Investment Recipes

by AtonRā Partners

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On the Menu

CROs ARE GOING MAINSTREAM

Riding The Outsourcing Wave

Boosting Pharma & Biotech productivity

CROs (Contract Research Organizations) improve Pharma & Biotech's productivity by reducing the complexity, duration and cost of their clinical trials.

- R&D efficacy in the Biopharmaceutical industry has been declining by 8.4% per year over the last few decades (chart on the top-right).
- According to the Tufts Center for the Study of Drug Development (CSDD), between 2003 and 2013, the R&D spending increased by 145% while the average approval rate declined from 21.5% to 12%.
- Today more than 50% of Pharma & Biotech companies rely on external R&D's.

Benefiting from Biotech's growth

Biotechnology is overtaking conventional drugs' growth, but Biotech companies lack the financial resources and infrastructure to conduct extensive clinical trials on their own and look for the support of CROs.

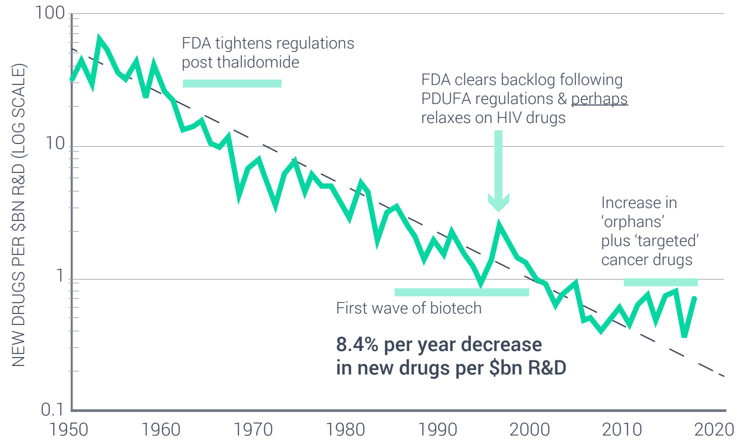
- Biotechnology products today represent 27% of total sales.
- Expected to grow at a rate of 27%-32% between 2020 and 2024.

M&A appeal

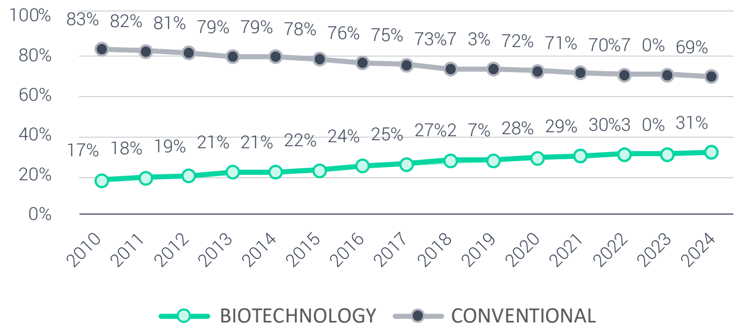
The CRO market is highly fragmented. The industry is heading towards consolidation, with players seeking to expand their sales through new therapeutic areas, geographies, and clinical offerings.

- There are more the 1000 CRO players worldwide.
- The five top CROs hold 34% of the market.
- The biggest player has less than 12% of market share.

R&D PRODUCTIVITY HAS BEEN DECLINING



TECHNOLOGY % OF PRESCRIPTION & OTC SALES



Source:
World Preview 2019, Outlook to 2024, Evaluate

CROs ARE GOING MAINSTREAM

Boosting The Pharma & Biotech R&D

Reducing the complexity of clinical trials

Researchers target more complex diseases and use new therapeutic approaches, which require specific expertise, advanced technological capabilities, and familiarity with the regulatory process. CROs help reducing complexity by offering excellent therapeutic and regulatory know-how.

- The number of patients required for clinical trials in most of the therapeutic areas increased by 10% over the last year.

Speeding up clinical trials

Clinical trials duration has increased along with complexity. To compress development times, CROs propose innovative approaches, such as using real-world evidence and data sources other than traditional clinical trials, e.g., electronic health records, wearables, etc., to achieve drug approvals.

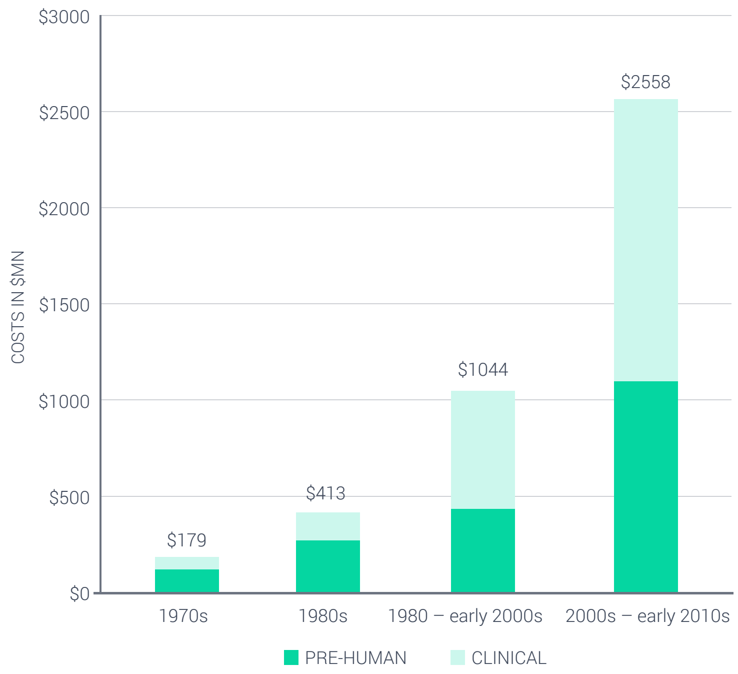
- Today clinical trials last on average 2.5 years longer than 10 years ago.
- A study led by the Economist reveals that real-world evidence (nonclinical data) increases success rates and reduces development times.

Allowing cheaper global reach

Biopharmaceutical companies are increasingly seeking approvals in multiple markets worldwide. CROs offer global reach and spare the companies the need to build redundant and expensive development capabilities worldwide.

- A successful international launch requires approval in more than 50 different countries around the world.

R&D COSTS PER APPROVED NEW DRUG HAVE INCREASED 14X SINCE 1970



Source:
Estimation of clinical success rate and related parameters, Oxford Journals, Biostatistics,
The changing landscape of Research & Development, IQVIA Institute

CROs ARE GOING MAINSTREAM

Riding The Biotech Growth

CRO market is set to expand

The FDA is promoting the development of disruptive treatments by establishing new programs, e.g., Breakthrough Therapy and Orphan Drug Designation, that accelerate the approval of such therapies. As a result, the number of clinical trials is on the rise.

- The number of clinical trials has grown exponentially over the last 20 years.
- Gene therapy's trials have more than doubled over the past 3 years.

Emerging biopharmas are retaining control of their drugs

Emerging biopharma, responsible for most of the innovative drugs in development, have traditionally sold their promising treatments to larger drug makers. Companies are increasingly opting to hold onto their assets.

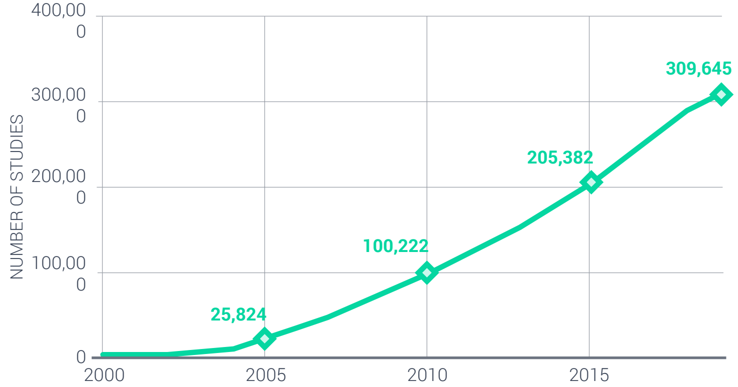
- They represent around 80% of the total R&D pipeline.
- In 2018, emerging biopharma was responsible for half of total FDA approvals, up from just one third in 2010.

Large Pharma is playing catch up

Large Pharma companies are determined to stay in the race and have been investing in new disruptive treatments. As a result, Pharma's demand for outsourcing has also grown. This shift is likely to intensify as several blockbuster drugs are seeing their patent expire, and generic competition is getting fierce.

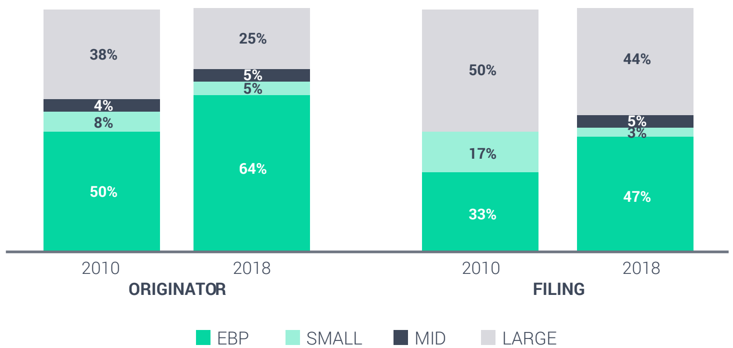
- In 2020 Novartis will lose market exclusivity for 8 of its drugs while Merck & Co and AstraZeneca will each see 5 U.S. patents expire.

SUBSTANTIAL GROWTH SEEN IN STUDIES REGISTERED ON CLINICALTRAILS.GOV



THE NUMBER OF REGULATORY APPLICATIONS SUBMITTED BY EMERGING PHARMAS IS INCREASING

NAS Launches: 24 in 2010, 56 in 2018



NAS = New active substances, EBP = Emerging biopharma

Credit: "The Changing Landscape of Research and Development, "IQVIA for Human Data Science

CROs ARE GOING MAINSTREAM

M&A Appeal

Shifting towards a One-stop model

The industry has started to see a movement towards a full-service model, a one-stop-shop offering the whole spectrum of biopharma services. Mergers between CROs and CDMOs/CMOs create the most comprehensive portfolio of services for their customers, from research to development and manufacturing.

- Thermo Fisher has been at the forefront since the acquisition of Patheon in 2017, offering end-to-end solutions to its clients.

Expanding the offering

CROs are bolstering their offer beyond traditional clinical capabilities and looking for specialty expansion into fast-growing therapeutic areas such as oncology and rare diseases. Again, M&A is a fast route.

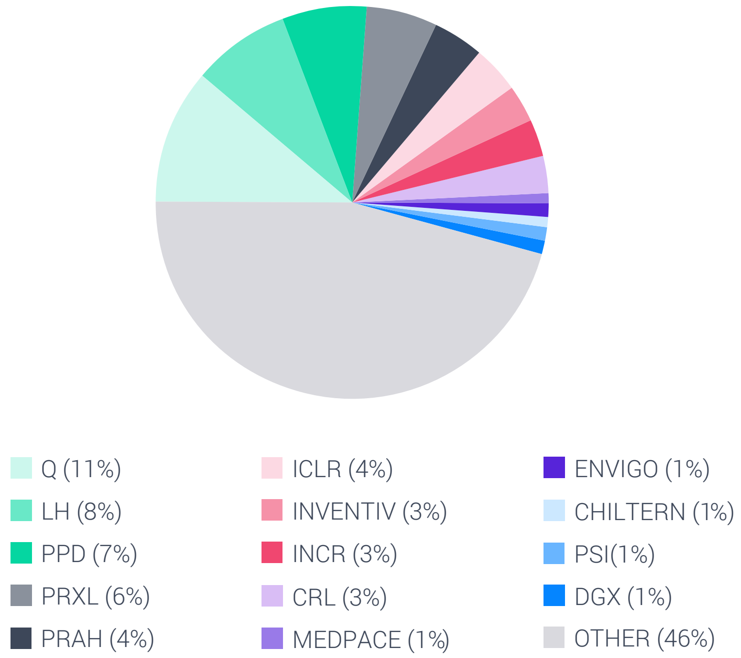
- Preclinical and post-approval services still have low penetration rates (28% and 15%, respectively).
- According to EvaluatePharma, oncology is projected to represent 15% of prescription sales in 2020, up from 10% in 2014.

Empowering clients with real-world data

CRO companies have been investing in Big Data to improve the efficacy of clinical trials. To gather more valuable insights from the vast amount of data, tuck-in acquisitions in the AI space will likely play a significant role in the future.

- Quintiles' merger with IMS Health allows the company (now called IQVIA) to leverage Electronic Health Records (EHR) and prescription data to support clinical trials.

A VERY FRAGMENTED MARKET



CROs ARE GOING MAINSTREAM

Catalysts

- **FDA is supporting Real-World evidence.** The FDA has recently approved Pfizer's Ibrace drug based on real-world (nonclinical) evidence. Additional approvals increase interest from Biopharma, and boost CROs added value.

- **Investments in AI and Big Data analysis.** CROs are sitting on mountains of real-world data coming from Electronic Health Records (EHR) and wearable devices, and they now need to extrapolate value from data. We would not be surprised to see acquisitions in the AI and Big Data analysis space.

- **M&A.** New acquisitions will likely play an important role, consolidating the market and driving growth. Lonza or Catalent (CDMO's) could follow Thermo Fisher's move and look for an M&A opportunity in the CRO space.

Risks

- **Increased competition from academies and hospitals.** Academies and hospitals are valid competitors to CROs if they manage to demonstrate high capacity in preparing, organizing, and monitoring studies.

- **Biotech consolidation.** In response to a rising M&A activity in the Biotech space, companies could scale up and run clinical trials on their own.

- **Drug pricing.** A too-aggressive plan from the U.S. government to reduce drug prices could drastically penalize the profit margins of drug manufacturers, and pricing pressure would reverberate to CROs.

Bottom Line

- Given the unique advantages offered by CRO companies, such as global reach and real-world data, we believe that outsourcing will continue to grow strongly.

- The CRO market is likely to expand, driven by the robust demand for services coming from Pharma and Biotech industries. In a bid to strengthen their competitive positions, we expect CRO companies to pursue an M&A strategy, most notably in the AI space.

Companies mentioned in this article:

AstraZeneca (AZN LN), Catalent (CTLT US) , IQVIA (IQV US), Lonza (LONN SW), Merck & Co (MRK US), Novartis (NOVN SW), Patheon (not listed), Thermo Fisher (TMO US)

WEALTHTECH – EVOLUTION OR REVOLUTION?

The Shape Of Wealth Management Is Changing

The democratization of wealth management as a necessity

Demand for more efficient wealth management services is on the rise, driven by failing state pension systems and a long-lasting low interest rates cycle. A wave of new tech companies is entering the industry, catering to a mass of middle-income individuals.

- Thanks to robo-advisors and passive investments, access to institutional-like wealth management services have spread over the last few quarters.
- Over the last five years $17bn have been raised in this segment alone, according to FinTech Global.

Traditional wealth managers are forced to invest in IT

Increased competition is forcing large institutional wealth managers to heavily invest in IT, or partner with specialized Fintech, to offer to their clients systematic, transparent, and low-cost investment strategies.

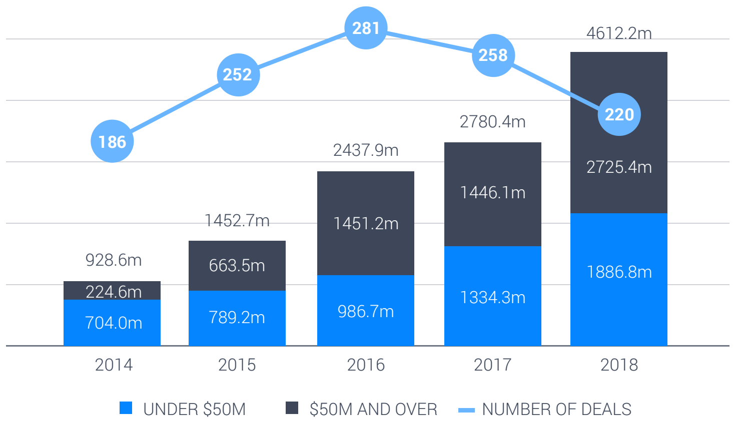
- AI, NLP and other technologies allow personalized service while reducing costs (and fees).

Moving from product providers to solutions providers

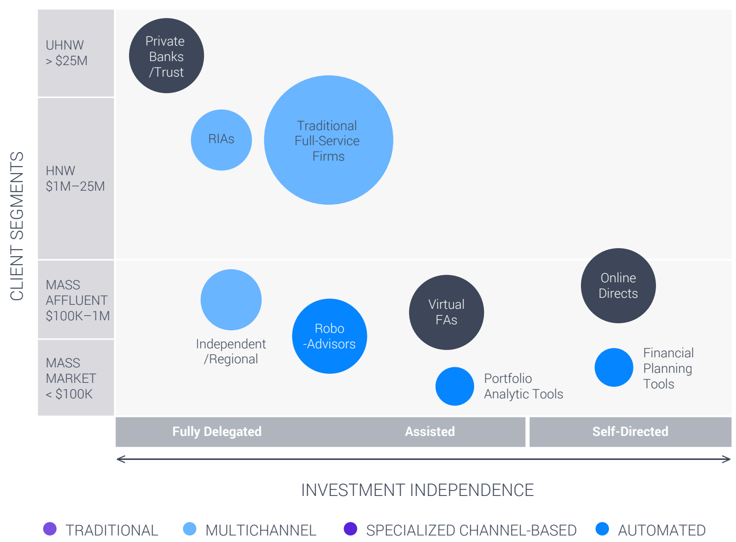
Successful small-to-mid-sized wealth managers are adapting to a more challenging environment by offering hyper-personalization. Alternative assets, including private equity, VCs, and private debt, are becoming very popular.

- Non-traditional asset classes and niche investment strategies are sprawling.
- Investors are looking for uncorrelated asset classes, and wealth managers want to protect their profitability.

GLOBAL WALTHTECH INVESTMENT 2014 – 2018



WEALTH MANAGEMENT COMPETITIVE LANDSCAPE



Source:
https://medium.com/@chitu_rk/future-of-wealth-management-a-hybrid-approach-252fea01fdc2,
https://thefintechtimes.com/wealthtech-investment-increase/

WEALTHTECH – EVOLUTION OR REVOLUTION?

From Doing Digital To Being Digital

"Siri: What's the best way to manage my savings?"

Wealth managers use IT analytics to better profile and understand their clients, allowing them to reduce costs and personalize their offer. Such service spans from:

- Intelligent automation of onboarding to investor education (through e-learning platforms) and advice delivered by AI-driven chatbots.
- D2C (direct to consumer) and advised platforms.

The rise of robo-advisors

Robo-advisory is one of the hottest verticals within the Fintech space, with growth rates expected to rise by over 40% CAGR over the next five years.

- Assets under management by robo-advisors (fully automated and Hybrids) are expected to quadruple by 2023 from less than US$ 750bn in 2019.

Human touch remains still a key element for many clients

Trust remains the hardest barrier to overcome for these technologies and products. We believe that the adoption rate remains linked to the awareness and understanding of how robo-advisors work.

- Even if fully automated robo-advisors allow mass affluent to profit from professional-like wealth management services,
- the hybrid robo-advisors (human touch alongside automation) currently dominate the industry with a 70% share.

	FULLY AUTOMATED	HYBRID	ADVISOR-ASSISTED
Business Model	Stand-alone channel: 100% software-based advice; clients provide information online, upon which portfolio recommendations are made and managed.	Human financial advisor supported by digital advice: old-school service mixing on-line tools with the ability to call an advisor (most common model for incumbent players).	Digitally-enabled human financial advisors: phone, Skype/Facetime or online-chat virtual meetings and investment advice.
Value Proposition	Low-cost, investment expertise, unbiased advice, simplicity and better service.	Digital capabilties with human back-up and lower-cost pricing.	Digital platform combined with advisor relationship; affordable pricing.
Typical Investor	Tech-savvy, younger, price-sensitive and conservative.	Tech-savvy but like the idea of help being available if needed.	More traditional, looking for human guidance at lower fees.
Platform Fee	15 - 35bps	25 - 50bps	30 - 90bps or flat fee
Investible universe	ETFs, Stocks, Bonds	ETFs, Stocks, Bonds	Bonds, Alternative Investments
Minimum Investment	$0 - $5'000	$5'000-$100'000	1 million +

ROBO-ADVISOR	APPROACH	AUM ($MN)
Vanguard Personal Advisory Service	Hybrid	$140'000
Schwab Intelligent Portfolios	Hybrid	$41'000
Wealthfront	Fully Automated	$20'000
TD Ameritrade Essential & Selective Portfolios	Fully Automated	$19'900
Betterment	Fully Automated	$18'000
Personal Capital	Fully Automated	$10'000
Etrade Core Portfolio	Fully Automated	$6'200
WealthSimple	Hybrid	$4'000
FutureAdvisor	Hybrid	$1'200
MI Finance	Fully Automated	$500
Interactive Advisors	Fully Automated	$83

Source:
https://www.statista.com/outlook/337/100/robo-advisors/worldwide,
AtonRa Partners

The Charles Schwab Corporation and the TD Ameritrade Holding Corporation have entered into a definitive agreement for Schwab to acquire TD Ameritrade in a stock transaction.

WEALTHTECH – EVOLUTION OR REVOLUTION?

Catalysts

- **Attrition rate to increase.** Based on an E&Y survey, one-third of clients plan to switch wealth providers over the next three years. Wealth managers offering the best customer experience and technology are the ones that will survive.
- **Partnerships and M&A's.** Fee pressures, increased trust in technology, and the necessity to have a multi-channel strategy are likely to drive more asset managers partnering/acquiring WealthTech companies.
- **French pension reform strike.** The longest strike in French modern history highlights once again the need for individuals to take care of their retirement savings.

Risks

- **Poor economics.** Robo-advisors' customer acquisition costs stand at $1'000 per customer. With current fee structures (0.25%), stand-alone robots-advisors would need between $15bn to $25bn in AuM to breakeven.
- **Race to the zero fees in the retail investing world.** The most common strategy to beat competition and grow deposits is by lowering advisory fees. Citigroup has just announced that robo-advisers for customers with at least $50,000 at the bank will be free (vs. 0.4% for incumbents and 0.25% for the likes of Betterment, Wealthfront and Stash).
- **Cyber-Security.** Data protection remains one of the most significant risks for WealthTech companies.

Bottom Line

- Attractive fees, quick and easy account opening, access to different and innovative products and services and better customer experience are the key reasons for robo-advisor's fast growth.
- Robo-advisors with a hybrid approach (human touch alongside automation) are likely to stand out in the WealthTech market.

Companies mentioned in this article:

Betterment (Private), Charles Schwab Corporation (SCHW US), E-Trade (ETFC US), FutureAdvisor (Private), Interactive Advisors (Private), M1 Finance (Private), Personal Capital (Private), Stash (private) TD Ameritrade (AMTD US), Vanguard (Private), Wealthfront (Private), Wealthsimple (Private)

A NEW TOUCH FROM TECH GIANTS

Hand-To-Hand Payments

Amazon is pioneering the hand-payment in retail stores

Amazon is the first company to bring a means of payment based on a person's hand to retail checkout. It is testing this technology in its Whole Foods stores.

- Amazon filed a patent for a non-contact biometric identification system in June 2018.
- Hand payments should be made available in 1H2020.

Hands to become next payments means

Hand-payments bypass the need for cash, cards of any sort, and smartphones, offering an accurate and ultrafast means of payment.

- Recognition accuracy hovers around one tenth-thousandth of 1%. The stated target is close to a millionth of 1%.
- The payment would require less than 300 milliseconds to complete.

Big tech companies competing in the mobile payment landscape

Disintermediation from mobile payments services may be the next step for tech giants such as Apple, Alphabet, and Amazon.

- They may link cards to their platforms (eventually a deposit account) without needing additional intermediaries.
- Amazon's hand payments will rely just on credit cards, overcoming the need to have a smartphone.

Source:
https://www.wsj.com/articles/cash-plastic-or-hand-amazon-envisions-paying-with-a-wave-11579352401?shareToken=st65d84402871741bdbd5c7b573bca87dd,
https://www.patentlyapple.com/patently-apple/2020/01/amazon-files-patent-for-non-contact-biometric-id-system-for-their-amazon-go-stores-and-beyond.html,
https://www.patentbell.com/readpatent.html?patent_no=20190392189

A NEW TOUCH FROM TECH GIANTS

Faster, Secure, Disrupting

Shaking the payments landscape

Hand payments can improve the user experience to a level that may shadow pure services vendors, but payments processors are still needed as:

- Processors will still handle transactions from the credit cards linked to the user ID.

A more secure identification system

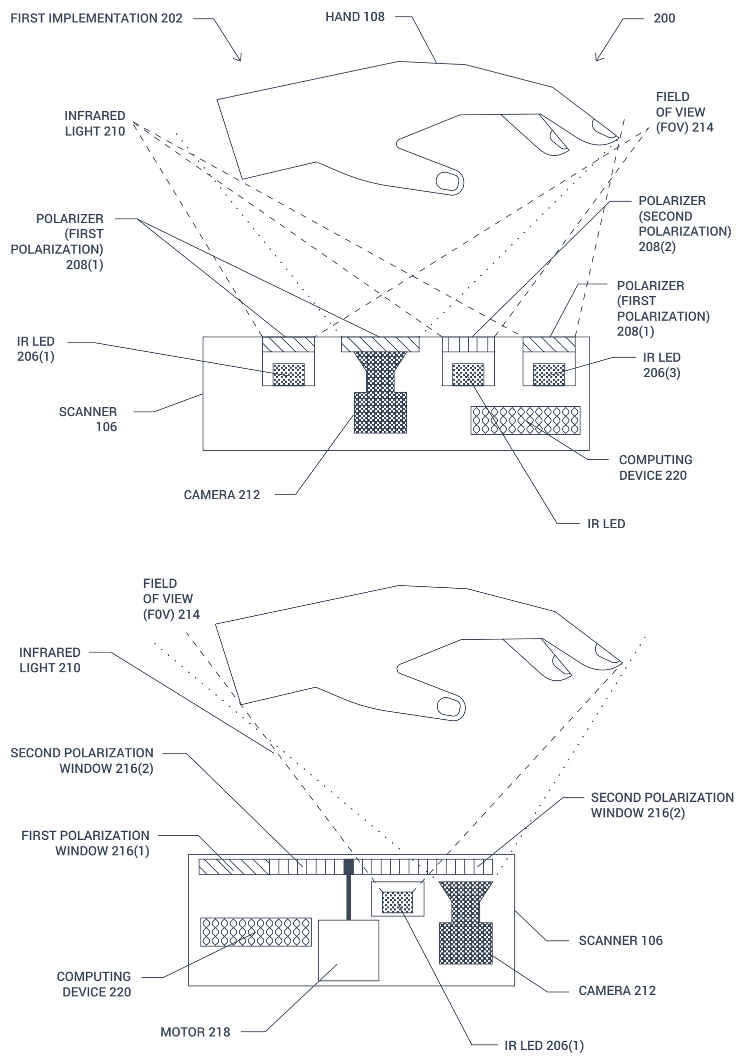
The scanner for non-contact biometric identification enhances the degree of security around the user's identity as it works on two levels of polarization to recognize the shopper.

- First, it detects lines and creases. Then, veins, bones, soft tissues, etc.
- False acceptance rates (FAR) and false rejection rates (FRR) are lower in palm vein technology than in common fingerprints' scans.

All the way to substituting retail banks

Tech giants are increasingly activating payment services for their users. Their vast user base (e.g., Amazon counts 310mn active users) may trigger a switch from traditional banking channels to their platforms.

- The hybrid robo-advisors (human touch alongside automation) currently dominate the industry with a 70% share.



Source:
https://www.patentbell.com/readpatent.html?patent_no=20190392189

A NEW TOUCH FROM TECH GIANTS

Catalysts

- **Hand-payment adoption.** No cash, no card, no smartphone. Users may trust Amazon more than any other, to handle personal data.
- **Adoption of Alphabet's checking accounts.** Disintermediation from banks will point to moving the experience out of the current financial system.
- **Apple users switching to Apple Card.** The Card will expand its reach this year. It may bring Apple pay to masses thus hampering traditional banks.

Risks

- **Hand-payment not accepted in competing stores.** Retailers may not embed Amazon's technology in their checkout system.
- **U.S. government intervention against Amazon.** President Trump is enacting policies to hold Amazon responsible for counterfeit goods. Obstacles to Amazon's growth also slow down its technology penetration.
- **Unaccommodating regulation.** NYC passed legislation prohibiting stores, restaurants and other retail outlets from refusing to accept cash.

Bottom Line

- Amazon's new payments means provide users with a better experience and increased security.
- Big tech companies are increasingly stepping into the mobile payments landscape. Though likely to shadow smaller players over the long run, it will trigger benefits in the short term.

Companies mentioned in this article:
Alphabet (GOOGL US), Amazon (AMZN US), Apple (AAPL US)

HOT TRENDS IN CYBERSECURITY

True Cybersecurity Is Preparing For What's Next

Cybercrime on the rise

Digital space is where global criminal growth is highest, fueled by rising geopolitical tensions, relative convenience, and anonymity of the internet. Information theft is the most lucrative and "safest" crime.

- Malware detection in 2019 grew by 265% Y/Y, according to TrendMicro.
- Ransomware damage was $11.5bn in 2019 and expected to hit $20bn in 2021.

Growing surface exposed to cyber-attacks

The exponential increase of connected devices, migration to the cloud, and transition of public infrastructure to digital provide more points of entry into the system and give more opportunities for cyberattacks.

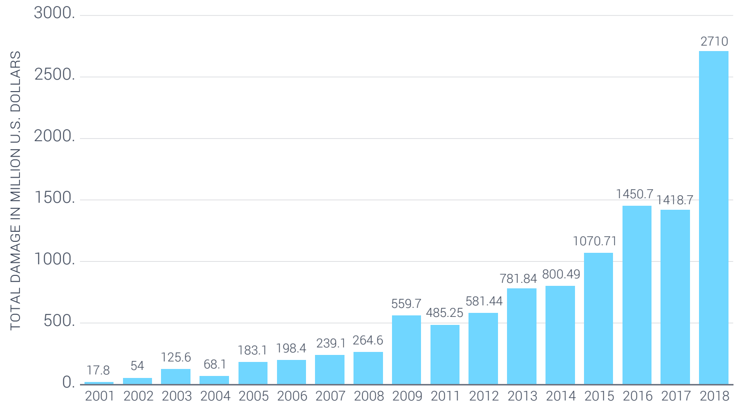
- From miles away, a "smart" kettle may be hacked to take over a Wi-Fi network, consequently a smart home, and ultimately someone's life.
- Ransomware attacks against government servers of real estate markets, as seen in Baltimore and Atlanta, raise concerns about Public IT security.

Artificial Intelligence & Machine Learning is a double-edged sword

AI & ML will have an increasing impact on security, both positive and negative. While enabling security tools to be automated and upgraded with smarter threat detection and analysis, they may also emulate "human-like" content that bypasses cyber filters.

- AI systems may now mimic voices, accents, and faces, bypassing standard security measures.

AMOUNT OF MONETARY DAMAGE CAUSED BY REPORTED CYBER CRIME TO THE IC3 FROM 2001 TO 2018 (IN MILLION U.S. DOLLARS)



Source:
Quote by Neil Rerup (President ECSA), securityboulevard.com,
Herjavecgroup - Official 2019 Annual Cybercrime Report, Statista, AtonRâ Partners,
https://corpblog.viasat.com/dont-forget-security-with-all-those-internet-of-things-devices/

HOT TRENDS IN CYBERSECURITY

A Future Where "Crime" And "Attack" Begin With "Cyber"

Geopolitical tensions to breed cyber-warfare

Governments are becoming the most targeted entity. Public networks have vulnerable entry points as expensive cyber-defenses are often neglected when upgrading and digitizing public infrastructure, e.g., electric utilities.

- In a connected world, the weakest link sets the strength of the whole network.
- Targeting unprotected public utilities could open the way to most critical objects such as prisons, defense sites, and transport hubs that are connected.
- Cyber-warfare also aims for civil unrest and disruption.

Moving to Cloud requires additional security

Being in the cloud allows criminals to gain access to data more easily than hacking into a user's device. As a result, data protection challenges are more significant, with the top 3 being data encryption, traceability, and security.

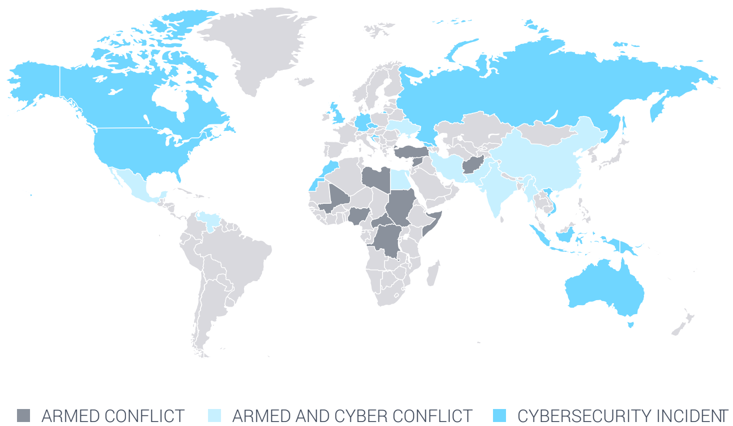
- Proofpoint reported that 60% of major US Firms have been hacked in the cloud, and 92% were targeted at some point during 2019.
- During the same timeframe, 15mn unauthorized login attempts to cloud networks were detected, of which 400K were successful.

Internet of Things creates more vulnerabilities

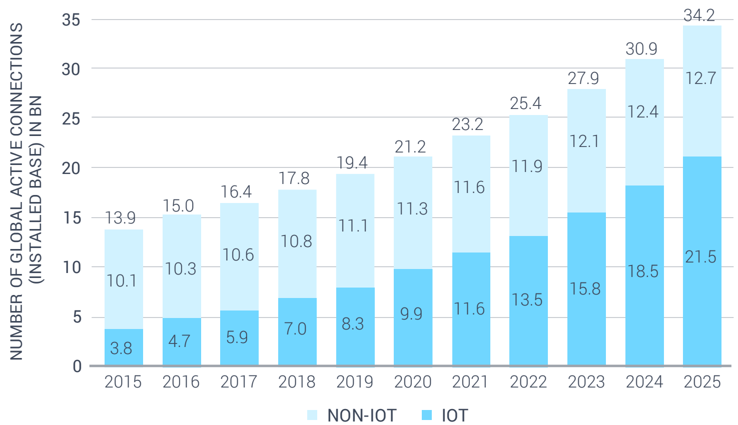
The number of IoT connected devices is expected to rise sharply over the next five to ten years as shown in the right graph. Each device is an additional entry point for a criminal.

- Hackers broke into a casino network through a smart thermometer in a lobby aquarium.
- The FDA is issuing alerts on several smart medical devices, e.g., cardiac devices and insulin pumps, which may be remotely accessed and used "against" patients.

GLOBAL SECURITY TRACKER 2019-2020



TOTAL NUMBER OF ACTIVE DEVICE CONNECTIONS WORLDWIDE



Source:
AtonRâ Partners, ProofPoint, https://iot-analytics.com/state-of-the-iot-update-q1-q2-2018-number-of-iot-devices-now-7b/

HOT TRENDS IN CYBERSECURITY

AI & Machine Learning – Virtue Or Vice?

AI is a dual-use technology

Most AI virtues such as easy scalability, low price, and potential for automation may also serve malicious purposes. As companies are adding AI & ML algorithms to prevent threats, hackers are leveraging the same tools.

- Cybersecurity platforms quickly adapt to firms of different sizes providing cheap, smart, efficient, and automated digital solutions.
- Automation and AI allow criminals to easily and inexpensively spread malware and be more efficient by finding a personal approach to each target.

Cybersecurity needs AI just like a sword needs a whetstone

AI can understand threats easily, reduce response times, eliminate human errors, and with ML it may recognize patterns in data, learn from its experience, and act without waiting for human input.

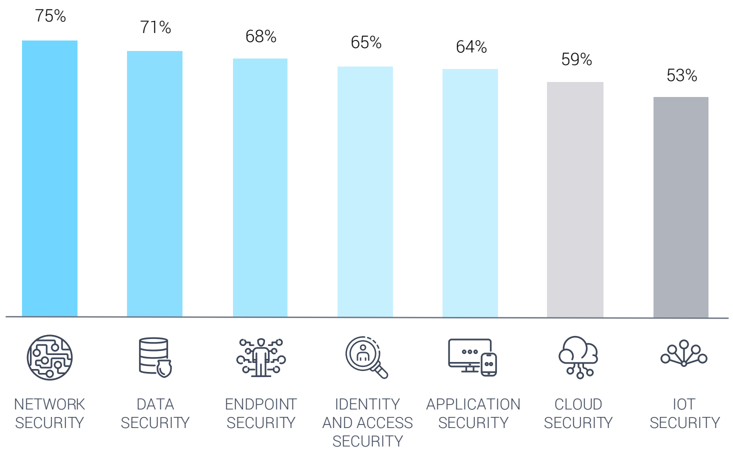
- Launched in September 2019 by DarkTrace, Cyber AI Analyst scans anomalies, synthesizes all the context of the attack, and reduces investigation time by 92%.

"Offensive AI" – an ultimate tool of malicious cyber weaponry

Financially motivated criminals may use open-source AI research projects, advanced ML and the human-mimicking ability of AI systems to create a sophisticated attack code. Such Offensive AI software would be able to mutate by learning about its environment and compromise systems undetected.

- A simple email phishing trojan Emotet upgraded with AI capabilities would be able to send personally tailored messages.
- AI-code already blends into the background, holds a genuine conversation with potential victims, and performs fast attacks with effective consequences.

ORGANIZATIONS' USE OF AI-POWERED CYBERSECURITY BY FUNCTIONAL AREA



Source:
https://www.wired.com/wiredinsider/2019/09/mimicking-cybersecurity-analysts-intuition-ai/, Capgemini Research Institute, AtonRâ Partners

HOT TRENDS IN CYBERSECURITY

Catalysts

- **Growth in ransomware costs.** As ransomware demands continue to rise, companies are likely to invest more in cybersecurity.
- **Increasing effect on civil order.** As more governments go digital and upgrade public infrastructure, more cybersecurity solutions are required to protect against cyber-warfare that could threaten civil order.
- **Fertile ground for M&A.** Over $6bn annual VCs investments go into a highly fragmented cybersecurity sector with a booming number of AI startups that will create many opportunities for consolidation in the industry.

Risks

- **Decreased budget spending.** US 2020 elections may lead to US military budget decrease, affecting public spending on cyber-warfare and -security.
- **Malicious AI outpacing Beneficial AI.** If a true "Offensive AI" finds no cyber solutions, public trust, spending and development of digital security may come to a halt.
- **Unmanageable number of attacks.** The exponentially increasing number of attacks may overwhelm security solutions. Without adequate protection against cyberattacks investments and public trust would decrease.

Bottom Line

- The Cybersecurity industry represents an attractive investment opportunity as digital security affects everyone, including governments, firms, and individuals. Sector growth is boosted by rising cybercrime, growing geopolitical tensions, and the addition of AI to the solutions toolbox.
- We favor this industry by having a considerable 30% exposure to cybersecurity in our Security & Space certificate, favoring solutions provided by Fortinet for 5G/IoT/Cloud/Endpoint protection and Leidos for Public IT and Healthcare cyber protection.

Companies mentioned in this article:

DarkTrace (not listed), Fortinet (FTNT US), Leidos (LDOS US), Proofpoint (PFPT US)

CREEATING THE CONDITIONS FOR TAKEOFF

A Good Story With Great Visibility

Timing has not cooled down our conviction

In early 2019 we added Cree in AI & Robotics and Sustainable Future themes as our belief in the value of the strategic turnaround of the company was in sight. The timing of the investment was not optimal for both endogenous and exogenous reasons.

- China-US trade war had a negative impact on business.
- Legacy businesses (LED lighting) weighted more than we anticipated on margins.

Strong(er) focus on core expertise

Since 2017, the company has focused on the manufacturing of key materials (Wolfspeed business line) for the power management, telecommunication and radiofrequency technology: sectors in which Cree has always excelled.

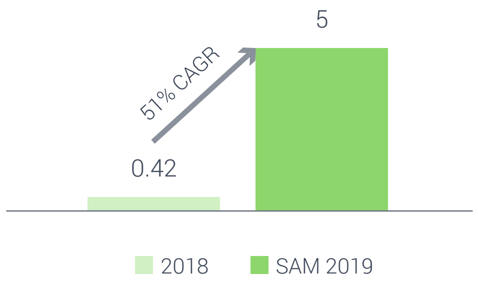
- In 2019 it has divested from the lighting business and reduced capacity production for LED and switched the manufacturing capacity towards Wolfspeed.
- Revenues contribution from Wolfspeed increased from 7% in 2016 to 50% in 2019.

Well positioned to serve high growth markets

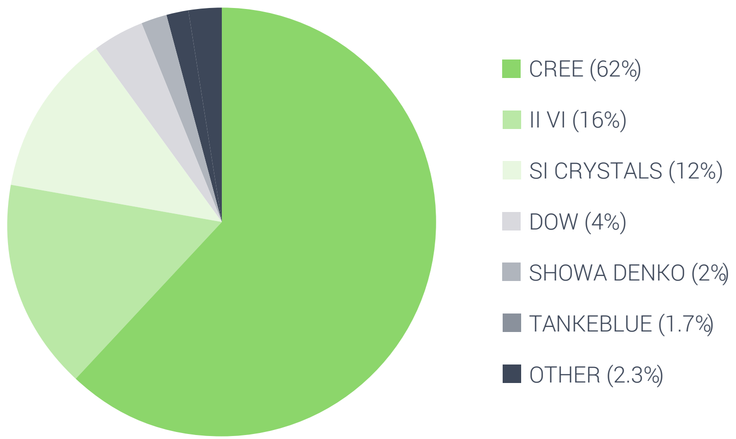
The company is the market leader for compound semiconductors, such as Silicon Carbide (SiC) and Gallium Nitride (GaN), two materials required to improve efficiency and performance in several fast-growing fields, such as electric vehicles (EVs) and 5G.

- Cree has a 62% market share for SiC, the second player (IIVI) stands at just 16%.
- Key deals were announced with STM, Infineon, On Semi, Delphi, ABB.
- A huge effort is underway to increase production capacity and meet future demand.

SIC ESTIMATED MARKET SIZE ($BN)



SIC PRODUCERS MARKET SHARE



Source:
Yole and Cree IR

CREEATING THE CONDITIONS FOR TAKEOFF

Way Better Than Silicon

Silicon Carbide, a truly revolutionary material

SiC and GaN are part of a family of materials called "wide bandgap semiconductors", that allow devices to operate in harsher conditions, such as higher voltages and higher temperatures, when compared to silicon.

- More efficient: up to 85% in power loss reduction.
- The material can dissipate heat, allowing to increase the density of devices.
- Microwave devices work more efficiently at high electric fields, a big advantage to cater to the needs of datacenters and 5G infrastructure.

Replacing silicon

SiC is a real game changer particularly in power management, namely the control of currents and voltages: battery-powered vehicles, fast electric chargers and production of renewable energy.

- Thanks to lower losses, SiC based EVs like Tesla extended their range up to 12%.
- Tesla 3rd generation superchargers use SiC and charge 50% faster.
- Solar and wind inverters become smaller, lighter and more efficient.

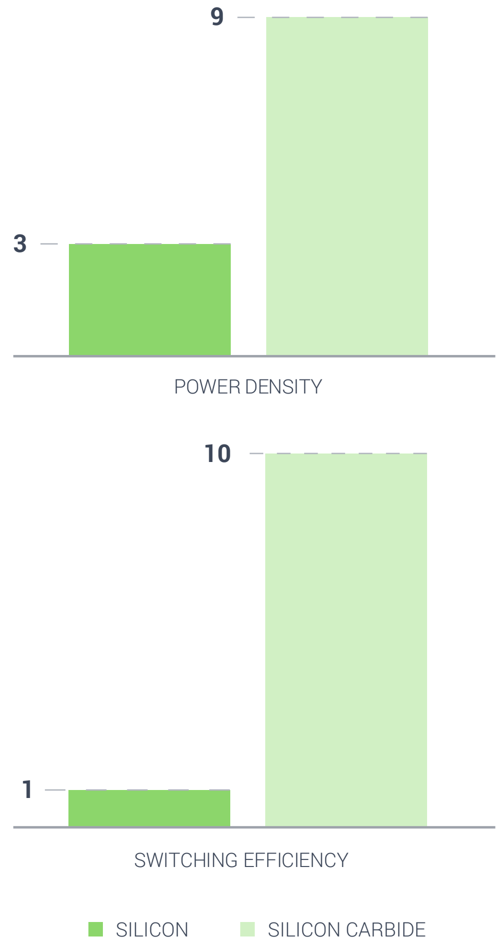
Scaling up to serve unmet demand

The business has been slowed by constrained supply and high manufacturing costs of SiC substrates. Cree has invested $1bn to increase its capacity and will be able to serve fast growing and diversified industries like Automotive, Energy Infrastructure, Aerospace & Defense, and Communication Infrastructure.

- The new factory will be fully operational in 2024.
- Capacity will be boosted by an impressive factor of 30.
- Economy of scale will drag wafer costs significantly down.

Source:
Cree IR

SILICON CARBIDE VS. SILICON



CREEATING THE CONDITIONS FOR TAKEOFF

Tracking Growth

Driving a cleaner world

Car manufacturers are heavily investing in electric vehicles (EVs) and SiC is already part of this equation for first-in-class companies, such as Tesla, BYD and Toyota. Cree has signed a series of long-term agreement with OEM to provide SiC supply.

- Cree's revenues from the Automotive sector are expected to reach $4bn.
- The incremental cost of using SiC, rather than current Si solution, is $200 per car.

A lighter and more efficient infrastructure

SiC has a higher thermal conductivity, i.e. it is capable of dissipating heat more easily. This property allows the material to work more efficiently even at high temperatures and high voltages, making it ideal for power conversion in several high growth fields.

- EVs' fast-chargers installed base will reach 3.3mn units in 2024.
- Partnership with ABB to provide solar and wind inverters with SiC components.
- These two segments are expected to account for $1.3bn in revenues for Cree.

A sky full of opportunities

SiC, GaN and SiC on GaN improve performances and durability across multiple applications, making them the ideal choice for the aerospace and defense sector.

- Compared to standard technologies, amplifiers made of these materials are 73% lighter, consume 83% less power, and last 60 times more.
- The total addressable market is estimated at $2bn and a >$450mn opportunity for Cree.

Source:
Cree IR

CREEATING THE CONDITIONS FOR TAKEOFF

Catalysts

- **Emission Regulations.** Automakers are obliged to heavily invest in greener technologies in order to reduce carbon emission. SiC is a no brainer for efficient hybrid and electric vehicles.
- **Transformational plan.** Initiated in 2018, Cree's turnaround strategy, that consists of substantial cost reduction programs and the scale up of fab capacity, will support gross margin expansion.
- **5G rollout expansion.** Cree's expertise on GaN and SiC constitutes an important leverage to be used in the buildup of the 5G infrastructure.

Risks

- **Re-escalating China-US trade war.** Trade tensions can hit both Wolfspeed and the LED business, as the exposure of Cree to China is >40% of its revenues.
- **Delay in factory expansion.** The long-term profitability of the company depends on the planned capacity expansion, therefore a delay in the production ramp-up may undermine the company's financial stability.
- **Silicon hits back.** Silicon remains the cheapest semiconductor material, and as long as it remains cost competitive it can undermine the adoption and takeoff of silicon carbide and thus Cree.

Bottom Line

- Thanks to a solid and bold strategy, good commercial channels and agreements, Cree is paving the way be become the undisputed leader in the provisioning of wide bandgap semiconductors for the automotive, energy and telecommunications industries.
- Despite the challenging short-term operating environment, we believe that the road ahead is straight as electric efficiency is becoming one of the key driver both to reduce emissions and boost performances. Therefore we remain convinced about the upside offered by the company.

Companies mentioned in this article:

ABB(ABBN:SIX), Cree (CREE:US), Delphi (DLPH:US), Infineon (IFX:GR), II VI (IIVI:US), On Semiconductor (ON:US), STMicro (STM:IM),

GLOBAL WARMING & AIR CONDITIONING

Room Cooling In The Spotlight

Air Conditioning is impacting the climate

Air-conditioners installed base continues to increase, as well as cooling-related CO2 emissions, driven by population growth, living standards improvements, and the world's urbanization.

- Air conditioning represents today 20% of total electricity demand for buildings
- and >12% of buildings' energy-related emissions.

New technologies to tackle the challenge

To cope with this new challenge, new air-conditioning systems are being developed, leveraging on IoT, data analytics, and cleaner refrigerant liquids.

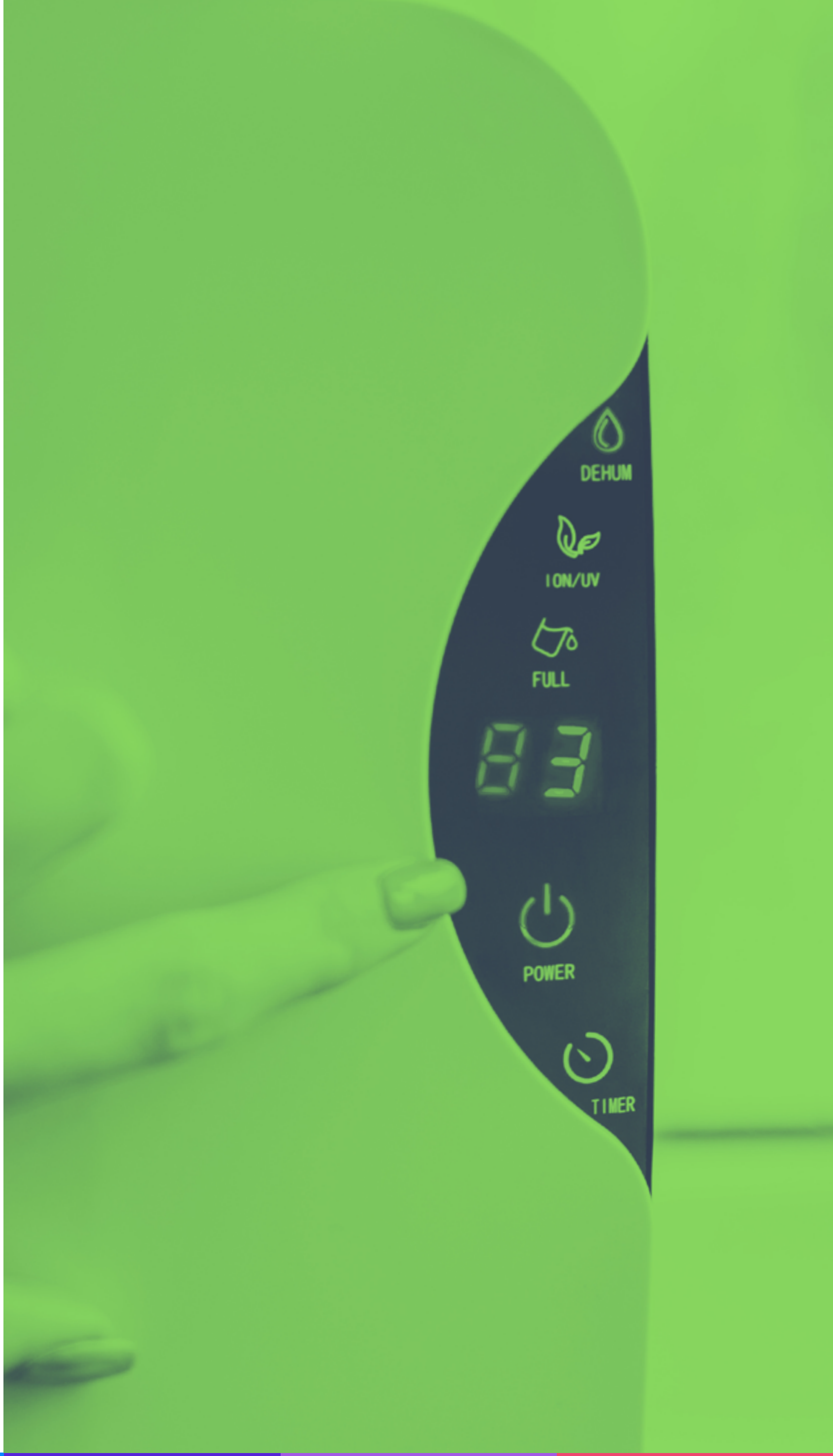
- Smart Air Conditioners (Daikin, Ingersoll Rand, etc.), using connected sensors and smart scheduling, could reduce electricity consumption by up to 40%.

Governments to lead the way

Governments' regulations are important to cut the cooling-related energy demand and effective policies are being adopted at the international level.

- The Montreal Protocol, signed in 1987 by the international community, banned the use of ozone-depleting substances
- and its consecutive revisions keep on raising the environmental standards for air conditioning.

Source:
The Future of Cooling, IEA, 2018,
https://www.iotcentral.io/blog/iot-transforms-the-way-users-interact-with-smart-air-conditioners



GLOBAL WARMING & AIR CONDITIONING

Summer Is Coming

Global warming is a fact

Global temperatures have risen by almost 1°C since 1880 and the past five years have been the warmest on record.

- Global warming is projected to reach more than +3°C by the end of the century.
- The number of cooling-degree days is expected to increase by 25% by 2050.

Air conditioners are on the rise

Rapid urbanization coupled with population growth as well as rising prosperity in some key developing countries is boosting the global deployment of air conditioners (ACs) and more notably room air conditioners (RACs).

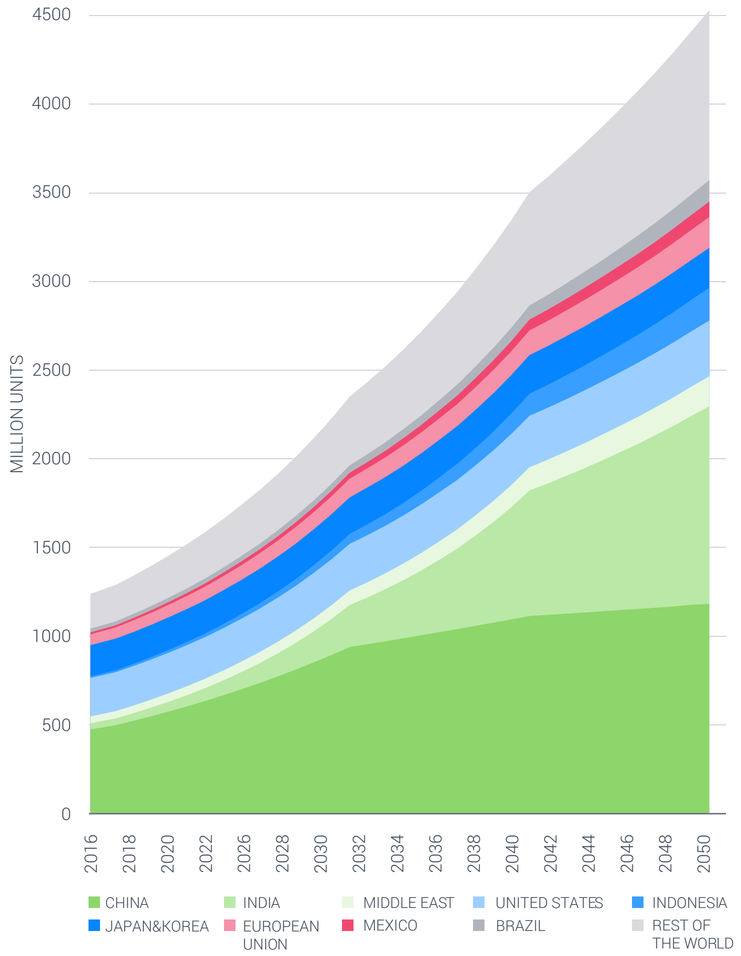
- RACs are systems with capacity below 15kW, representing 70% of all ACs.
- The number of RACs is expected to grow from 1.2bn (2016 data) to 4.5bn by 2050 on a worldwide basis.

A vicious cycle

Warmer weather fosters the growth of ACs which, when powered by fossil fuels, increase CO2 emissions, resulting in further warming: a vicious cycle.

- The energy demand for air conditioning is expected to more than triple by 2050, representing >12% of the global electricity demand.
- CO2 emissions related to powering ACs are expected to grow from 1'135 Mt (2016 figure) to 2'070Mt by 2050.

GLOBAL ROOM AIR CONDITIONER STOCK PROJECTIONS BY REGION 2016–2050



Source:
Solving the Global Cooling Challenge, Rocky Mountain Institute, 2018,
https://climate.nasa.gov/climate_resources/139/graphic-global-warming-from-1880-to-2018,
https://climateactiontracker.org/global/temperatures/

GLOBAL WARMING & AIR CONDITIONING

New Technologies On A Roll

Increased efficiency

ACs use compressors and fans powered by electric motors. Replacing fixed-speed drives with variable-speed drives improves efficiency.

- Motors can adjust speed according to room temperature (instead of only turning ON/OFF the system).
- Avoid energy-intensive restarts and saving 25% of power needs.
- Variable-speed ACs represent 60% of new sales in China, 80% in E.U. and U.S., but only 10% in India & emerging countries.

Integrated connectivity

Smart ACs integrating digital technologies & connectivity are now available on the market.

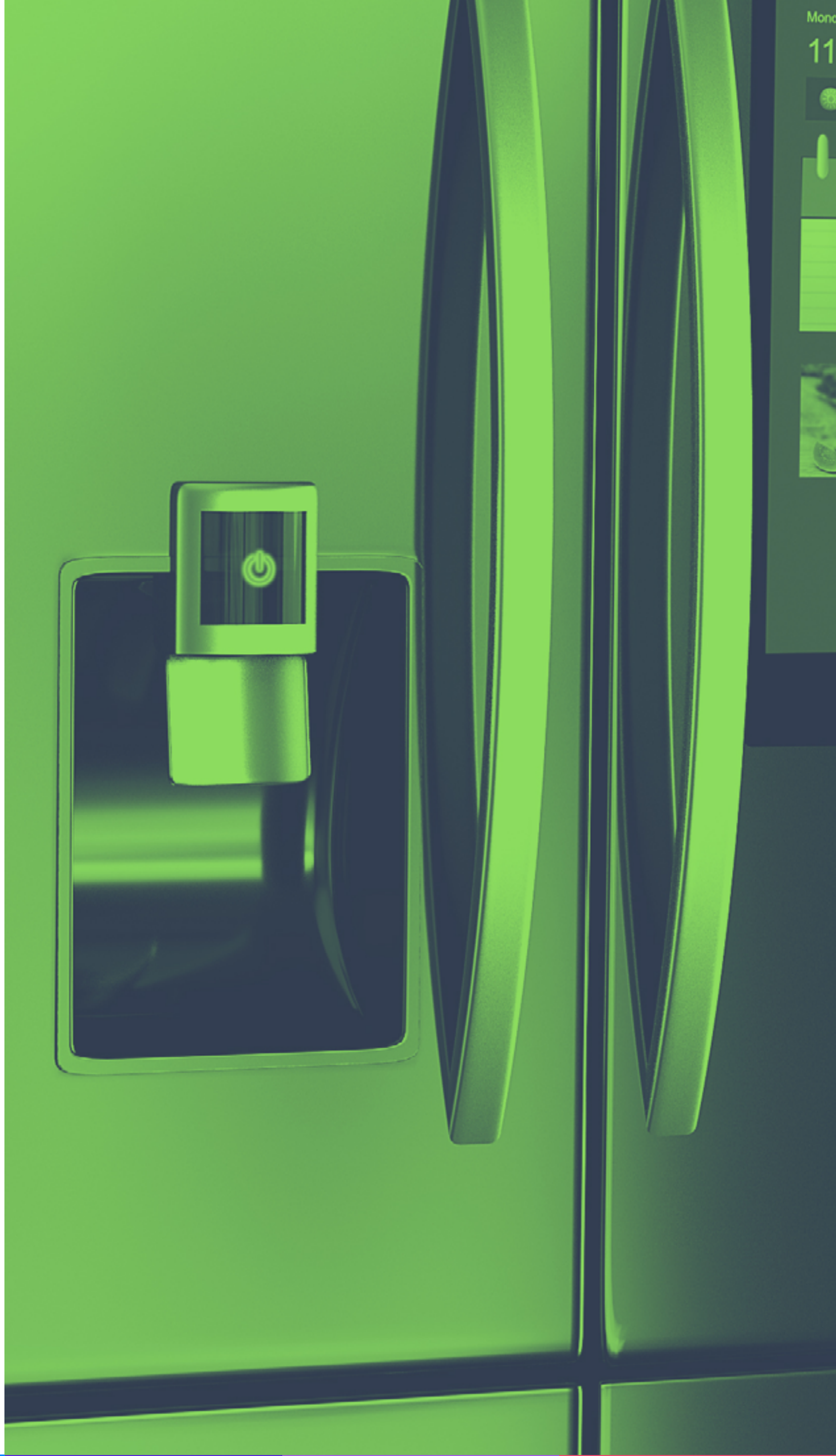
- Connected sensors enable a real-time response of ACs and introduce AI capabilities and data analytics for performance monitoring, proactive energy efficiency, fault detection and predictive maintenance.
- Trane's recently acquired EcoFactor, a cloud-based platform analyzing data from smart devices to help improve and develop such services for ACs.

Improved refrigerants

Refrigerants could have a major environmental impact if not properly selected. R-410A is today's most widely used refrigerant, it does not harm the ozone layer but contributes to global warming.

- The next-generation (R-32) refrigerant has a 30% lower global warming potential and reduces electricity consumption by 10%.

Source:
The Future of Cooling, IEA, 2018



GLOBAL WARMING & AIR CONDITIONING

Governments' Policies Are Key

International regulations

The Montreal Protocol, initially made to ban the use of ozone-damaging chemicals, was pushed one step further with its latest Kigali revision aiming to gradually phase down the use of hydrofluorocarbons (HFCs) over the 2019-2047 period.

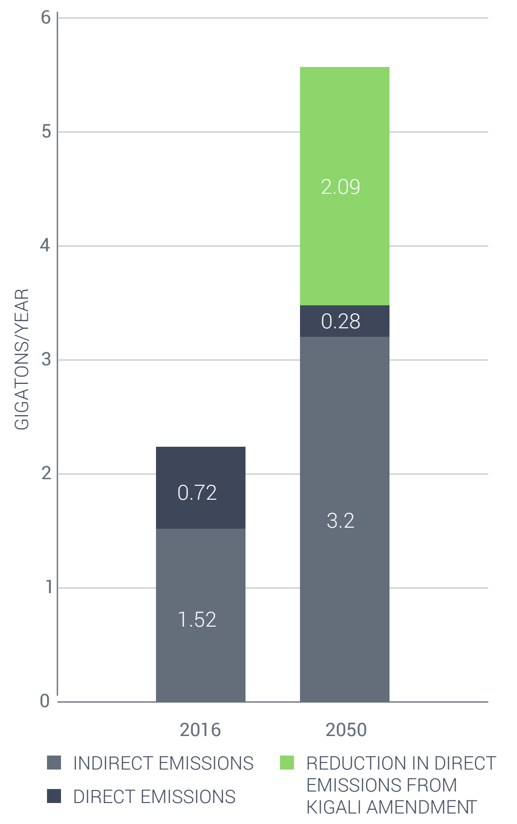
- In developed countries, HFCs use is to be cut by 45% before 2024 and by 85% before 2036.
- Countries will have to swift to Kigali-compliant refrigerants with low global warming potentials (GWPs).
- HFCs phase down is expected to avoid up to 0.5°C of global warming by 2100.

Labeling is a must that needs improvement

Labeling energy efficiency of ACs and setting up Minimum Energy Performance Standards (MEPS) is a useful measure for driving efficiency improvements.

- Several countries have already adopted labeling programs to push energy efficiency.
- In many regions, the most stringent energy label (i.e., the best "grade" available on the label) is still below the performance of the most efficient available ACs.
- Future policies should tend to impose stricter MEPS (which should be closer to best-in-class ACs performance), so that only the most efficient ACs are rewarded with the best grade.

IMPACT OF KIGALI AMENDMENT ON ANNUAL CO_2 EMISSIONS (DIRECT AND INDIRECT) FROM RAC OPERATION



Source:
https://www.unenvironment.org/news-and-stories/news/historical-agreement-hydrofluorocarbons-reached-kigali,
http://rmi.org/wp-content/uploads/2018/11/Global_Cooling_Challenge_Report_2018.pdf

GLOBAL WARMING & AIR CONDITIONING

Catalysts

- **Large multilateral fund.** Created to help developing countries to comply with the Montreal Protocol, the fund exceeded the $4bn mark, a significant amount of money which will be spent in new efficient AC technologies.
- **Phase-out of HFC refrigerants.** The E.U. has set a regulatory step down of HFCs' consumption by 40% in 2024, which should foster the transition towards low-GWP refrigerants.
- **Rising minimum energy performance standards.** The U.S. is requiring air conditioners to show an increased minimum seasonal energy efficiency ratio (SEER) from 2023.

Risks

- **Purchasing behavior.** Focus on upfront costs instead of long-term operational costs when purchasing an AC, tends to favor old & less-efficient technology.
- **High barriers to entry.** AC industry is quite concentrated with a few big players controlling most of the market as they benefiting from economies of scale, and hampering new, more innovative, entrants.
- **Geothermal breakthrough.** Geothermal HVAC systems (Ormat Technologies), using heat pumps to heat & cool a space, are gaining in popularity as they are the most environmental-friendly cooling option, threatening AC technology.

Bottom Line

- People will adapt to warmer temperatures and deploy cooling technologies to guarantee comfort while complying with new standards. Efficient AC providers e.g., Daikin Industries, or variable speed motors manufacturers e.g., Regal Beloit are best positioned to benefit from this trend.
- We remain convinced that deploying efficient cooling technologies will be key to address climate change imperatives in this space and we strive to select innovative actors in our Sustainable Future theme.

Companies mentioned in this article:

Daikin Industries (DKILY US), EcoFactor (not listed), Trane: a brand of Ingersoll Rand (IR US), Ormat Technologies (ORA US), Regal Beloit Corp (RBC US)

CHARTS FOR THOUGHTS

Fintech – An Emerging-Markets Story?

Fintech adoption is highest in emerging countries

Given the relatively low traditional banking development in emerging countries, Fintech (and notably mobile payment) have found fertile ground and little competition, allowing them to spread fast.

- Mobile- and smart-phones have been the trojan horses carrying Fintech into the most remote corners of the world.

Asian countries the most attractive

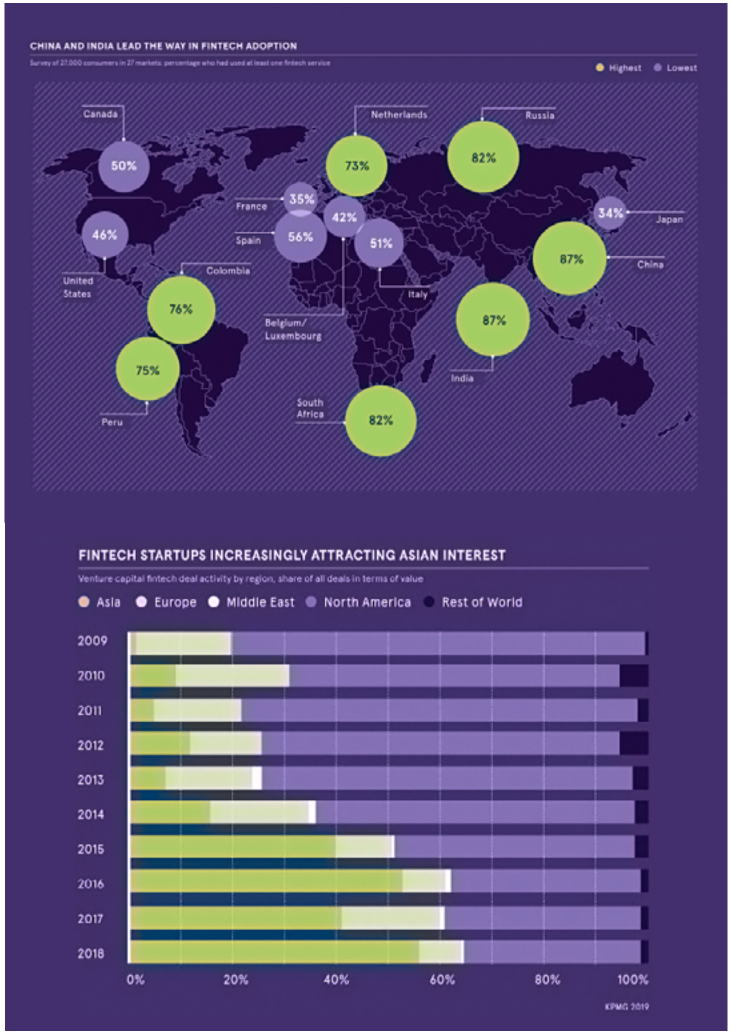
Within the emerging markets, Asian countries offer a higher relative wealth, as they have mostly benefited from the stunning growth of China, as well as pure demographic factors. No wonder investments focused in this area.

- China has been the engine of Asian growth over the past few decades.
- Asia is home to >60% of the global population.

High penetration rates achieved – what next?

Emerging markets penetration rates are topping out, but underlying growth remains, driven by horizontal expansion (increased services) and improving overall wealth levels. On the other hand, developed countries offer average wealth levels that are multiples of those in emerging markets, and penetration rates that leave plenty of room for growth.

- Striking the right balance across verticals and geographies will be key.



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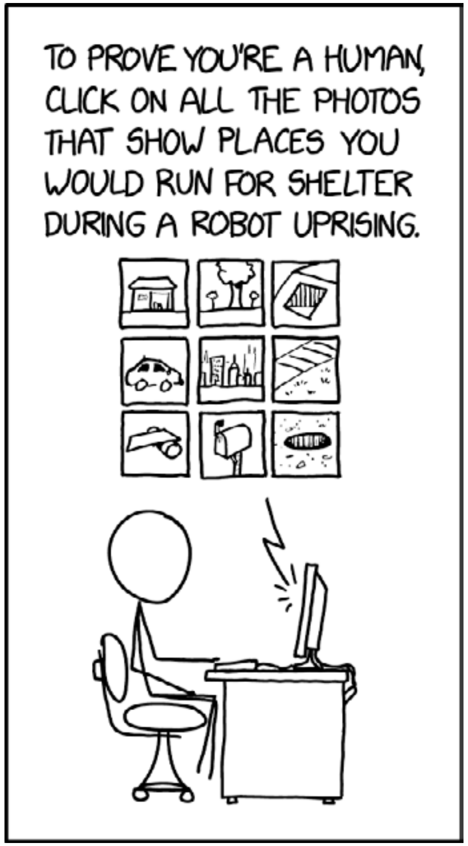
CASUAL FRIDAY



SOURCE:
https://xkcd.com/2228/

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