corporate buildings are examples of threats that require different layers of protection. And these are still minor concerns when considering how vital medical devices must remain inaccessible to malignant third-parties.

OVER \$1 TRILLION GLOBAL SPACE INDUSTRY BY 2040 (CAGR 5%)



CYBERSECURITY MARKET (\$BN)



SOURCES:
Bryce Space and Technology, AtonRā Partners

Catalysts

- **Cost of launch to drastically fall.**
 - **Multi-satellite (below 500 kg. each) launch per rocket** will reduce the launch cost per satellite.
 - **Maximizing the modularity of vehicles** using components on different launcher families will further add to economies of scale.
 - The use of liquid oxygen and methane as propellant also unlocks potential for reusable rockets, since the combustion is much cleaner and preserves the engine.
- **Governments will adopt a strong regulatory framework and boost investment in security.** The emergence of cyber warfare led governments to require help from security companies. Moreover, the **rising public awareness about privacy and cybersecurity** will drive companies to invest in security massively.
- **Positive developments in the Franco-German relationship.** The result is the birth of joint defense programs: Maritime Patrol Aircraft, UCAV and the Main Battle Tank (both to be under German leadership), and, finally, SCAF (Système de Combat Aérien Futur) with an estimated R&D investment of c.€15bn from each side.

Risks

- **Cybersecurity – Reputation.** A leading cybersecurity company that suffers a breach or whose products fail to protect from an attack would immediately lose credibility and market value altogether.
- **Space Debris.** This refers to human-made objects in space that have lost their functionality. Mostly present in the region of space closer to earth (LEO – below 2,000km). The removal of large debris to support the long-term sustainability of space orbits has become necessary.
- **New technology still in the proof-of-concept phase.** Most new space technologies and services are expected to continue to be in the proof-of-concept phase and will thus likely require additional funds and development before providing broader commercial services and economic returns.

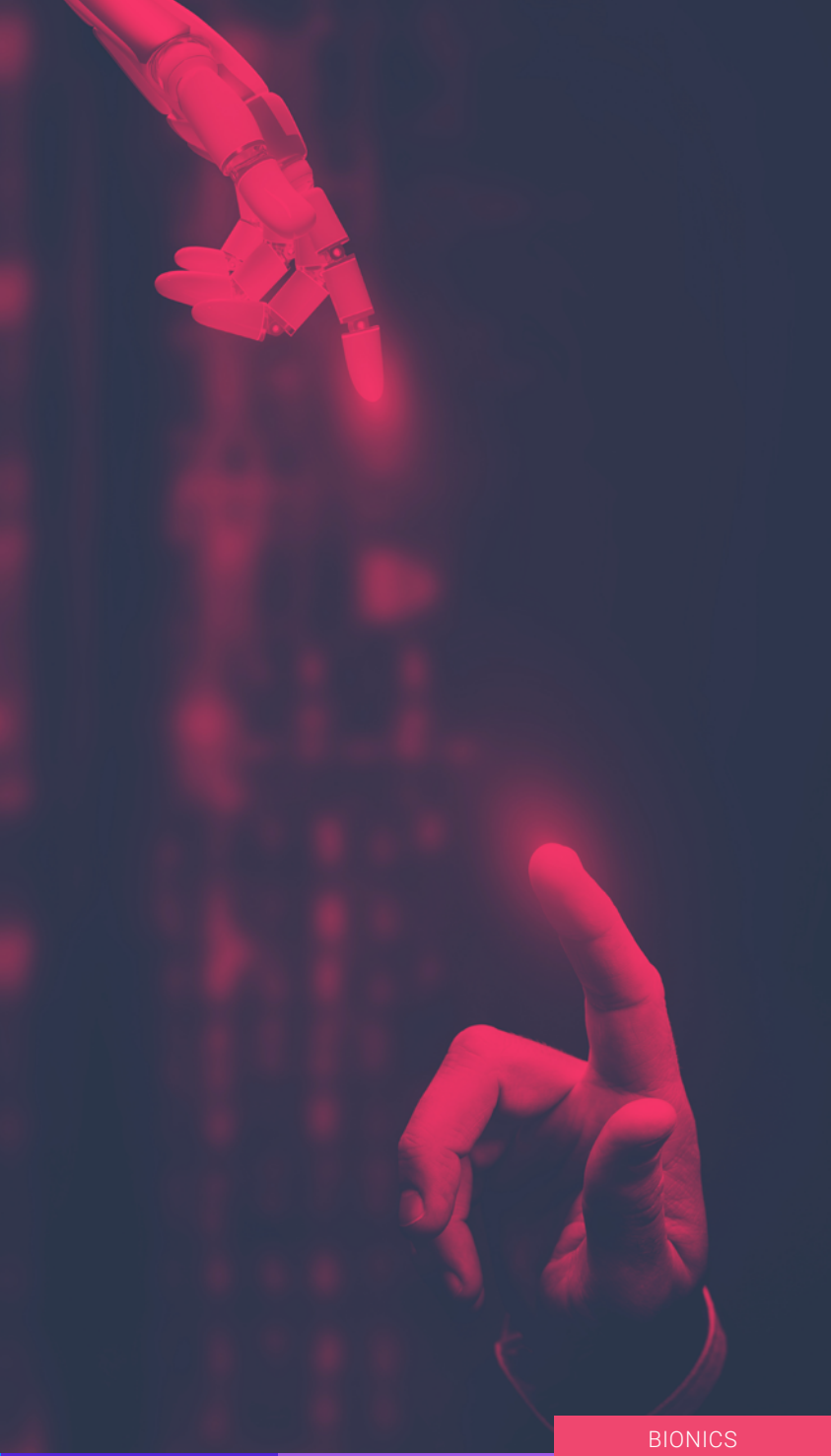
Bottom Line

- With the exponential increase of connected devices, the attack surfaces are booming. The integration of automation into cybersecurity tools is becoming mandatory.
- Cyber threats are always a step ahead, protecting user at the endpoint is not sufficient: ML and AI will help design a security system that analyzes the user steps throughout its digital journey.
- With governments expected to be strong clients in the near future (e.g., The US 2020 President's Budget includes more than \$17 billion for cybersecurity-related activities), this market is growing consistently. The increasing severity of the regulatory space will fuel this growth even further.
- In the space segment, satellite constellations, smallsats, and commercial space travel will likely be at the forefront.

BIONICS: ALL STARS ARE ALIGNED

It Is Just The Right Time

- We launched the Bionics theme in January 2017 with a clear idea: **we are living longer but not necessarily better.**
 - Growing pressure to lower healthcare costs despite an ever-increasing demand for care services means that technology will have to play a significant role in the healthcare industry, improving both productivity and patients' outcomes.
- Going back to 2017, we highlighted two major **catalysts** for this portfolio:
 1. an improved outlook for the reimbursement of bionic devices;
 2. an FDA fast-track process to approve medical devices.
 - Three years down the road, these have been confirmed in several Bionics' sub-sectors.
- A new major factor is showing on the horizon: the rise of MedTech in China.
 - China, with several annual cancer cases nearly three times as much as those in the US and among the highest number of people with diabetes, represents a very lucrative and under-penetrated market.
 - Domestic Chinese MedTech companies have already found their footing in some of the fastest-growing market segments.
- Looking forward, the sector is moving now towards an acceleration phase, and some of the bionics' sub-sectors have reached a turning point, as reimbursements and regulations are now in place.
Stars have finally aligned for Bionics.



Bionics Selected Sub-Sectors Overview

- **Artificial organs**

- **Insulin pumps and Continuous Glucose Monitoring (GCMs):** The technology has progressed to a level that is now being widely accepted by physicians, patients, and most insurances. Going into 2020, we expect a new wave of artificial pancreas and miniaturized insulin devices coming to the market, which should drive up the adoption of such devices.
- **Transcatheter heart valve replacement:** Atrial, mitral, and tricuspid valves can now be replaced through a catheter in the skin. The less invasive surgery saves lives, reduces complications and re-hospitalization. Several studies have supported this procedure, which is also gaining additional coverage from CMS (Centers for Medicare & Medicaid Services). Approval of new indications will boost this market opportunity.
- **Heart pumps:** The lack of extensive randomized studies has not yet allowed confirming the benefits of such devices compared to conventional treatments. These uncertainties negatively impacted the sector.
- **Heart monitoring devices:** News regarding an expected cut in reimbursements for a category of heart monitoring devices (the extended Holter) negatively impacted the sector.

- **Medical robots:**

- **Robotic surgery:** With a robust M&A activity and new players coming into the market, robotic surgery is still among the most active sectors of Bionics. Robotics companies benefit from the advances of nanotechnology and semiconductors and are likely to reshape the surgical sector, but more interestingly will also significantly impact the diagnostic one.

- **Genomics:**

- **Genetic tests & Liquid Biopsy:** Sequencing continues to expand its applications with a boom of innovative technologies such as genetic testing and liquid biopsy, which are building clinical proofs and, as a consequence, gaining reimbursement. We believe that these markets will see increased adoption going into 2020.

- **Digital health**

- **Telemedicine & Patient Remote Monitoring:** This sector has been among the main drivers of growth in the Bionics theme in the past. Starting in 2020, CMS will expand reimbursement, and as a consequence, we should see some re-rating (**Biotelemetry**, etc.).
- We have undergone an incredible year for the Bionics sector, with a strong set of news flows. Clear guidance from the regulatory side, in addition to some technological breakthroughs, has fueled both investments and interest in the sector over the last few months. We believe that going into next year this is likely to be even more the case.

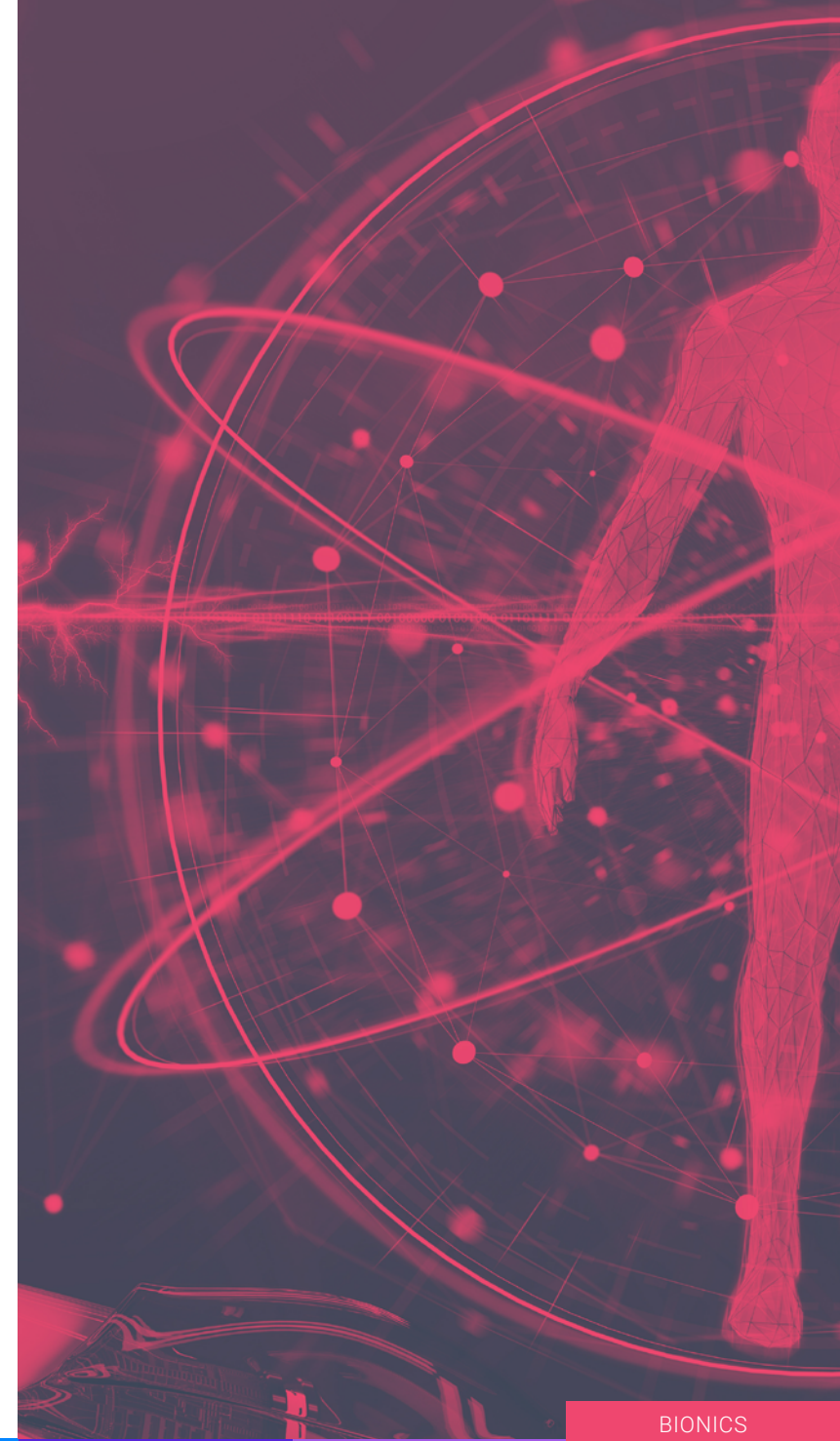
Outlook 2020 (1/2)

- **A step closer to new artificial pancreas systems**
 - **Medtronic (MDT US)** expects to launch Minimed 780G, the new version of its Minimed 670G (the only artificial pancreas in the market, approved in 2016). **Expected: Mid 2020**
 - **Insulet (PODD US)** plans to launch Horizon system, the new insulin pump connected to **Dexcom's (DXCM US)** G6 Continuous Glucose Monitor (GCM) and controlled by a smartphone. **Expected: Second half of 2020**
 - **Beta Bionics (not listed)** plans to launch iLet, an advanced automated insulin pump that will be connected with either **DexCom's (DXCM US)** or **Senseonics' (SENS US)** CGM. **Expected: Late 2020 / Early 2021**
- **Brain-Computer Interface moves into human clinical trials**
 - **Neuralink (not listed)** plans to start testing its Brain-Computer Interface on human volunteers. It has the ambition of inserting one million flexible electrodes into tiny holes carved by laser into the skull. **Expected: Before the end of 2020**
- **Over-the-counter hearing aids could expand adoption**
 - FDA will propose a rule to establish a new category of devices: over the counter hearing aids. The rule will make the device more affordable and increase its adoption. **Expected: By August 2020**
- **Miniaturization will ease the adoption of medical devices**
 - **Tandem Diabetes Care (TNDM US)** will launch a new insulin pump, called t:sport, half the size of the actual insulin pump available in the market. **Expected: Second half of 2020**
 - **DexCom (DXCM US)** expects the launch of its new smaller, fully disposable, less expensive Continuous Glucose Monitor system (G7 CGM system) developed together with **Verily (not listed)**. **Expected: Late 2020**



Outlook 2020 (2/2)

- **Liquid biopsy ramps up.**
 - Liquid biopsy is leveraging on Machine Learning to gather value from the data generated by sequencing technologies. **Guardant Health (GH US)** is waiting for the approval of Guardant360, which should allow the company to expand its total addressable market. **Expected: Early 2020**
 - CMS is expected to issue a final National Coverage Determination decision for advanced cancer tests using Next-Generation Sequencing. **Expected: End of January 2020**
- **The surgical robots' market gets crowded.**
 - **Johnson & Johnson (JNJ US)**, together with **Verb Surgical (not listed)**, plans to launch its digital mini-invasive platform. **Expected: Mid 2020**
 - **Riversfield (not listed)**, a Japanese startup, is awaiting the approval of its low-priced surgical robot. **Expected: 2020**
- **3D-printed livers enter clinical trials.**
 - **Organovo (ONVO US)** will file the submission to start a human clinical trial for its bio-printed liver patch. **Expected: Second half of 2020**
- **China MedTech focus – long term initiative start bearing fruits.**
 - Precision Medicine Initiative: In 2016, China announced the largest ever precision medicine Initiative, a five-year plan, with an expected investment of more than \$9bn for research.
 - Made in China 2025: One of the targets of the Made in China plan, released in 2015, is to domestically manufacture by 2020 up to 50% of mid- and high-end medical devices used by the hospitals.



2019 – A Glance In The Rear-View Mirror (1/3)

Wearable kidney receives priority review.

- The first Automatic Wearable Artificial Kidney (AWAK), developed by **AWAK Technologies (not listed)**, received the Breakthrough designation granted by the FDA.

Robotic surgery is becoming faster and more reliable.

- A doctor in China became the first to perform remote control surgery (50 Km) over a 5G network.

The American Medical Association proposed a change in class for Extended Holters (Heart monitoring).

- Extended Holters could see a significant reduction in the reimbursement rate starting in 2021.

IMPACT



January 2019

February 2019

March 2019

April 2019

IMPACT



FDA regulates smart pills.

- A surge of ingestible electronics pills demands triggered the FDA to release guidelines on how developers can get smart pills approved. We believe this is positive for the market.

Interoperability is coming to devices.

- The FDA approved the first interoperable pumps, the ACE Pump by **Tandem Diabetes (TNDM US)** and the iCGM by **DexCom (DXCM US)**, allowing patients to tailor diabetes therapies according to their needs.

The first 3D-printed heart.

- The Tel Aviv University was able to create a 3D printed heart with human cells (A proof-of-concept the size of a mouse).

Price of bionic arms drastically cut down.

- **Open Bionics (not listed)** has managed to launch a 3D-printed bionic arm for less than \$5k, versus \$100k of existing market solutions.

2019 – A Glance In The Rear-View Mirror (2/3)

Liquid biopsy receives priority.

- **Grail (not listed)**, a company developing liquid biopsy solution for early-stage cancers, announced that its multi-cancer test had been granted Breakthrough Device designation.

Digital health IPOs dominated the year.

- **Livongo Health (LVGO US)**, **Health Catalyst (HCAT US)**, **Phreesia (PHR US)** all made successful IPOs that were largely oversubscribed.

IMPACT



May 2019

June 2019

July 2019

August 2019

IMPACT



Augmented Reality is entering surgical rooms.

- **Medtronic (MDT US)** announced its partnership with **Karl Storz (not listed)**, integrating 3D vision systems into Medtronic's new robotic platform.
- Besides, **Intuitive Surgical's (ISRG US)** augmented reality product and **Medivis' (not listed)** SurgicalVR platform got approved.

Governmental support to mHealth devices starts to ramp up.

- **Fitbit (FIT US)** collaborated with **Singapore's government** to supply residents with free fitness trackers.

Expedited pathway for Breakthrough technologies gets ready.

- CMS finalized the path to boost reimbursement for Breakthrough devices.

2019 – A Glance In The Rear-View Mirror (3/3)

Robotic surgery market gets crowded.

- **CRM Surgical (not listed)** launched its robotic surgery platform in Europe and is waiting for FDA approval.
- Later in the year, **Avantera Medical (not listed)** launched its robotic surgery platform in Europe and is waiting for FDA approval.

AI is getting its way into diagnostic.

- **Medtronic (MDT US)** announced the launch of an artificial intelligence endoscopy system in European markets designed to detect precancerous polyps.

Neurostimulation surfs the need.

- FDA approves **Axonics' (AXNX US)** neuromodulation system for urinary indication.

Big Tech moves into healthcare.

- **Amazon (AMZN US)** unveiled a medical speech recognition service that analyzes doctor-patient conversations to fill Electronic Health Records correctly.

Artificial pancreas.

- **Tandem Diabetes Care (TNDM US)** receives approval for its artificial pancreas.

IMPACT



September 2019

October 2019

November 2019

December 2019

IMPACT



Safer medical devices receive fast-track approval.

- The FDA proposed the Safer Technologies program for Medical Devices (STeP) to expedite the approval of medical devices that significantly improve the safety of currently available treatments.

Robotic surgery attracts major M&A activity.

- **Stryker (SYK US)** announced the acquisition of **Wright Medical (WMGI US)**.
- This follows the acquisition of **Corindus Vascular (not listed)** by **Siemens Healthineers (SHL GY)** for \$1.1bn, and **Johnson and Johnson's (JNJ US)** acquisition of **Auris Health (not listed)**.

Bionics: A Vital And Dynamic Sector – 2019 M&A And IPOs

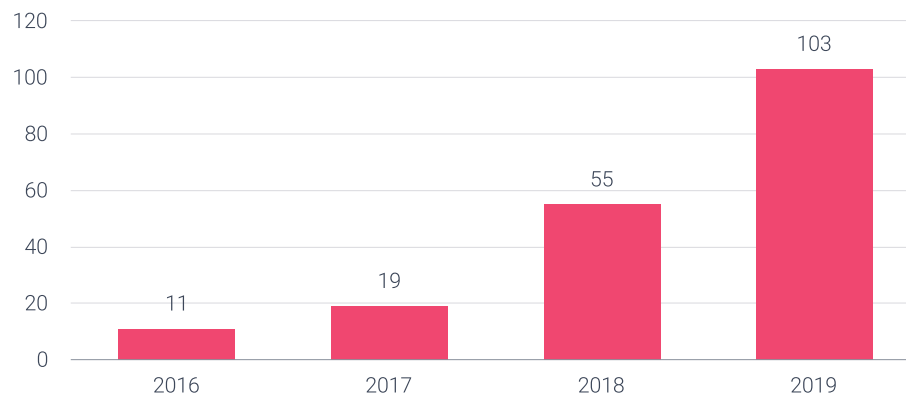
Buyer	Target	Value	State
Boston Scientific (BSX US)	BTG	\$4bn	Announced
3M (MMM US)	Acelity	\$6.7bn	Completed
Johnson & Johnson (JNJ US)	Auris Health	\$5.75bn	Announced
Fresenius Medical Care (FMS US)	NxStage Medical	\$2bn	Completed
Thermo Fisher (TMO US)	Brammer Bio	Not disclosed	Announced
Cantel Medical (CMD US)	Hu-Friedy	\$775mn	Completed
Boston Scientific (BSX US)	Vertiflex	\$465mn	Completed
ConMed (CNMD US)	Buffalo Filter	\$365mn	Completed
Siemens Healthineers (SHL GR)	Corindus Vascular Robotics	\$1.1bn	Completed
Stryker (SYK US)	Wright Medical	\$4bn	Announced
Smith & Nephew (SN LN)	Osiris Therapeutics	\$660mn	Completed
Boston Scientific (BSX US)	Millipede	\$450mn	Announced
Colfax (CFX US)	DJO Global	\$3.15bn	Completed
Sonic Healthcare (SHL AU)	Aurora Diagnostics	\$540mn	Completed
Veritas Capital (not listed)	AthenaHealth	\$5.7bn	Completed
Baring Private Equity Asia	Lumenis	\$1bn	Announced

IPOs 2019	Sector
Livongo Health (LVGO US)	Digital health platform for diabetes management
TransMedics (TMDX US)	Transportation system for organ transplants
Avantor (AVTR US)	Provider of lifescience products and services
Medacta Group (MOVE SW)	Minimally invasive surgical techniques
Axonics Modulation Technologies (AXNX US)	Neuromodulation devices for bladder and bowel dysfunction
Ra Medical Systems (RMED US)	Laser systems for vascular and dermatological diseases
Avedro (AVDR US)	Ophthalmic medical devices and corneal remodeling technology
Silk road Medical (SILK US)	Medical devices for cardiovascular diseases
Health Catalyst (HCAT US)	Data and analytics technologies and services for healthcare organizations
Phreesia (PHR US)	Medical software
Change Healthcare (CHNG US)	Software, analytics, network solutions and technology-enabled services
ShockWave Medical (SWAV US)	Medical devices for calcified cardiovascular diseases
Sequana Medical (SEQUA BB)	Medical devices for liver disease, malignant ascites and heart failure
Next Science (NXS AU)	Technologies for bacteria eradication
Innotherapy (246960 KS)	Medical hemostatic agents
Adaptive Biotechnologies (ADPT US)	Immuno diagnostic tests

Structural trends (1/2)

- **Bionics' regulatory landscape is undergoing a positive metamorphosis.**
 - **The Breakthrough program** provides a strong incentive for companies to submit requests for approval of high-risk medical technologies, as the Breakthrough designation allows for:
 - **a favorable regulatory environment:** the Breakthrough Program accelerates the time to approval;
 - **a favorable reimbursement landscape:** the Breakthrough Program accelerates and expands insurance coverage;
 - **Reimbursement of Bionics devices is rapidly expanding.**
 - In 2020, companies that succeed in getting breakthrough-designated devices to market will be **automatically reimbursed** and will benefit from **extended coverage**.
 - In 2020, CMS will expand reimbursement for healthcare providers using **Remote Patient Monitoring devices (RPM)** and telemedicine. Additionally:
 - CMS has proposed to increase the reimbursement of **next-generation sequencing tests** to detect early-stage cancers.
 - CMS is considering a national coverage determination for mitral and **tricuspid valve percutaneous replacement (TMVR) devices**.

**BREAKTHROUGH DESIGNATION APPROVALS
(AS OF SEPTEMBER 2019)**



SOURCES:

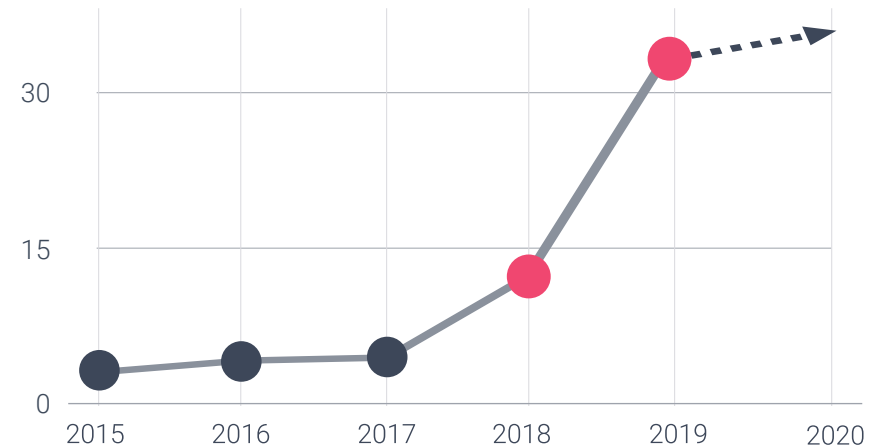
https://assets.ey.com/content/dam/ey-sites/ey-com/en_gl/topics/life-sciences/life-sciences-pdfs/ey-pulse-of-the-industry-2019.pdf

Structural trends (2/2)

- The potential for **AI in the healthcare sector** is massive and spans from early disease detection to personalized diagnostics and therapeutics.
 - According to The Lancet Digital Health Journal, AI tools today **can detect diseases with the same accuracy of a healthcare professional**, which should help alleviate healthcare cost inflation and doctors shortage.
 - Since 2018, the Food and Drug Administration (FDA) has approved/cleared more than 33 AI algorithms, most of them used for diagnosis and remote monitoring.
 - This year **Medtronic (MDT US)** launched its AI colonoscope; **Hologic (HOLX US)** received the approval of its 3D mammography technology; **Philips (PHIA NA)** launched its AI's prostate cancer detection technology.
 - Companies such as **Siemens Healthineers (SHL GY)**, **GE Healthcare (GE US)** and **Philips** are working on the development of digital twins, which could help the healthcare sector to save money by predicting patient outcomes and avoiding unnecessary surgeries.
- **Smaller deals rather than transformative takeovers have lately dominated M&A.** Big MedTech companies are increasingly relying on smaller targets to inject innovation into their pipelines.
 - **Strategic acquisitions** driving innovation are still likely to prevail over financial takeovers. The strategy is the same as we have seen in the global technology arena in the past: buy technology that can be used across all patients.

MORE THAN 30 AI ALGORITHMS HAVE WON FDA APPROVAL 2018-19

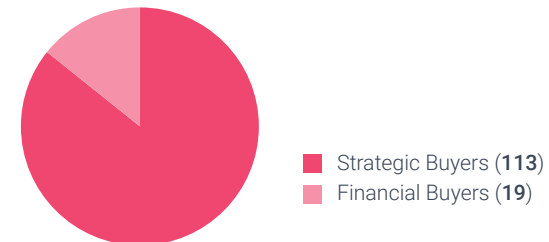
Use cases go beyond imaging to diagnosing fractures, predicting seizures, and improving rehabilitation.



Source: EY, US Food & Drug Administration.

Number of approvals may exceed 33 because some approvals may be mapped to multiple use cases or therapy areas.

BUYERS: STRATEGIC VS FINANCIAL



SOURCES:

[https://www.thelancet.com/journals/landig/article/PIIS2589-7500\(19\)30123-2/fulltext](https://www.thelancet.com/journals/landig/article/PIIS2589-7500(19)30123-2/fulltext)

https://assets.ey.com/content/dam/ey-sites/ey-com/en_gl/topics/life-sciences/life-sciences-pdfs/ey-pulse-of-the-industry-2019.pdf

<https://www.medworldadvisors.com/single-post/2019/10/23/Global-MedTech-Industry-MA--Q1Q2-2019-Review>

Bionics' ABC

- Bionics provides exposure to disruptive high-tech devices originating from the **convergence of biology and electronics**.
- Bionics focuses on highly **unmet medical needs** with the aim of improving people's quality of life while also reducing healthcare costs.
 - A growing **life expectancy**, the increase of **chronic diseases**, and rising **healthcare expenditures** are the main positive drivers for this sector.
 - Regulatory bodies are accelerating the approvals of such devices
 - Medical devices are also enjoying the expansion of **insurance coverage**.
 - The sector is characterized by **high barriers to entry** due to high R&D costs, stringent regulatory scrutiny, and reliable patent protection.
- Our investments in the Bionic themes include revolutionary sectors such as **Genomics, Synthetic Biology, Medical Robots, Healthcare 3D Printing, Regenerative Medicine, Artificial Organs, and Digital Health**.
- **Innovation and R&D** are core: in 2018, 13'795 patents were filed globally, a number which is much higher than in any other industry.
- Bionics is quite a **defensive sector** as diseases are not tied to any economic cycle.

BIONICS' DIVERSE AND INNOVATIVE SECTORS



Synthetic Biology: Making the Impossible Possible

Biology is becoming programmable...we are now able to re-write the code that powers life.



Digital Health: The Era of Patient Empowerment

The human body is becoming the biggest data platform... and Bionics companies are capturing this value.



Genomics: Towards Precision Medicine

Each patient is different and unique in front of a disease so must be the treatments.



Healthcare 3d Printing: The Solution To The Organ Shortage Crisis?

Today texts and images are printed on a paper by controlling and placing ink or toner on the surface of the paper. In a similar way, 3D printers print... medical devices, drugs and even living organs!



Medical Robots: New Means For Better Medicine

With over 16,500 hospitals worldwide medical robots can help reduce costs, while also improving outcomes for patients and operations' effectiveness.



Regenerative Medicine: A Bit Of Me

Some animals have impressive regenerative capabilities. The Axolotl is able to regrow limb, tail, eye, jaw, and heart. What about humans?



Artificial Organs: The Bionic Man Is Now A Reality

Artificial organs (limbs, ears, eyes, heart, pancreas) are already being used to improve people's quality of life and some others are under way.

Catalysts

- **Silver aging.** As the global elderly population continues to grow, so will the demand for health care.
- **US Regulation pushes for innovation.** A series of recent initiatives by the FDA (De Novo pathway, Breakthrough Device Program, Software as a Medical Device, Pre-cert Pilot Program, etc.) are to accelerate the time to market of new technologies, sparking industry innovation.
- **Consumer awareness.** The upsurge of high-tech devices in consumer electronics has lowered the adoption barriers of personal medical devices. Wearables and other medical devices are becoming trustworthy partners in our daily life and are entering in an ever-growing number of households.
- **Digitalization is blurring the lines between pharma, medical devices, and consumer electronics.** GAFAM companies and some other large corporations are expanding their presence into the digital health sector, driving patient-centered care models.

Risks

- **EU Regulation could affect medical device manufacturers.** Europe's new Medical Device Regulation (MDR) will replace the current Medical Device Directive (MDD) in May 2020. The new regulation will see fewer regulatory bodies and more requirements, making it more difficult for players to receive approval.
- **"Medicare for all" proposal.** With Medicare for all, the healthcare sector will receive lower reimbursements per product and decrease their profit margins. Margin pressure could accelerate M&A activity.
- **Potential reinstatement of the US Medical Device Excise Tax.** The 2.3% Medical Device Tax (MDET) of US sales had been suspended since 2016 but has been scheduled for reinstatement for 1 January 2020.

Bottom Line

- The **convergence of man and machine** is becoming more and more palpable, and a **new generation of medical devices** are finding their way into the human body.
 - Medical technology has improved dramatically, becoming **more reliable, personalized, and portable**. **Semiconductor** integration is becoming omnipresent and seamless, driving cost down and adding extra functions, such as **connectivity, low power consumption, and miniaturization**.
- It looks like **2020** is going to be **another exciting year** for Bionics, as MedTech manufacturers are striving for **growth through innovation**.
 - We foresee the emergence of **new artificial organs** and **surgical robots**;
 - We expect important **breakthroughs** in innovative fields such as **Brain Computer Interface, Liquid Biopsy, artificial kidney, and 3D printed organs**;
 - **Reimbursement and regulation** will continue to be a hot topic and fuel the adoption of medical devices.
- We remain **firmly convinced** that Bionics is helping and will help millions of people to live healthier.



SEASON'S GREETINGS


AtonRā Partners

Invest Beyond The Ordinary

Explore our investment themes:
www.atonra.ch/investment-themes/



HEALTHCARE
M&A



SUSTAINABLE
FUTURE



BIOTECHNOLOGY



AI AND
ROBOTICS



FINTECH



SECURITY
AND SPACE



MOBILE
PAYMENTS



BIONICS

About AtonRâ Partners

AtonRâ Partners is an asset management company, founded in 2004 with head office in Geneva, incorporated under Swiss law, duly approved by the Swiss Financial Market Supervisory Authority (FINMA) under the Swiss Collective Investment Schemes Act.

AtonRâ Partners is a conviction-driven asset manager combining industrial and scientific research with financial analysis. AtonRâ Partners focuses on long-term trends powerful enough to be turned into thematic equity portfolios.

Disclaimer

This report has been produced by the organizational unit responsible for investment research (Research unit) of AtonRâ Partners and sent to you by the company sales representatives.

As an internationally active company, AtonRâ Partners SA may be subject to a number of provisions in drawing up and distributing its investment research documents. These regulations include the Directives on the Independence of Financial Research issued by the Swiss Bankers Association.

Although AtonRâ Partners SA believes that the information provided in this document is based on reliable sources, it cannot assume responsibility for the quality, correctness, timeliness or completeness of the information contained in this report.

The information contained in these publications is exclusively intended for a client base consisting of professionals or qualified investors. It is sent to you by way of information and cannot be divulged to a third party without the prior consent of AtonRâ Partners. While all reasonable effort has been made to ensure that the information contained is not untrue or misleading at the time

of publication, no representation is made as to its accuracy or completeness and it should not be relied upon as such.

Past performance is not indicative or a guarantee of future results. Investment losses may occur, and investors could lose some or all of their investment. Any indices cited herein are provided only as examples of general market performance and no index is directly comparable to the past or future performance of the Certificate.

It should not be assumed that the Certificate will invest in any specific securities that comprise any index, nor should it be understood to mean that there is a correlation between the Certificate's returns and any index returns.

Any material provided to you is intended only for discussion purposes and is not intended as an offer or solicitation with respect to the purchase or sale of any security and should not be relied upon by you in evaluating the merits of investing in any securities.