TREND ALMANAC
2020

10 Trends - the most important tech and human trends reshaping your world in 2020

Bank-roll Your Shopping

Banks witnessed startups pocketing huge sums with point-of-sale financing: now they want in.

Prioritizing Value in Healthcare

How technology and regulatory forces are driving the shift to value-based care.

Taking the Quantum Leap

Quantum Computing takes off as the ecosystem grows and the toolkit expands.

The CRISPR Revolution

CRISPR, a once-in-a-generation innovation, is moving into clinical trials.

"The future is not a gift, it is an achievement."

- Albert Einstein,
- Harry Lauder,
- Robert F. Kennedy*

*Source with multiple attributions: it doesn't need to be precisely sourced to be universally true.

Thinking Forward

Welcome to the third edition of Virtusa xLabs' Trend Almanac.

As we enter a new decade, we can see the momentum of emerging tech continuing to reshape our world at a relentless pace. Data continues to proliferate. AI continues to pervade our work and home life; and it is becoming increasingly easy to implement new tech without eye-watering budgets and squads of PhDs. As they say, the only constant is change.

Business leaders are still in two minds about this tech-enabled future. On the one hand, there's a utopian view in which hyper-connected companies draw on dynamically scaling hybrid-clouds, and filter value from vast data lakes. They launch new joint-ventures that capitalize on fleeting windows of opportunity, with an ever-changing roster of partners. On the other hand, the dystopian view sees tech unleashing disruptive chaos; poorly focused regulation presents hurdles and no protection; and commercial success and ethical behavior are seldom bedfellows.

Realistically, neither of these extreme options will exist. In the near-term, businesses will navigate a middle path, with both commercial and regulatory pressures giving course corrections along the way. What matters today is not pondering the long-term fate of business. What matters is identifying relevant emerging technologies and placing bets with a high probability of creating a commercial difference. This is clearly easier said than done, but we hope that the Trend Almanac highlights some tech and use cases that will help you to narrow the odds that your bets pay off.

Across all the trends gaining traction this year, we have identified three overriding themes:

• The democratization of emerging tech, reducing the investment and skill needed to develop and capitalize on tech across infrastructure, applications and data.

• The need for transparency, ethical practice, and good governance to balance the manic rush to explore and exploit "The New".

• A change in how companies manage tech-enabled innovation programs, ensuring that tech is seen as a means to drive better commercial outcomes, rather than being an end in itself.

In essence, these overarching trends point to the fact that the barriers to innovation are reducing. Nonetheless, ensuring that innovation programs generate long-term value still comes down to three questions: which tech to focus on; how to identify relevant and radical uses cases for the tech; and, lastly, how can companies foster innovation in a way that rapidly filters ideas with commercial potential from those based on hype, and accelerate the cycle of getting great ideas into production.

We hope that you enjoy reading this year's set of trends and that at least one of them creates a spark of inspiration that helps you identify a new emerging tech project in 2020.

Best regards

Senthil Ravindran

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Trend Overview

1. Shop Now, Pay Later

Point of sale finance is getting red hot. In recent years, digital startup lenders have carved up the segment, leveraging the latest tech to introduce installment loans to the millennial market, but also thinking outside the box by devising new business models. Consumers are on board, as are retailers. Meanwhile, banks have mostly been onlookers, having decided not to develop their own customer-facing solutions. In 2020, we think banks will get in the game.

2. No Child's Play in the Sandbox

A new breed of regulatory sandbox is making waves. Thematic regulatory sandboxes are credited with taking a more focused approach to sandbox design, where the policy objectives as well as the problem tackled by the sandbox are clearly defined. This appeals to regulators as much as fintechs and big firms, who are looking to build engagement and accelerate promising innovations to markets in a controlled and safe environment.

3. Open Banking Goes Global

Open Banking is starting to become a global movement. To date, actual regulations and market changes have only occurred in Europe, even though as a topic it has been on everybody's tongue. But the move by Australian regulators to implement substantial regulatory reforms this year, giving consumers greater control of their data, signals the paradigm shift to the API economy is well underway. We explore this trend and classify the current approaches to Open Banking across the world.

4. Value Over Volume in Healthcare

Healthcare systems around the world are sinking under the weight of escalating costs. However, there are positive signs that a transition is underway from the reigning fee-for-service delivery model, which has contributed to the cost overhang in many countries, towards the value-based care model. Regulatory and technology forces are key factors that are driving this shift. In 2020, we believe this pivot to value-based care will gain further momentum.

5. The End of All Disease?

CRISPR is a breakthrough technology lauded for its extraordinary precision and ease of use. Since Doudna and Charpentier's landmark paper was published in 2012, there has been a flurry of research activity and much progress as well as media interest in the field. CRISPR is now poised to move into the next phase in the journey from lab to market.

6. From Factory to App: Automobiles Take a New Route

Consumer adoption of "mobility as a service" (MaaS) is challenging the auto manufacturers' traditional approach to "mobility as an asset". Tech-enabled innovations, such as ride-sharing, last-mile micro mobility solutions, and the rise of autonomous cars as a utility, are driving the growing popularity of MaaS offerings. In 2020, auto manufacturers will join this trend by creating new propositions around MaaS.

7. Ready, Set, Quantum!

After decades in the wilderness, quantum computing is finally hitting its stride. Instead of being held back by hardware hurdles, in a surprising twist, enterprises have been powering ahead with innovations on "near-term" quantum machines. No longer is this esoteric field the domain of researchers alone, it is now being addressed by a broader set of players, helped along by greater access to tools and collaborations.

8. Corporate Innovation Labs Grow Up

The reputation of corporate innovation hubs has taken a hit in recent years, causing businesses to rethink their operating model. This year, there will be a greater focus on empowering a network of affiliate labs in a federated model, which will enable labs to pursue innovation rather than incremental optimizations. With this model, there will be greater alignment between the business unit's objectives, its funding, and the activities of the innovation program.

9. Self-Aware Infrastructure

In a digital world run by infrastructure, machine learning is weakening the dependency on human supervision. Progressively, smart infrastructure will be able to self-govern, self-optimize and self-heal, resulting in highly optimized, fault-tolerant tech infrastructure. As cloud service providers continue to expand their footprint in the infrastructure market, we will see the first signs of self-aware infrastructure in 2020.

10. Machine Learning for All

In 2020, we believe there will be more efficient algorithms to automate Machine Learning (AutoML). This will spur adoption of AutoML at the enterprise level, helping non-tech firms access the capabilities to build ML applications quickly. This democratization of machine learning will also make AI experts and data scientists more productive and advance the field of AI to new frontiers.

Shop Now, Pay Later

Banks are reconquering the customer relationship by offering point of sale finance

Something is up with "point of sale" (POS) finance.

Decades ago, when purchasing a consumer durable, rather than pay for it all at once in the shop, you could apply for a short-term bank loan and pay it off in installments. Sounds simple? It wasn't. There was a pile of paperwork and then the tedious wait for the bank's verdict on your application. The same was true with higher purchase plans, but these typically carried steep fees and interest rates. For many people, POS finance was just too painful to bother with. At any rate, before long, the credit card arrived on the scene and ousted POS finance as the preferred consumer finance option. For years, POS lay in the shadows.

Fast forward to 2020, and the ground has shifted. Digital startup lenders, of the likes of Blispay, Bread, GreenSky, LoanStar, and Vyze, have reinvented POS finance as an automated, seamless customer experience to rival the credit card. This is growing their loan balances (up to 38% in 2018 from 35% in 2017).[1] It's also causing VC firms to shell out big bucks. For example, Klarna, a leading "buy now, pay later" online payments firm, is Europe's largest private fintech with a $5.5 billion valuation,[2] and Silicon Valley-based Affirm was recently valued at $3 billion.[3]

For retailers, having a POS financing option is a significant differentiator, helping to build customer loyalty and convert sales.[4] Banks are enjoying a more diversified loan book at a time when demand for real-estate loans and car loans are sluggish.[5] Customers, for their part, can now easily access a simple loan with clear payment terms. Nowadays, when customers buy shopping-cart items on an e-commerce website, they are increasingly turning their backs on predatory credit cards in favor of "pay later."

In this payment model, the retail transaction is funded in near real time. The merchant makes the sale. The online lender wins new business. The customer receives the items a day or two later. Alerts from the digital lender keep the customer on track with the payments over a fixed period – usually in monthly installments – with no fees, and no compounding interest.

Another shift is also beginning to take place. In the past, banks dominated the consumer credit landscape. Today, they have been relegated to the back end of a market said to represent a 1.8 trillion-dollar opportunity. While banks have been slow off the block in developing customer-facing solutions, they are still within striking distance due to their size, stability, and tremendous cash flow advantage. In 2020, we believe banks and financial institutions will reassert themselves to win back market share.

Let's rewind. In phase one, fintechs took the initiative. First, they noticed that millennials don't trust incumbent financial institutions and are reluctant to be saddled with ongoing credit-card debt[6] , with only a third of millennials owning a credit card in the United States.[7] Besides being debt-averse, as a group millennials tended to face higher rates of denial of financial products because they lack sufficient credit history.[8] They were also less inclined to make larger purchases, like furniture and TVs, preferring experiences over material things. Accordingly, fintechs rehabilitated POS finance by going after the Millennial market, helping them to finance big-ticket items, and even smaller items, with more straightforward credit products.[9]

Second, the mass diffusion of apps and smartphones, as well as consumers' increasing confidence in non-bank digital lenders,[10] opened the door to disruption.

Third, fintechs fully automated the underwriting process. As Forrester reports, they have "combined online lending and improved credit scoring with digital payments and digital checkouts to enable immediate funding." By and large, fintechs have partnered with commercial banks to issue the loans, and the credit is restricted to retail goods and services. For this reason, merchant acquisition is critical to their business model.

Taken together, online lenders have succeeded in reigniting the POS finance market, throwing the race wide open.

In phase two, we believe mainstream banks, emboldened by these developments, will move into POS finance with their own customer-facing solutions. Already, JPMorgan Chase has entered the fray. In February 2019, the bank unveiled several initiatives, including "My Chase Plan" and "My Chase Loan", to tap the growing consumer demand for POS finance.[11]

They are also on the acquisition drive. In 2019, Mastercard created a new role for itself in the POS finance market when it snatched up Vyze, a fintech with an end-to-end platform offering microfinancing options for merchants' customers at checkout.[12] Meanwhile, Visa inked a partnership deal with Payworks to combine capabilities and white-label its payments platform, enabling a direct relationship with the customer.[13]

Another critical turning point was SWIFT's publication of a new standard for pay later APIs, called the "Transactional Finance Application Programming Interface", created with the input of UK POS finance fintech Divido.[14] The interbank payment network believes that having a single standard for merchants to connect with member banks around the world will minimize the need for multiple costly implementations.[15] The standard will facilitate instant loan approval between banks and e-retailers and is due to be revised in 2020.

In all, this string of developments signals that the big financial players will be embracing installment loans as a matter of priority. Less clear, however, is precisely how they will try to fully capitalize on the trend. Both from an operating and business model perspective, strategic decisions need to be made on how best to leverage tech innovations around new payment channels. With so much up for grabs, the race is on.

Examples

One Second Loans

Citizen Bank has developed its own powerful loan platform that offers interest-free loans at checkout for the consumer while charging the merchants a fee for each loan.[16]

Its relationships with merchants have been critical to its success. Merchants like the platform because it provides a frictionless experience, and it makes their products more accessible and affordable.[17] Citizen Bank is the exclusive point of sale lender for Apple's iPhones in-store and online, and it has also stitched up exclusive partnerships with home security firms, Vivint and ADT.[18] In October 2019, the bank announced a partnership with Microsoft, whereby it will finance consumers wanting to buy the Xbox All Access program with 0% APR and a "seamless" point of sale experience through Amazon's online checkout in the US.[19]

Since mid-2015, Citizen's portfolio of unsecured consumer loans has more than tripled. Another key factor for Citizen Banks' success is the speed at which the loans get approved and funded. The bank claims its loans get approved "in less than one second" with a simple swipe of a credit card.[20]

PayPal Credit

One of the main benefits of PayPal's point of sale "PayPal Credit" is that it can be obtained with or without the merchant's consent. When customers pay using PayPal, they are automatically directed to PayPal's checkout page where PayPal Credit is one of the payment options. After running an automated credit check, PayPal Credit offers four-month interest-free credit on any products valued at $99 or more.[21]

In 2019, it surpassed £2 billion in UK lending and 1.5 million PayPal Credit accounts.[22]
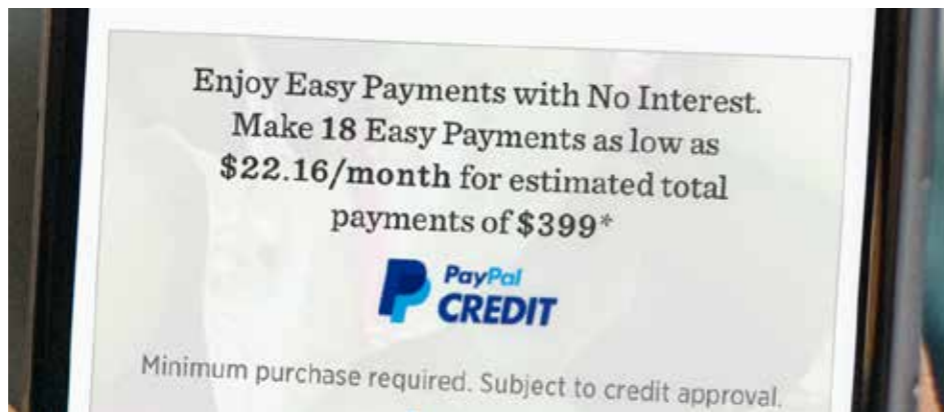
PayPal Credit Payment Interface[23]

The Klarna Card

Founded in 2005, Klarna is something of a veteran in the POS market. The Swedish startup has an established network of 190,000 retailers worldwide, and over 80 million people globally have used its services. The company offers three alternative payment models to its customers:

1. Interest-free installments: spread the cost in three installments that are charged monthly and automatically with no fees or interest.

2. Pay up to 30 days later: "buy now, pay later" having seen and tried the product.

3. 6-36 month financing: spread the cost over flexible payment plans, applying at checkout and receiving instant approval.[25]

Klarna's solutions are available for both online and in-store shopping, with a variety of payment methods, such as QR code scanning via the customer's phone or being transmitted a link by SMS or email so they can fill out their personal information and select a payment method.[26]

Klarna entered the UK market in 2014 and has nurtured a 3 million-strong active user base, with 100,000 downloads of the app in August 2019 alone. At its last funding round in April 2019, the company was valued at $3.5 billion.[27]

Pushing from the digital into the physical payments space, Klarna recently introduced a new approach to POS finance by launching a Klarna payment card in Germany that links to their customers' bank accounts. The card is targeted at credit-card-less Millennials and allows users to choose whether they wish to pay for their purchase immediately or within 14 days, without any interest fees. Customers can use the Klarna app to set a threshold and automate which purchases they wish to pay later.
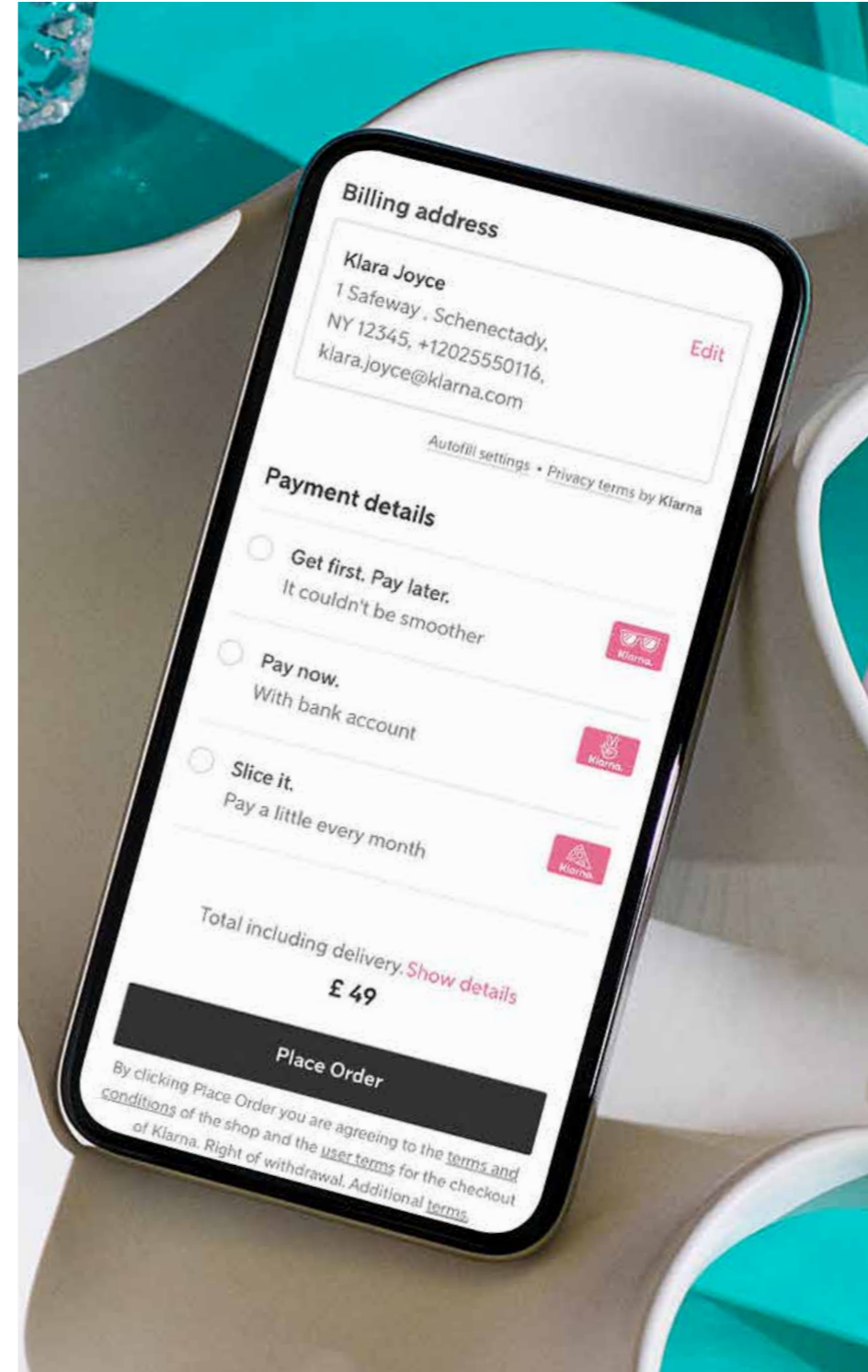
Klarna App Interface - Payment Options[24]

Shop Now, Pay Later

Expert Interview

xLabs interviewed Amit Bhute, Senior Vice President and Global Head of Banking & Financial Services at Virtusa, about our 2020 trend of greater bank activity in the point of sale loans market.

Why is point of sale (POS) finance becoming popular?

Younger consumers are attracted to "buy now, pay later" models, which are encouraged by retail brands. With more time to pay for purchases, they are more confident to buy items of higher value, enabling them to obtain higher specification or higher status brands.

Young people are also less inclined to use credit cards with rolling credit, where the rate of interest and non-payment penalties are likely to be high, preferring short-term credit options for specific purposes.

POS finance is also becoming popular due to increased availability and visibility at checkout, especially online.

What is in it for the merchant?

One immediate benefit of POS finance models, compared to debit or credit cards, is the amount of time between the purchase being made, and the merchant receiving the funds, with the POS finance provider typically paying the merchant same day, improving cashflow.

The application process is typically a lot less form- and document-heavy than traditional credit and loans, which helps to decrease time at checkout and avoid cart abandonment. POS finance is increasingly making credit viable for smaller value single purchases.

Giving the consumer the ability to pay later may encourage them to purchase higher value items, or reduce the need for discounting.

How are players in the credit- and debit-card world reacting to the opportunities and threats in the POS finance market?

For the players in the card ecosystem, POS finance outside of their traditional routes causes a revenue losing headache in terms of fees both from merchants and consumers. As with the threat from Open Banking and PSD2 payment initiation models in Europe in retail, the current approach appears to be "joining with" rather than beating, with Mastercard acquiring Vyze, and JPMorgan entering the POS finance space as a provider.

What hurdles do banks face in developing their own POS offerings?

It's hard for banks to develop this functionality, as it relies on elements including access to the merchant's POS ecosystem, a defined process, and an available finance product to support the flexibility and relatively low value of credit required. The process piece can be mitigated by using a standard such as SWIFT's Pay Later API.
In addition, testing products end-to-end that include third-party merchants can be tricky, with the bank potentially needing to build and/or procure their own point of sale emulator.

What new business models will arise with a POS finance capability?

As the name suggests, point of sale financing usually occurs at checkout, that is, at the end of the buying process. Yet there's been an interesting recent development involving point of sale lender, Affirm, which has created an app that encourages customers to start their shopping journey with it. Essentially, customers accessing the app can find locations where they can shop using Affirm's POS finance system. If Affirm can change consumer behaviors by wooing them to open their shopping app at the start of their product search process, Affirm is in a position to forge a closer relationship with the customer and solidify loyalty. Of course, Amazon dominates the product discovery space in the US. So, for Affirm's ambitious gamble to pay off, it will have to lure Amazon customers to its platform.[28] This case study alone highlights just how disruptive having financing options can be in the retail environment.

Another point to make is that financing doesn't have to be in the form of a loan. Banks could look at potentially introducing merchant specific "lines of credit" for their retail customers, allowing them access to credit for certain retailers – think academic publisher selling books to university students, for example.

What impact will this trend have on bricks and mortar retailers?

Today, POS finance seems to suit e-commerce rather than physical point of sale – except for large household purchases, such as white goods, and furniture – as it does add some friction to the payment process and requires more sophisticated physical point of sale technology. Times are changing, and as customer demand drives the need for retailers to provide support for contactless card and mobile wallets, other factors are influencing the future of POS, such as Open Banking, or other viable alternatives to cards (Mastercard's Pay by Bank app is a good example). All of this is moving point of sale technology forward to be more flexible and adaptive to new trends, enabling physical retailers to stay relevant.

What will banks need to do to be competitive in this space?

Fintechs have started out with an undisputed advantage. Their technological agility and customer-sensitivity have ruptured the POS loans market and pulled them into a position where they can court and win the customer relationship.[29]

Yet a striking aspect of POS finance is that customers don't harbor strong feelings and loyalties about any provider. What they value is convenience. So, while banks have been slow to push into the space, they still have time if they act quickly to take up a strong market position. Doing so will require a strong merchant strategy to onboard them to the banks' platforms. We think they should consider utilizing a standard such as "pay later" to enable better merchant penetration.

It will also demand technology to enable the bank to process potentially a new type of credit product with all that entails – calculating risk and repayments, then approving or rejecting loans – all in real-time, 24/7. Behind this process, banks will need to look at how the merchant integration will work over APIs, as well as how the loan, the payment to merchant, repayment process, and customer journey will work. This will need service design and will probably mean building new APIs and microservices linking the channel to the back office and systems of record.

What role will regulators play in this emerging microfinancing ecosystem?

Regulators will be examining the social impacts of this innovation, monitoring whether the growing demand for point of sale lending will create a wave of increased debt, particularly as these options are popular with young people. Although it differs from traditional credit, when a customer defaults on an installment loan it still impacts his/her credit rating, which many consumers don't fully appreciate.[30] Given these concerns, the UK's FCA is already looking to introduce new rules around "buy now, pay later" services.[31]

What will the next phase look like in point of sale lending?

E-commerce retailers will be working with banks to analyze customer spending habits and basket contents to provide dynamic financing offers while the customer shops. This will enable the retailer to use POS financing as an incentive to drive customers toward offers and promotions, such as buying a higher spec (more expensive) TV, by providing better finance terms on the higher priced option.
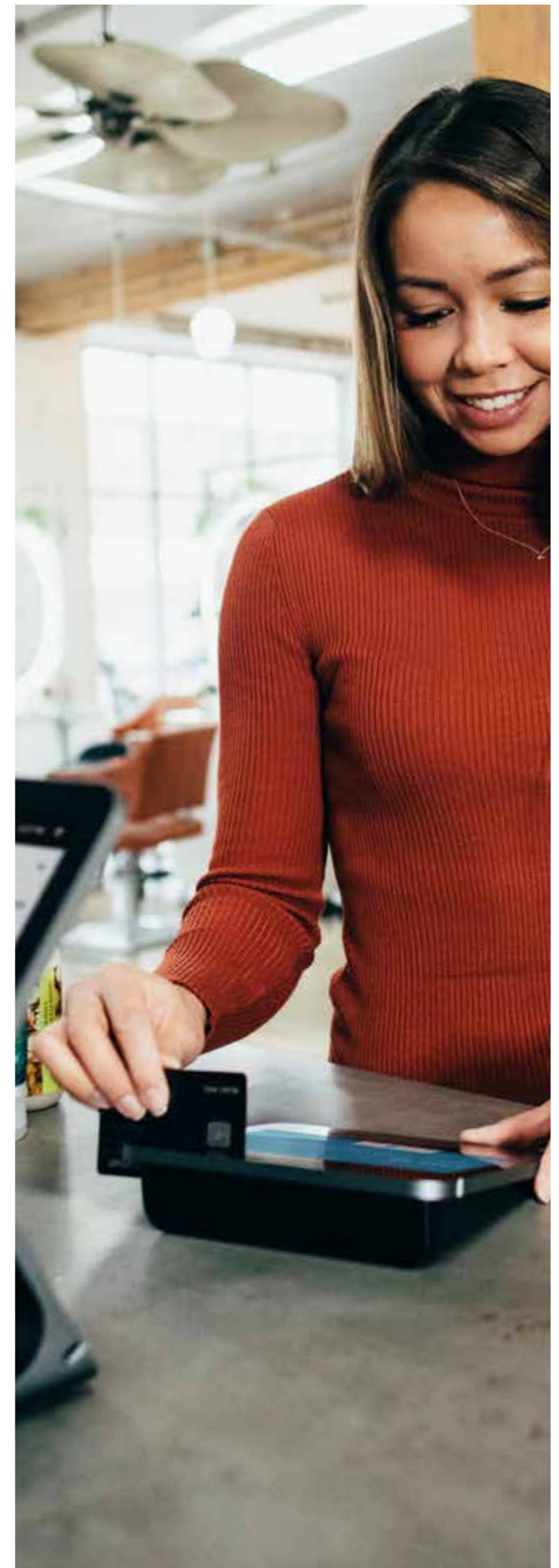
No Child's Play in the Sandbox

Regulators are embracing change by introducing thematic regulatory sandboxes

A London-based fintech was in the throes of a funding round when things started to go awry.

The young team, every inch "tech wunderkinds", had barreled along with product development, mindful of the regulations. Ahead of the audit deadline required by their funders, however, they decided to check the compliance rules - and uncorked a nightmare for their troubles. They discovered in certain critically important areas they were not compliant.

A flurry of back-and-forth calls with the regulator followed, documents were meticulously assembled, and then there was a crazy day when everyone in the firm halted work to scour the internet for more guidance. In the end, a lucky encounter with an entrepreneur who had already gone through the regulatory hurdles was the most valuable source of advice.

This tale of woe is a common experience for fintechs as they pursue market entry. But the increasingly cumbersome and expensive compliance process is also a tricky place for regulators to be. Today, regulators sit at the intersection of accelerating technological change, growing global interconnectivity, and a fragmenting financial services system. While the authorities have always had to deal with change, the staggering pace and range of new technologies and competitors hitting the market is stretching their capacity to monitor and manage risk. At the same time, it's threatening to unpick some of their traditional assumptions about the market and their oversight role. In this context, how can financial regulators best respond?

In 2020, we see regulators continue to devise new tools to take better measure of these macro developments. Leading the pack is the "regulatory sandbox", which has stormed the headlines and been adopted by regulators worldwide[1] since it was introduced in 2016 by the UK's Financial Conduct Authority (FCA). This year, the sandbox tool will evolve with new variants emerging, such as "thematic regulatory sandboxes" (TRS), which we believe will have a high take-up rate with regulators.

A regulatory sandbox (RS) provides a "safe harbor" for early-stage companies and other tech firms to test innovative products, services and business models in a limited, live-market environment, without having to be fully licensed.

Participating firms get a limited license to do a trial run of their project to check for viability in a real-world environment, and – if it works – opt for a full license. If it falls short, they can refine their business models in a controlled setting. Other firms might use the sandbox to fast-track the development of a minimum viable product. Still others might use it to enhance their understanding of the relevant regulatory requirements and ascertain the types of authorization they might need.

For the authorities, the value of a sandbox framework is varied and linked to their principal regulatory mandates. Some common reasons for adopting a sandbox include supporting the fintech ecosystem, driving economic growth, expediting compliance work, and an increasing emphasis to support innovation.[1] In the FCA's case, it is predominantly used to encourage competition by reducing time to market at potentially lower cost, improving access to finance, and helping more innovative products reach the market.[2]

A TRS, by contrast, has a greater focus than its general purpose cousin.[3] For unlike regulatory sandboxes, thematic sandboxes take a highly targeted approach where policy objectives are clearly defined and the problem tackled by the sandbox is spelt out. This in turn shapes sandbox design, eligibility criteria for participants, and the range of possible outcomes. To land on the right sandbox objective, the World Bank's independent think tank, CGAP, is proposing that regulators pay greater attention to industry consultation, soliciting their viewpoints early and repeatedly to help inform their decision-making.[4]

Why are regulatory innovations like thematic sandboxes, "express" sandboxes,[5] sandbox umbrellas,[6] and piloting programs gaining momentum? Looking at their histories goes some way to finding our answer.

The global financial crisis was a watershed for the regulation of the financial system. Before the crisis, the regulatory posture towards financial innovation was laissez-faire in the West and, for the most part, absent in the East. Into this free-wheeling space, novel derivative products like "collateralized debt obligations" began to beguile Western markets, and by 2008 it was clear they had helped run the US economy aground.

The resulting global meltdown ushered in a new regulatory paradigm that was radically at odds with the pre-crisis era of deregulation.[7] Driven by the authorities' twin priorities of financial stability and consumer protection, markets underwent a major period of reregulation.[8] In short order, banks were compelled to prepare recovery and resolution plans, submit to stress testing, increase their capital requirements, and massively increase their reporting obligations.[9] The EU's General Data Protection Regulation

(GDPR), a sweeping data privacy regulation for consumers, is in line with this movement. Together, these post-crisis reforms have fundamentally reshaped the business models and structures of banks.[10]

Against this backdrop, fintechs began flourishing in the West, unhindered by burdensome, costly compliance requirements. In the East, meanwhile, the fintech explosion was catalyzed by the pursuit of economic development. As these "too small to care" enterprises matured into "too big to fail" juggernauts, they graduated into systemically important institutions[11] where the bulk of regulatory efforts are concentrated. The neat division between regulated traditional banks and the unregulated rest began to collapse.

Standard regulatory instruments weren't holding up in a dynamic environment. So the regulatory bodies began to cast about for new thinking and methods to better address the increasing "digitization and datafication" of the financial system.[12] A breakthrough innovation was regulatory technology ("regtech"), which uses information technology to support regulatory monitoring, reporting, and compliance. Regulatory sandboxes have now stolen the show.

They began cropping up globally in 2015, emerging out of *institutional access points* that regulators provided for firms seeking guidance on navigating regulatory requirements. Since then, RS has caught on like wildfire with regulators. Even the media were quick to pounce. Before long, these two innovations became the buzzwords of an emerging regulatory paradigm, in which the need for financial stability and consumer protection is balanced against the need for innovation and economic growth.[13]

One of the criticisms leveled against regulatory sandboxes, though, is that it's all just hype, that they haven't met their policy and regulatory objectives.[14] Significantly, to date, sandboxes have not attracted high participation rates by firms.[15] Taking the most mature sandbox system as an example, since the FCA rolled out its sandbox there

have been only 117 participating firms. In the UK, there are over 60,000 licensed financial institutions. Unless the sandbox can draw in more firms, it's hard to see how the regulator can reach its policy objectives, be it to increase competition, promote innovation, advance financial inclusion, or reduce compliance costs.

In a conversation with xLabs, Sharmista Appaya, a Senior Financial Sector Specialist at the World Bank Group, said "the regulatory objectives for setting up a sandbox vary, especially across different regions. So, they should not be measured with the same metrics. Yet there's a tendency to do that, which doesn't translate well."

We believe that thematic sandboxes could help in this respect. Thanks to their more focused approach, they are likely to be more relevant for financial institutions; and the compliance expectations and the road ahead are better signposted for participants. Had our London fintech entered a thematic sandbox, it would have stood a better chance at solving its compliance issues earlier.

By the same token, because regulators must clearly define the objectives and requirements of thematic sandboxes, it is more likely they will achieve their goals. Early signs suggest regulators are interested in taking this on.[16]

"The regulatory objectives for setting up a sandbox vary, especially across different regions. So, they should not be measured with the same metrics. Yet there's a tendency to do that, which doesn't translate well."

- Sharmista Appaya,
Senior Financial Sector Specialist,
World Bank Group

Examples

Co-creating Solutions in Malaysia's Sandbox

Malaysia's central bank, Bank Negara, is making fast progress with its thematic regulatory sandbox. In late 2018, the bank received new applications to test innovative financial solutions and business models with a specific thematic track.[17] Its first "Specialised Sandbox" aims to enable more efficient and accessible financial services through digital onboarding, with a focus on eKYC (electronic know-your-customer).[18]

One of its standout successes was its work with WorldRemit, a remittance service provider that is heavily dependent on eKYC. Back in 2017, when it entered the sandbox, eKYC was incompatible with the regulation. After localizing its product within the sandbox, however, WorldRemit earned its authorization to operate in Malaysia. Significantly, the collaboration also led to the regulator to develop standardized eKYC guidelines, which should boost competition from other innovators.[19]

Malaysia's Central Bank[17]

The Reserve Bank of India Proposes a TRS Tool

For several years, the Reserve Bank of India has been reviewing its oversight of the rapidly evolving fintech ecosystem in the country. In August 2019, it published its proposal for a RS, with the RS organized around thematic cohorts focusing on financial inclusion, payments and lending, eKYC.[20]

The RBI's RS aims to address challenging areas where there is an absence of governing regulations, as well as areas that might benefit from a temporary ease in the regulations so market participants can pursue innovation.

The financial sector regulator will be providing the requisite regulatory guidance and will seek to facilitate greater efficiency and risk management for both consumers and providers.

The Financial Conduct Authority Refines Its Sandbox Approach

The pioneer of RS, the UK's FCA, is continuing to refine its sandbox approach.[21] For its 6th cohort, the regulator is welcoming applications from innovative entities in the UK financial services market that address: financial inclusion issues, UK's move to a greener economy, and technology that supports businesses in meeting their regulatory obligations.[22]

On another theme, the FCA is interested in firms that are innovating in specific technologies areas, namely, federated learning and travelling algorithms, and complex scenario modelling and simulation.

The FCA Building in London[23]

No Child's Play in the Sandbox

Expert Interview

xLabs interviewed Ankur Razdan, Vice President at Virtusa xLabs, about our 2020 trend: the rise of thematic regulatory sandboxes.

Where will thematic regulatory sandboxes be the most valuable?

For firms, thematic regulatory sandboxes are particularly useful when the business and legal viability of their solution is in question. Rather than shooting ahead to get all the necessary licenses or simply deploying their solution they suspect meets the regulatory standards, it might be smarter to go through the sandbox testbed to verify the standards are being met.

Thematic sandboxes are helpful for regulators when they wish to foster market participation and accelerate the path to market. It should be noted that regulatory sandboxes are not like industry sandboxes in which prototypes are developed and explored. Rather, a regulatory sandbox should be primarily used to ascertain the *market feasibility* of new ideas. Entrants to regulatory sandboxes must be chosen carefully and the products entering the sandbox should have reached a certain level of maturity. Also, by definition, a TRS must be focused on solving a specific problem rather than being broad-based. Ideally, thematic sandboxes must be timeboxed with clear exit procedures.

What are the key risks involved with regulatory sandboxes?

There are three main risks, all of which can be mitigated in my opinion. First, regulatory sandboxes allow participants to experiment beyond the current regulations and test market viability through piloting new ideas. However, most regulators do not (and cannot) provide any legal waivers to the participants of the regulatory sandbox. So, the primary risk with regulatory sandboxes is probably related to adequate compensation for consumers that are a part of the pilot. Second, sandbox activity is normally timebound with defined exit criteria and processes; however, there's a risk that the objectives are not met and that the project runs over. If a fintech has been racing at breakneck speed to produce a product ahead of the pack, to be

the first, and then reaches the point when it believes it can release a product to the market, a limited release to the sandbox may appear to be an unacceptable delay. Competitors may make up ground here by not being so careful and going straight to market. Given the risk of delays in the sandbox process, this can be quite negative.

Third, there is a risk that the regulatory framework changes while the product or service is still under review in the sandbox.

However, a well-designed and transparent regulatory sandbox with clearly stated objectives, policies, and procedures can mitigate most of the above risks.

What are some of the criticisms of regulatory sandboxes?

One objective of a thematic sandbox could be to help inform a new regulatory position. However, this may not occur, even if participants are successful in their pilot.

Another criticism is that regulatory sandboxes have suffered from poor participation rates. Even so, the sandbox initiative is still nascent and participation rates are likely to increase in the future.

There is a widespread perception that the participants selected for the sandbox pilot are best in class, which automatically bestows upon them a "badge of honor" just by being a part of the process. This misconception distorts and obfuscates the main purpose the regulatory sandbox. Regulators are duty bound to ensure fairness: they cannot be seen to promote one participant over any other. This perception needs to be handled properly by regulators.

When the rules of the regulatory sandbox are not clear it can be difficult for participants to understand the requirements. Clearly stated procedures and policies along with periodic communication with industry bodies are good ways to tackle this problem.

Should all regulators have a thematic regulatory sandbox?

I wouldn't say categorically that all regulators should have a thematic sandbox, but certainly they should consider it. Sandboxes are one tool, albeit an important one, that supports greater competition and innovation. Other tools include incubators, accelerators, investment funds and matching schemes, innovation hubs, and R&D. Regulators should think carefully about their objectives, understand the needs of their market, and select the appropriate set of tools.

Which country/region do you think will emerge as the leader in TRS?

I believe regulators in various countries should establish sandboxes as per their need. The FCA launched its regulatory sandbox to increase the number of participants in the UK market. Other countries have their own distinct needs, so regulators may set up sandboxes with other objectives in mind. We probably should not be looking for leaders here, as the criteria for measuring success will vary for different sandboxes. Sandboxes are an important tool to take innovative ideas to market faster; they should be designed with the relevant policies and procedures to enhance innovation. The success or failure of any thematic regulatory sandbox should be based upon the success of the projects in total, rather than the outcome of any specific pilot.

Thematic regulatory sandboxes are emerging now. How do you see the sandbox concept evolving? What comes next?

Going forward, we see greater coordination between national regulators, where lessons learnt may be shared. This is already happening, albeit to a limited extent. Regulatory sandboxes are still a young initiative. As more data and anecdotal information comes to light, we expect the thematic sandbox concept will become more robust and mature in the future.

As many have noted, a major benefit of the thematic regulatory sandbox is that it is an effective signaling device to the market, in that it communicates that the regulator is flexible and open to firms with new ideas. This is certainly important, but we believe that sandboxes have greater potential than that.

For example, sandboxes could be reconceived to become more proactive. Experiences that firms and regulators gain in the sandbox are very rich. We see an opportunity to develop the sandbox framework into a more forward-looking tool that is able to apply the learnings of the past in any future simulations. Sandboxes could become more dynamic where the environment could flex more. The regulators could test new, flexible approaches and simulate the impacts of proposed reforms, and so forth. The increasing fragmentation of the financial services sector, and the accelerated pace of innovation, demands regulatory tools that are more flexible, data-centric, and supportive of innovation.

Open Banking Goes Global

Three different approaches to the API economy

"This year, Open Banking is coming to Australia."

Consumer protection has long been a key regulatory objective.

More recently, it has taken on a consumer data and privacy protection cast, as the digital revolution continues to disrupt industries globally, and corporates show unprecedented interest in harvesting customer data. A standout piece of regulation in this regard is the European Union's General Data Protection Regulation (GDPR), which prevents firms from accessing and using data without consumer consent.

In the finance sector, "Open Banking" also has this consumer protection principle at its core, in that it allows customers' financial data to be safely shared through the use of application programming interfaces (APIs), if there is consumer consent. Europe pioneered this regulatory innovation with its Second Payments Services Directive (PSD2), which mandates that European banks offering retail banking payments services release their customers' data to trusted third parties (TTPs) – regulated fintechs – but only if they obtain customer approval to do so. In one fell swoop, ownership of the financial data of consumers moved from the bank to the consumer. PSD2 was universally adopted by banks in the UK and EU on September 14, 2019, and has attracted the attention of regulators worldwide ever since.

This year, Open Banking will be going international, and with it the principle of consumer protection. We see three main approaches to Open Banking across the world. First, countries with a "regulatory-mandatory" approach legally require banks to comply with Open Banking regulations.

For example, Australia and Canada, following the lead of the EU and its PSD2 regulations, are next in line to unfurl significant Open Banking reforms.

Second, countries like New Zealand and Hong Kong are taking a more flexible approach wherein the regulators are producing guidelines, and in some instances API standards. While they are encouraging banks to sign up to these guidelines and implement APIs, they stop short of making this a regulatory requirement. Such an approach towards Open Banking we term "regulatory-facilitated".

Finally, there are countries characterized as "market-led". In these jurisdictions, the regulatory mandate is not as strong. Open Banking initiatives tend to be driven by innovative banks and fintechs who are looking to get ahead of the competition by leveraging the latest API technology.

We believe regulatory-mandatory countries will be the most active group in 2020, with the locus of attention shifting to Australia. Substantial regulatory reforms will take effect Down Under, encapsulated in Consumer Data Rights (CDR) legislation that gives consumers control of their data and the option to share it with authorized third parties. At the touch of a button, customers can elect to share their transaction data, such as spending history and direct debits, with a regulated third party.

While the scope of financial products was limited to cash payment accounts, the Australian Competition and Consumer Commission (ACCC) has dramatically widened the scope to include savings accounts, call accounts and term deposits, as well as loans and mortgages for individual

consumers. It has also expanded the scope to include business finance, overdrafts, lines of credit, asset finance, and trust accounts in the corporate domain.

The CDR is anticipated to go beyond banking to include the energy and telecom sectors within its ambit, and eventually penetrate other industries in the future. With access to customer data, companies across industries can develop new, relevant products and offer better deals to customers. One of the most striking consequences of Open Banking is that it will change the competitive dynamics across sectors. With this new regime, consumers can easily move between brands, or have products with multiple brands, and use a single pane view to track their activity via an app.

Significantly, Australia has chosen not to include the payment initiation aspects as part of its Open Banking initiative, as these will be dealt with by the New Payments Platform (NPP). By excluding payments (which is less about data sharing and more about consumer approval) as well as going beyond the banking sector, Australian regulators are signalling their commitment to consumer data protection.

Canada, Brazil, Mexico, and Israel have undertakings to legislate Open Banking in the financial services sector. In January 2019, Canada's Department of Finance published a consultation document, "A Review into the Merits of Open Banking".[1] It included investment accounts in its product scope, further extending Australia's CDR efforts in Open Banking. This major addition would mean that consumers with a diverse portfolio of financial products, such as cash and securities held across multiple financial institutions, will be able to get a better view

of their overall financial position, holdings, and valuations in a single place. The consultation document also indicated that it is considering including payments initiation within the Open Banking remit. If Canada does include transaction initiation, it's likely that the regulatory body, Payments Canada, will have a key role to play.

Regulatory-facilitated and market-led Open Banking initiatives have also gained plenty of traction, often promoted by local regulators. India was one of the first countries in the world to create regulatory-facilitated Open Banking guidelines, with initial participation from 21 banks in 2016. As part of the Unified Payments Interface[2] (UPI) initiative, the National Payments Corporation of India created a framework for third parties to initiate payments with consumer consent. By October 2019, UPI had 141 member banks and oversaw 1.15 billion transactions.[3]

The Monetary Authority of Singapore (MAS) is encouraging greater collaboration between banks and fintechs through the use of APIs. It has gone one step further by championing cross-border collaboration to foster innovation and financial inclusion through a financial API marketplace, launched at the Singapore FinTech Festival in 2018.

The Reserve Bank of New Zealand, on the other hand, is wary of reinventing the wheel. For this reason, it has elected to promote the Open Banking Implementation Entity's (OBIE) UK API standards conforming to PSD2.[4]

Meanwhile, in the USA, where data protection is less of a concern for regulators, market-led initiatives are more common. JPMorgan Chase, for instance, provides APIs for treasury management, trading and securities services as well as PSD2 APIs to cater to its UK client base.[5]

Of the three approaches we've discussed, regulatory-mandatory initiatives have proven the most effective in terms of the widespread adoption of Open Banking standards at the national level. By turns, regulatory-facilitated initiatives have enjoyed varying degrees of success, since the decision to adhere is ultimately the bank's prerogative. Standardization using a market-led approach is the hardest of all to achieve. Here, banks and tech giants have taken the lead, driven as they are by the need to innovate and stay competitive in a dynamic marketplace. However, this effort is hampered by difficulties in reaching consensus on the details of the functional scope, security, and API specifications.

As the world moves towards greater inter-bank and fintech collaboration, as well as cross-industry collaboration, the prime focus of attention remains the consumer. In 2020 and beyond, regulatory regimes around the globe will continue to work towards consumer protection concerns, including the consumer's right to fully control their data. In this way consumers will be able to manage their funds much more efficiently, which should improve the circulation of money in the economy. Open Banking standards are a critical component of this evolving paradigm. In 2020, we will see this Open Banking trend go truly global.

The Three Approaches to Open Banking
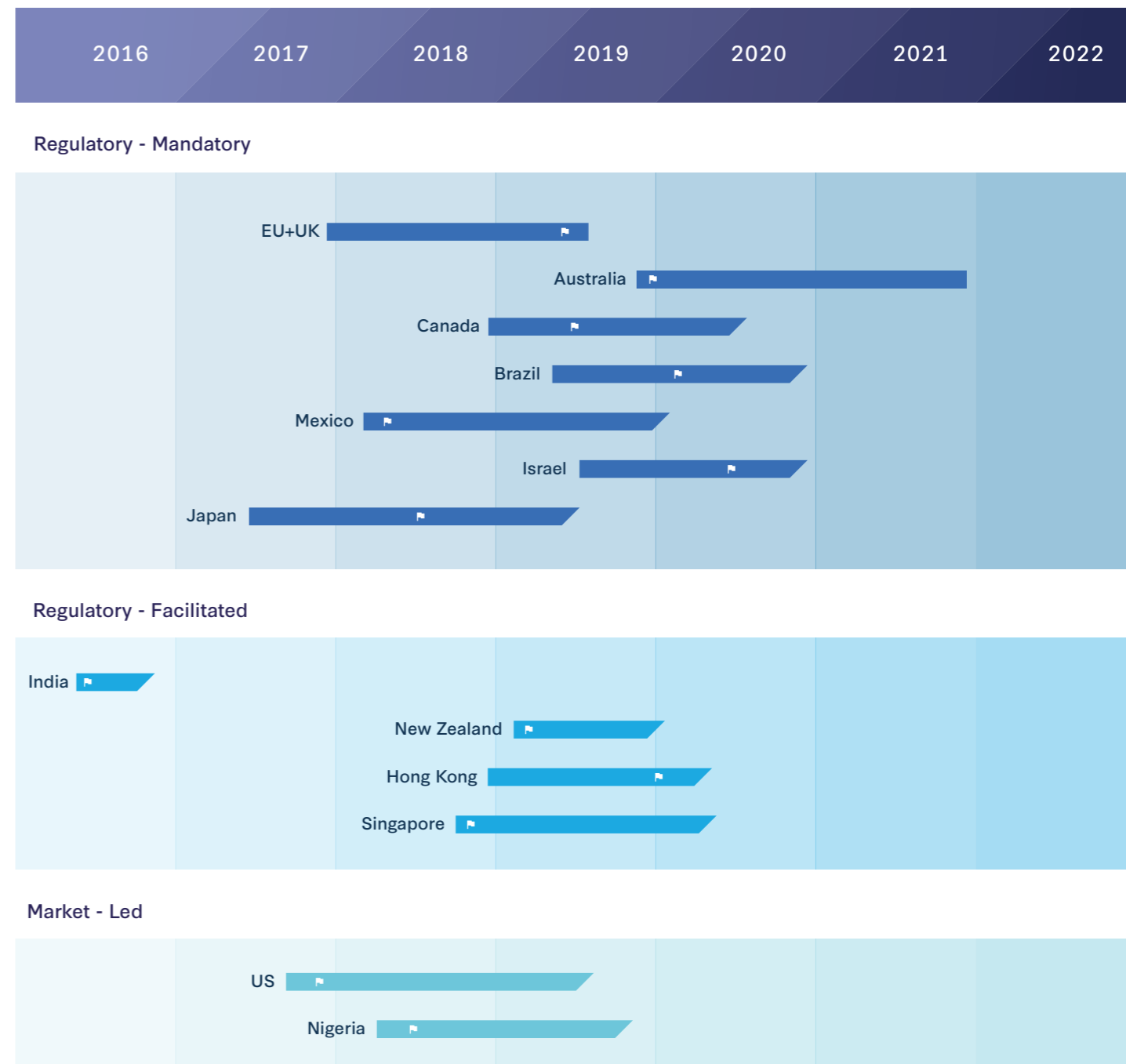
Source: Australian Competition and Consumer Commission; Central Bank of Brazil; Hong Kong Monetary Authority; European Central Bank; Financial Services Agency Japan; Bank of Israel; Reserve Bank of India; Bank of Mexico; Open Technology Foundation Nigeria; Reserve Bank of New Zealand; Monetary Authority of Singapore; Financial Conduct Authority UK; Consumer Financial Protection Bureau US; xLabs

This graph shows the three main approaches to Open Banking in the world to date: regulatory-mandatory, regulatory-facilitated, and market-led. Notably, only the UK, Europe and Australia are at a more mature stage with their Open Banking regulations and have a published regulatory roadmap.

For countries with facilitated regimes, implementation is at the discretion of banks and fintechs, but this is evolving.

Singapore, Nigeria and the United States have no specified regulatory timelines and it is up to the banks and fintechs to define their own implementation roadmap as they deem fit. In Singapore, the regulator hosts a regulatory sandbox to bring banks and fintechs together; however, the government does not specify any standards. Nigeria and the US are both predominantly market-led.

Note: transitioning to Open Banking regulations is a major undertaking and there is likely to be delays and hence changes to the stated timelines.

Legend

The country/region has a published regulatory roadmap for Open Banking with an implementation schedule over the time-period shown. (Note: beyond the end-date shown, the regulations will continue to be observed.)

The country has a set of Open Banking guidelines or an initiative in place. However, there is no timeline for implementation specified. Adoption is at the discretion of banks and fintechs.

Key milestone in the country/region's journey towards Open Banking.

Examples

Paytm's Payments Bank is Setting Records Through Open Banking

Paytm's Payments Bank (PPB) is India's only mobile-first bank with zero balance and zero digital transaction charge accounts.[8] With a customer base of some 42 million savings accounts, it is one of the most popular payments banks in the country. PPB differentiates itself partly through its Open Banking offering – currently it is responsible for about 30% of Open Banking transactions in India.[9] PPB enables its customers to manage all their accounts held in other banks and financial institutions through its app. In this way, they can keep tabs on real-time balances, and pay for their online purchases directly from their savings accounts.[10]

Open Banking is Revolutionizing Personal Finance

CreditLadder helps people to improve their credit scores by building a credit history through rental payments. By showing they can pay their rent reliably and on time, users stand to get better rates on financial products such as credit cards and mortgages, helping them get onto the property ladder faster.[6]

The UK rent recognition platform is licensed and regulated by the FCA. It uses Open Banking's read-only access to view and report its users' rent to credit reference agency, Experian. CreditLadder has been busy integrating with institutions such as Starling Bank, Revolut and Barclays, which could help mainstream its service and make it easier to use.[7]

Nibox Uses Open Banking to Further Financial Inclusion

Nigerian company Nibox provides multi-platform payment solutions not only for people with bank accounts, but also for those with no bank history. Integral to Nibox's financial inclusion strategy are its self-service payment terminals, allowing people to send and receive money offline. The terminal can be found at major locations across the country and transactions may be tracked online.[11]

Creating a Nibox account offers a variety of services to users, including paying bills, buying transportation tickets, and opening a savings account. Nibox is an important industry player in Nigeria's push to create common API standards among banks and financial institutions, and encourage adoption with stakeholders.[12]
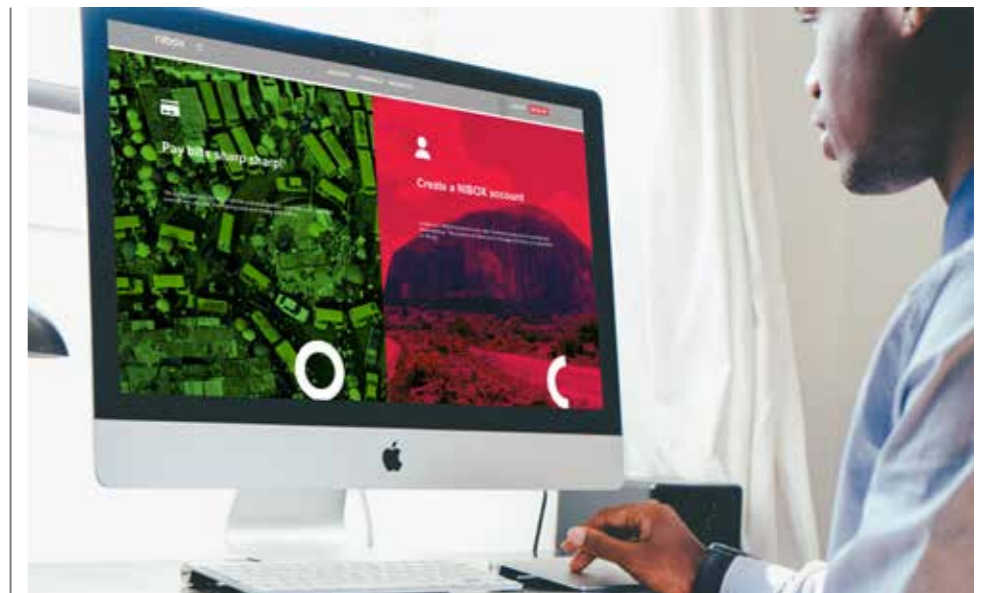
Open Banking Goes Global
Expert Interview

xLabs interviewed Arnab Mitra, Enterprise Architect for Open Banking at Virtusa xLabs, and Program Manager at Banking Industry Architecture Network (BIAN), for his take on our 2020 trend: the internationalization of Open Banking.

What is likely to happen in the 2-5 year time-frame with Open Banking?

The internationalization trend in Open Banking will continue apace – more central banks and regulators around the world will be introducing "mandatory" or "facilitated" Open Banking standards. This will be especially true where a strong regulatory framework already exists to protect the interests of consumers. At the same time, we will see the scope of financial products and services expand from retail payments accounts to loans, mortgages, money markets, and investment products. We're also likely to see regulators in other industries, such as energy and telecoms, create API standards, which should spur greater cross-industry collaboration. However, cross-border collaboration might prove more challenging due to different national regulations.

In regions where the regulatory framework is still evolving, particularly around consumer data protection, it might make more sense for regulators to create guidelines and offer sandbox environments for greater API-based collaboration between banks and fintechs. Such collaboration would be based more on high-level standards and would be less restrictive on the scope of financial products and services. The hope here would be to let market forces set the demand for standards, especially in terms of the functional scope of such standards. This is where the Monetary Authority of Singapore is leading the way with APIX, which is an innovation platform for banks and fintechs to collaborate and co-create new financial solutions.

Lately there is a lot of talk about Open Finance. What is your view?

Open Finance is a new idea that builds upon the idea of Open Banking by extending it to other financial instruments. The FCA in the UK set up an advisory group last year that identified the possibility of expanding the scope of PSD2 beyond payments accounts to include savings, loans, investments, and pensions.[13] Australia's Open Banking regime, in the form of the national Consumer Data Rights

Act (CDR) , already has these products in scope. With consumer data protection and consent at its heart, much like PSD2 and GDPR in the EU context, the CDR regulation goes a step further in including the energy and telecommunications sectors. If Open Finance were to become a reality, insurance would be the obvious sector to come into play. I think Open Finance is a natural evolution of Open Banking, so it makes sense.

What are the near-term implications of the CDR for banks operating in Australia?

The CDR will usher in a new regulatory regime for the financial services sector in Australia. As with most sweeping regulatory programs, the CDR will be rolled out in phases. By February 1, 2020, the Initial Data Holders (the "Big Four" banks in Australia) will have to make available the product reference data (the attributes of financial products: e.g. the interest rate on a savings account) and customer transaction data (a customer's transaction record) of Phase 1 and 2 products, such as current, savings, and term deposit accounts and loans. By July 1, 2020, the same regulations will apply to the remaining banks in Australia. In summary, banks will be engrossed with the task of managing their compliance obligations with the CDR, and all the costs and infrastructure that it entails. Once they clear those regulatory hurdles with a proper set up, they can focus on exploiting the business opportunities involved with monetizing customer data.

Why haven't the tech giants moved into banking yet? Will they make the move anytime soon?

Tech giants, such as Uber, Facebook, and Google, tend to move in unregulated domains. This gives them plenty of flexibility, and their operating costs are relatively low, not least because they're younger and use more advanced technology. Most of them do not

deal with people's life savings, so there has not been a serious regulatory crackdown so far. In 2020, I think they will continue to skirt the regulatory borders. Already there have been rumblings of greater regulatory scrutiny in the future, catalyzed by high-profile data breaches, such as the Cambridge Analytica scandal. But tech giants are still fairly agile and fast moving. Given Open Banking regulations are weaker in market-led countries such as the US, it's more likely that bigtech will venture there. In Europe, the barriers to entry and operation are much higher.

Which standards can banks and fintechs use in regions where Open Banking is market-led or even completely absent?

Open standards based banking can only be achieved if the participating parties reach consensus on the standards around security, procedures, and data exchange, using APIs. The absence of legal directives does pose a challenge; nonetheless, there are standards in use. An obvious one is ISO 20022 – an ISO standard for electronic data interchange between financial institutions that is central for payments. Voluntary standards organizations like BIAN have also made progress in defining standards and publishing their first APIs in late 2018.

The Open Banking regime is arguably the most advanced in the UK and Europe. What has been the impact on the financial sectors there?

For many observers, Open Banking has not been the watershed moment everyone was expecting. Access to customer data is a prerequisite to the monetization of that data. Yet the advent of Open Banking has not unleashed the tidal wave of competitive business propositions that many were predicting.

This viewpoint glances over the fact that for change to occur, you need both a supportive regulatory environment and attitudinal/behavioral changes by market actors. The latter takes time to occur. For perspective, contactless cards are now integral to payments, yet they came onto the scene as far back as 2007. Also, it's worth noting it has only been a few months since the September 2019 implementation date.

Even so, we should not understate the paradigm shift that has occurred with the birth of the API economy in the UK and Europe. It is changing the nature of financial institutions, their services, and markets across the continent. You can see from the examples we shared that enterprising fintechs are starting to explore the possibilities. Some have launched Open Banking platforms, which enable consumers and/or businesses to plug into various banks from a variety of countries via a single API.[14] From the consumer standpoint, they are now empowered to find new products, and obtain greater visibility over their finances. Of course, educating consumers on the possibilities now on their doorstep will also take time.
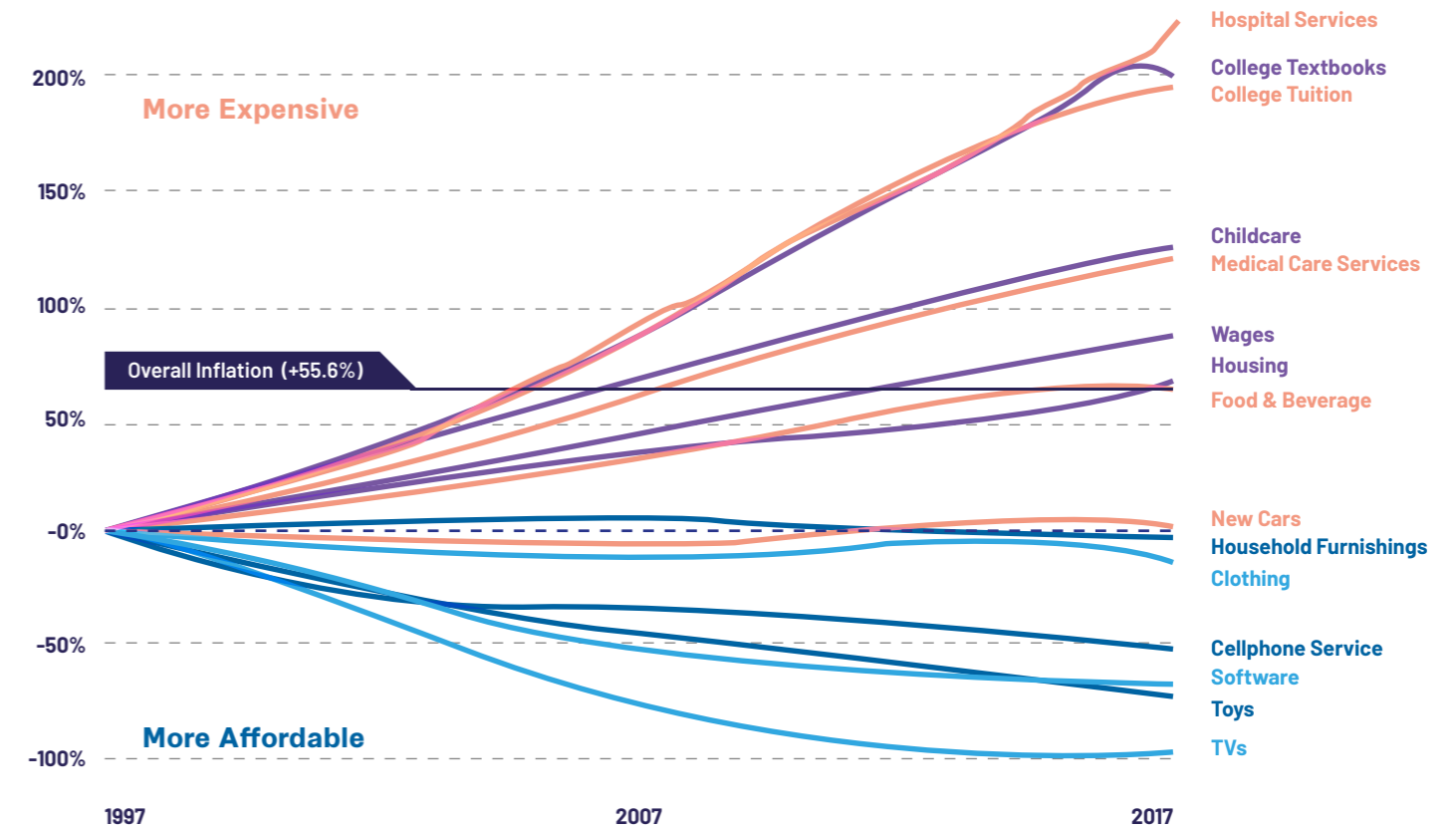
Value Over Volume in Healthcare

Delivering better patient outcomes by moving away from the fee-for-service model

Price Changes (Jan 1997 - Dec 2017)
Selected US Consumer Goods and Services, and Wages

More Expensive

200%

150%

100%

Overall Inflation (+55.6%)

50%

-0%

-50%

More Affordable

-100%

1997   2007   2017

Hospital Services
College Textbooks
College Tuition
Childcare
Medical Care Services
Wages
Housing
Food & Beverage
New Cars
Household Furnishings
Clothing
Cellphone Service
Software
Toys
TVs

Data Source: Chart of the Century[1]

Healthcare systems around the world, whether public or private, are struggling to respond to the urgent need to reduce the healthcare costs in their societies.

Evidence of these challenges is everywhere and is clearly summarized in the often referred to "chart of the century" (see above). The graph shows the cost of healthcare and education growing dramatically faster than other goods and services in the US over a 20-year time-frame, with healthcare topping the chart.[2]

Even as global healthcare spending is projected to rise from $7.7 trillion in 2017 to $10 trillion by 2020,[3] it will not be nearly enough to cover our growing healthcare needs. It is well-understood that the healthcare demands of the developed world will be amplified in the years to come by demographic shifts such as aging populations and the growing prevalence of chronic disease. Meanwhile, the developing world will face spending pressure to improve basic primary care, just as they continue to battle the impact of transmissible diseases such as malaria, tuberculosis, and HIV. According to a World Health Organization (WHO) 2018 report on global health expenditures, 10% of global GDP was spent on healthcare in 2016;

and it grew 6% annually in low- and middle-income countries, even faster than the 4% rate in higher-income economies between 2000 and 2016.[4]

Although the reasons attributed to rising healthcare costs are multifaceted and fiercely debated, there is little doubt that the existing prevalent fee-for-service model is a major cause. Recently, however, there has been a paradigm shift in thinking as well as budgetary spend towards the value-based care model – at least in the US context. In a nutshell, a transition is underway from a fee-for-service approach, which rewards providers for the amount of healthcare services rendered, to a value-based approach that makes payments for health outcomes measured against the cost of delivering those outcomes. In 2020, we believe the pivot to value-based care will

gain momentum, driven by a combination of regulatory and technological forces that are already in play.

The fee-for-service (FFS) legacy

The FFS model, based on episodes of care and developed over decades into myriads of complex treatment coding and approval processes, is best described as a volume-based delivery model. In this model, the number of procedures, treatments, and encounters with the healthcare system is the basis for how healthcare value-chain participants grow revenue and profit. Both the financial and outcome risks of the FFS are borne by the patient and the public, via the government underwriting. According to the WHO report, the public share is 51% of the global healthcare spend.[5] Payment is dependent on the quantity of encounters, treatments and procedures, rather than the quality of care delivered or outcome derived from the interventions. Hence, the incentives in the system give rise to a focus on filling beds and charging patients and payors at every step along the treatment process. The model does not always give priority to improving the patient's health or serving their best interests.

These misaligned incentives have given rise to a zero-sum game (win-lose) where industry participants compete to shift costs and accumulate revenue to the detriment of others. For example, when hospitals charge more for their services, payors lose. Further, healthcare objectives are derailed by the efforts of powerful lobby groups who jostle to win the largest slice of the pie. Meanwhile, actual patient outcomes are not optimized within budget.

Technology entrants, both large and small, are attracted to the healthcare market because of its colossal size ($3.67 trillion in the US alone) and the vast potential to improve on inefficiencies. However, the emergence of new biomedical technologies and digital innovations, such as connected devices and clinical decision support systems offering AI diagnostics and predictive modeling,

may actually exacerbate the over-servicing problem in a FFS context. Instead of embracing the positive synergies promised by "smart" networked devices, things and spaces, which are becoming increasingly ubiquitous, the FFS model can distort and impair the quality of healthcare delivery.

The value-based care cure

Over a decade ago, Michael Porter laid out the conceptual groundwork for value-based care. By setting the "best patient outcomes at the lowest cost" as his starting point, he built a blueprint for rearchitecting the competitive dynamics in healthcare to make it positive sum (win-win) for stakeholders to choose "values" over "volumes". Here, financial risk shifts from patients and payors to providers.[6] Resources are allocated based on the health outcomes delivered by the system. As a result, care becomes less episodic and more patient-centric, rewarding "value and care coordination – rather than volume and care duplication".[7]

Although his ideas were immensely influential, it took their enactment into laws and policies to stamp his ideas into practice, albeit it is still early days. Of particular importance are the rules relating to the technology elements essential to value-based care.

For instance, in 2016, the landmark 21st Century Cures Act was passed by Congress, whereby healthcare providers and health information technology vendors were required to provide open APIs for data sharing and interoperability. In addition, the Act established new pathways to expedite innovative technology solutions to market. The Food and Drug Administration is now mobilizing this by implementing streamlined review processes for medical technologies, as well as by conferring the "breakthrough therapy designation" that fast-tracks innovative drugs tackling serious or life-threatening conditions.

Furthermore, the Cures Act directs the Department of Health and Human Services (HHS) to enable the secure nationwide

exchange of electronic health information across disparate health information networks. In September 2019, a Recognized Coordinating Entity was selected to oversee its implementation. In all, the initiative – focused as it is on data sharing, data liquidity, and interoperability – is a crucial milestone in the evolution of a more holistic, scalable and patient-centric care delivery system.[8]

Other barriers to value-based care are being removed. On October 9, 2019, the HHS released proposed changes to the Ethics in Patient Referrals Act (the "Stark Law"), the Medicare and Medicaid Anti-Kickback Statute (the "Anti-Kickback Statute"), and the Beneficiary Inducement Civil Monetary Penalties Law (the "Beneficiary Inducement Statute"). The proposed changes recognize that incentives are different in a healthcare system that pays for value, rather than the volume, of services delivered. They aim to give greater certainty to healthcare providers involved in value-based arrangements and the provision of coordinated care for patients. They also ease the compliance burden for healthcare providers, while maintaining strong safeguards to protect patients and programs from fraud and abuse.

All these developments suggest the adoption of the value-based care model is at an inflection point. The growing convergence of regulation and new technologies is spurring the transition from traditional delivery models to value-based care arrangements. In this realignment, we come closer to an integrated view of the entire patient journey, weaving together all the touchpoints and data inputs for a more coordinated approach to patient care. Key features of this new paradigm include standard and open APIs for connectivity and data sharing; shared data acquisition, cleansing and preparation, and governance for collaborations; and artificial intelligence algorithms applied to shared data. Finally, it is hoped that a budget brought under control will still deliver improved healthcare outcomes, as the healthcare community deepens its embrace of digital health and value-based care principles in 2020.

"In 2020, the pivot to value-based care will gain momentum, driven by a combination of regulatory and technological forces that are already in play."

Examples

Holistic Approach to Diabetes Treatment

The University of Pittsburgh Medical Center Health Plan and pharmaceutical manufacturer, Boehringer Ingelheim, entered into a value-based contract, effective January 1, 2019, for Jardiance (empagliflozin), which is an oral type 2 diabetes medicine that also might reduce the risk of cardiovascular death in adults with type 2 diabetes and cardiovascular disease.[9] The aim of the contract is to align the incentives of both the insurer and manufacturer, and to link reimbursement of the drug to the total costs of care for all diabetes patients – not just the costs relating to those with existing heart disease, as was previously the case.[10]

Getting Paid Only for Results

Medtronic CEO, Omar Ishrak, is a big supporter of the principle that value should be the outcome of his company's initiatives. The world's largest medical device maker has been experimenting with value-based care reimbursement models for some time. This has led to nearly 1,000 deals requiring Medtronic to reimburse hospitals for select costs if its Tyrx antibacterial sleeve fails to prevent infection in patients who receive cardiac devices.[11] This goes beyond simple product warranty to cover infections derived from other factors during surgery when the antibacterial sleeve is used.

Linking Precision Medicine to Value-Based Care

Harvard Pilgrim Health Care has been negotiating several outcome-based contracts that tie-in elements of the "precision medicine ecosystem under the value-based care umbrella".[12] For example, in a first-of-its-kind agreement with Illumina, a next-gen genetic testing company, Harvard Pilgrim will cover the costs of non-invasive pre-natal genetic testing for younger women with average-risk pregnancies. The tests could detect genetic abnormalities, which might remove the need for certain screening procedures and thereby keep costs down. Where the payor's spending exceeds current benchmarks, Illumina has agreed to cover the difference.[13] Effectively, the deal should help expand the availability of genetic testing while balancing affordability.

Value Over Volume in Healthcare
Expert Interview

xLabs interviewed Dane Stout, Senior Director in Life Sciences at Virtusa, about how technological and regulatory forces are galvanizing adoption of the value-based care model.

How can providers and payors prepare for the transition to value-based care in a technological sense?

Technology will play a fundamental role in the transition to value-based care in three ways. First, at the foundation level, data management and governance must be addressed. A structure that integrates the different data sources associated with care delivery, which puts patient outcomes at the center, must be implemented. All stakeholders must rely on and have access to a common, authoritative source of data that can be shared and analyzed.

Second, connected, networked devices and health information technology (HIT) systems must be active, participative nodes in an interoperable network. All the data needed to support value-based judgements and payment models must be captured, such as the data relating to the drugs and medical devices used, the clinical protocols that are applied using those products, and how individual patients actually respond to treatment plans. This data must be shareable and accessible across the entire healthcare system.

Third, payors and providers must have the ability to analyze the collected data. They need access to big data and the ability to manage information pertaining to individual services in real-time. In support of this, ML and AI will be critical.

These three elements – data and governance, connectivity, and analytics – are critical for breaking down fee-for-service walls and moving on to actual value delivery. And today we have the technological innovation available to support these changes.

How do you measure "value" in a value-based care model?

"Value" is defined as the delivery of measurable quality care that improves an individual's life, condition, and overall well-being. This encompasses the social setting, family considerations, and other dependencies. Many metrics are used today, such as quality-adjusted life year used by Health Technology Assessment organizations like ICER and NICE, but there is no one-size-fits-all measurement. Perhaps we should start with the outcome in mind and build the indicators that measure value from there.

How are incentives being structured to support innovation in the value-based care model?

I've spoken with hospital CEOs who've changed from maximizing "bodies in beds" just a few short years ago to now not looking at that as a measure of value at all. According to Health Payer Intelligence, there are currently 40 different alternative payment models that link payment to quality performance rather than total billable services.[14] At the heart of most of these new models is a very different financial risk structure. These are different combinations of upside risk (incentives), downside risk (penalties), or a combination thereof (referred to as two-sided risk), for providers.

Comprehensive care payment models typically incorporate upside risk only. The provider is paid for delivering comprehensive care to the patient, and if targeted outcome measurements are achieved, an incentive payment is earned.

In care payment models that incorporate downside risk, providers must refund the payor for any incurred losses if they exceed financial benchmarks. Centers for Medicare and Medicaid Services' bundled a payment model for acute myocardial infarction episodes: this is a prime example where, retrospectively, the provider must refund a portion of payments received if costs exceed the quality adjusted targeted price.

Most payors, government and private, are looking to combine upside and downside risks to make it both more appealing for providers and to ensure accountability for targeted quality achievement.

Healthcare stakeholders are poised between traditional and modern care delivery models. How can they best deal with rising compliance costs as they transition to value-based care?

In the US, both Health and Human Services and the Food and Drug Administration are now much more willing and active participants in support of new value-based models, such as lifting the restrictions on sharing health economic outcome data between life science companies and payors, which was previously restricted and, in many cases, flagged as a violation.

The compliance burdens associated with new models will be tempered in part by the fact that the regulatory and policy overseers also need help in this space. They will take a more collaborative approach to working with all key stakeholders to figure out how to protect data, apply artificial intelligence, and enable connectivity and interoperability between medical devices and HIT systems.

What are the implications of value-based care for the operating models of healthcare providers?

The fee-for-service model meant understanding past performance to maximize revenue, whereas value-based care requires a more forward-looking, strategic mindset to get paid. Providers must be able to predict patient costs, measure outcomes, and improve population health to not only qualify for incentive payments but also to avoid financial penalties in some models, as previously discussed.

Today, confidential pricing contracts between payors and providers, particularly in the US, can mean astonishingly high differences for cost-of-care to a consumer, with no way to do direct cost comparisons effectively. However, accountability, transparency, and operating efficiency will change as patient outcomes become the focal point. The ability to pass along costs and improve performance by traditional levers such as price hikes, increased procedure volumes, or maximizing revenue through billing and coding techniques will diminish over time. Governments and the public are demanding transparent pricing so that consumers can evaluate healthcare provider costs like any other goods or services they select.

Could you unravel the paradox of higher quality care at lower cost in the value-based care model?

There is no paradox. Humankind has always sought to generate more value from less. The problem with fee-for-service healthcare systems is that merely seeking greater efficiencies in healthcare delivery does not yield the most effective outcome. The goal should be to deliver a more effective outcome within budget. What is happening today is a reassessment of just what that effective outcome is. There is a movement toward the provision of healthcare services to maximize the value to the patient. The adoption of a value-based care model does not necessarily imply a higher cost model. Instead, it focuses on a more effective healthcare solution by delivering higher value to the patient.

With the advent of AI, telehealth and connected care, the ability to derive more value with less labor intensity is within sight. The economist, Herbert Stein, coined a phrase known as "Stein's Law." It applies to global healthcare today and for all of us who are impacted. "If something cannot go on forever, it will stop."[15] I think that sums up nicely where we are with fee-for-service healthcare.
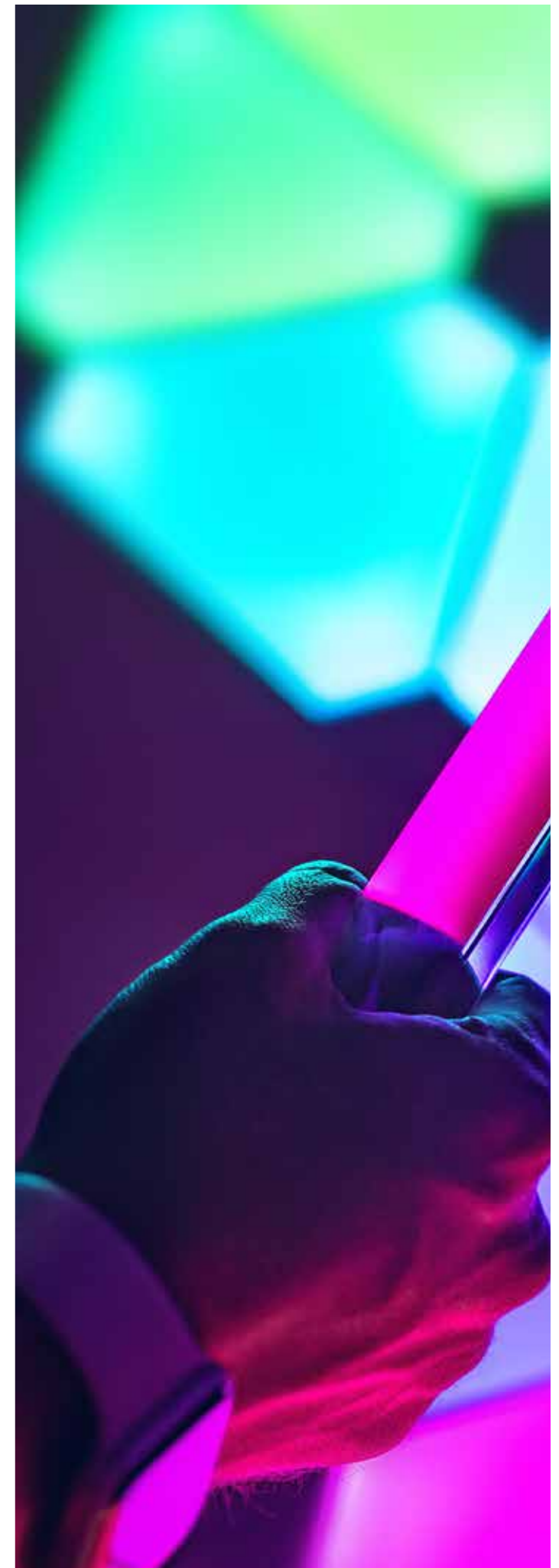
The End of All Disease?

The promise of medical breakthroughs as CRISPR moves into clinical trials

He Jiankui, a biophysicist from the Southern University of Science and Technology, Shenzhen, China, stunned the scientific community when he announced the birth of the world's first gene-edited babies in 2018.

Using the revolutionary genome-editing tool CRISPR, dubbed "molecular scissors" for its ability to "cut and paste" genes, Jiankui claims to have altered the twin girls' genes to make them HIV resistant. Their father is HIV-positive.

In carrying out the experiment, he disregarded norms and rules regulating the use of CRISPR (Clustered Regularly Interspaced Short Palindromic Repeats) in human embryos, a tool that is still in its infancy. These rules exist because altering the human germline means modifications will be inherited by descendants, which may or may not be desirable. Also, gene-editing could unleash unpredictable changes in the human subject.

While the story raised alarm bells about the terrifying implications of CRISPR, its full impact has yet to sink in. Reflecting on the incident, pioneering geneticist and Harvard Medical School professor George Church asked, "Is the genie really out of the bottle?" His answer was "Yes."[1]

Going down the "rogue scientist" route is just one of many possibilities that could arise from the use of CRISPR technology; but there's another possibility that is starting to take off in a big way. Since 2012, when Jennifer Doudna and Emmanuelle Charpentier published their landmark paper on CRISPR/Cas9 and ignited the imaginations of biologists the world over, labs have been feverishly experimenting with the technique. Only a year before, in 2011, there were about 100 published papers on CRISPR; by 2018 the figure climbed to over 17,000.[2] Each day brings news of an expanding toolbox that involves further refinements to CRISPR and a dizzying array of potential CRISPR applications[3] - everything from curing genetic diseases, bioengineering new crops, and eliminating malaria. With so much experimental work going on, CRISPR is now poised to move into the next phase in the journey from lab to market. We believe there will be a concerted push into clinical trials in 2020.

What is so special about CRISPR technology?

If you haven't been following CRISPR closely, you might be wondering what the fuss is all about. Why are people at once so worried and excited by it? Why is it being hailed as a "molecular marvel"[4] that may well be "the most important scientific discovery of the century",[5] with the "power to remake life as we know it"?[6] After all, gene-editing is not new; it has been around for decades.

What makes CRISPR so important is its extraordinary precision, coupled with the fact it is easy to use, and inexpensive. We're talking about a method that can accurately edit genes in almost any organism, be it plant, animal or human. The ability to add, delete or repair genes enables scientists to control which genes get expressed, in a time frame measured in hours/days not weeks/ months. Researchers can be trained in as little as a week.

Owing to these features, as well as precipitous cost declines,[7] CRISPR has democratized gene-editing[8] and unlocked entire categories of research that have lain dormant for years.[9] Consequently, CRISPR is now widely available, and the big money is flowing in.

Promising therapeutic applications

CRISPR's potential to cure disease and repair genetic mutations is considerable. Historically, therapeutics has focused on the symptoms of disease, but gene therapy addresses the root cause of the disease by correcting gene mutations encoded by DNA. The thinking goes that if the faulty genes can be corrected, the disease could be reversed. Although many gene therapies and genome-

editing technologies have arisen over the past few decades, CRISPR is held to be the most disruptive. The first potential application of CRISPR is likely to be in the monogenic diseases space, where errors in a single gene cause disorders. Here, CRISPR's addressable market is estimated to be over $75 billion annually, with close to $2 trillion in latent demand from unaddressed populations.[10] Considering that monogenic diseases account for a mere 2% of all genetic diseases, it is clear the future is bright for this fast-evolving field.

Also, we have not even touched on the promising applications of CRISPR technology for the global agriculture industry, with its potential to increase crop yields and boost the nutritional value of food products. By some estimates, CRISPR could expand the global agriculture market to $170 billion between now and 2025.[11]

In the commercial therapeutic setting, CRISPR will find use in chimeric antigen receptor T-cell (CAR-T) therapy, a type of immunotherapy that utilizes an individual's immune cells to kill cancerous cells while leaving healthy cells intact. According to ARK Invest estimates, the global addressable market for CAR-T will be around $40 billion annually if its applications are limited to stage 3 and stage 4 metastatic cancers. If applied to all stages of cancer, the market could scale to $250 billion.[12]

To date, there are less than two dozen clinical trials in progress.[13] All of them are in Phase 1 and Phase 2 stages, meaning the studies are designed primarily to test the safety and efficacy of a potential treatment.[14] Although the trials are small, they have the power to "make or break" as they are the first real hurdle on the road to commercial viability.

The genome-editing applications that survive the rigorous clinical trial process will be fit for market, while also abiding by regulations protecting patient safety. This is good news for those who want to see the promise of CRISPR realized in a controlled, ethical way, rather than the rogue scientist route. Taking the longer view, CRISPR offers hope for people suffering from genetic diseases that are currently incurable. The technology is good news for pharma companies and their investors as the race for first-mover advantage heats up. After eight years of intensive R&D, and huge investor and media interest, CRISPR has matured to move to the next step. In 2020, the stage is set for the first big tranche of clinical trials.

"CRISPR technology has promising applications for the global agriculture industry, with its potential to increase crop yields and boost the nutritional value of food products."

Examples
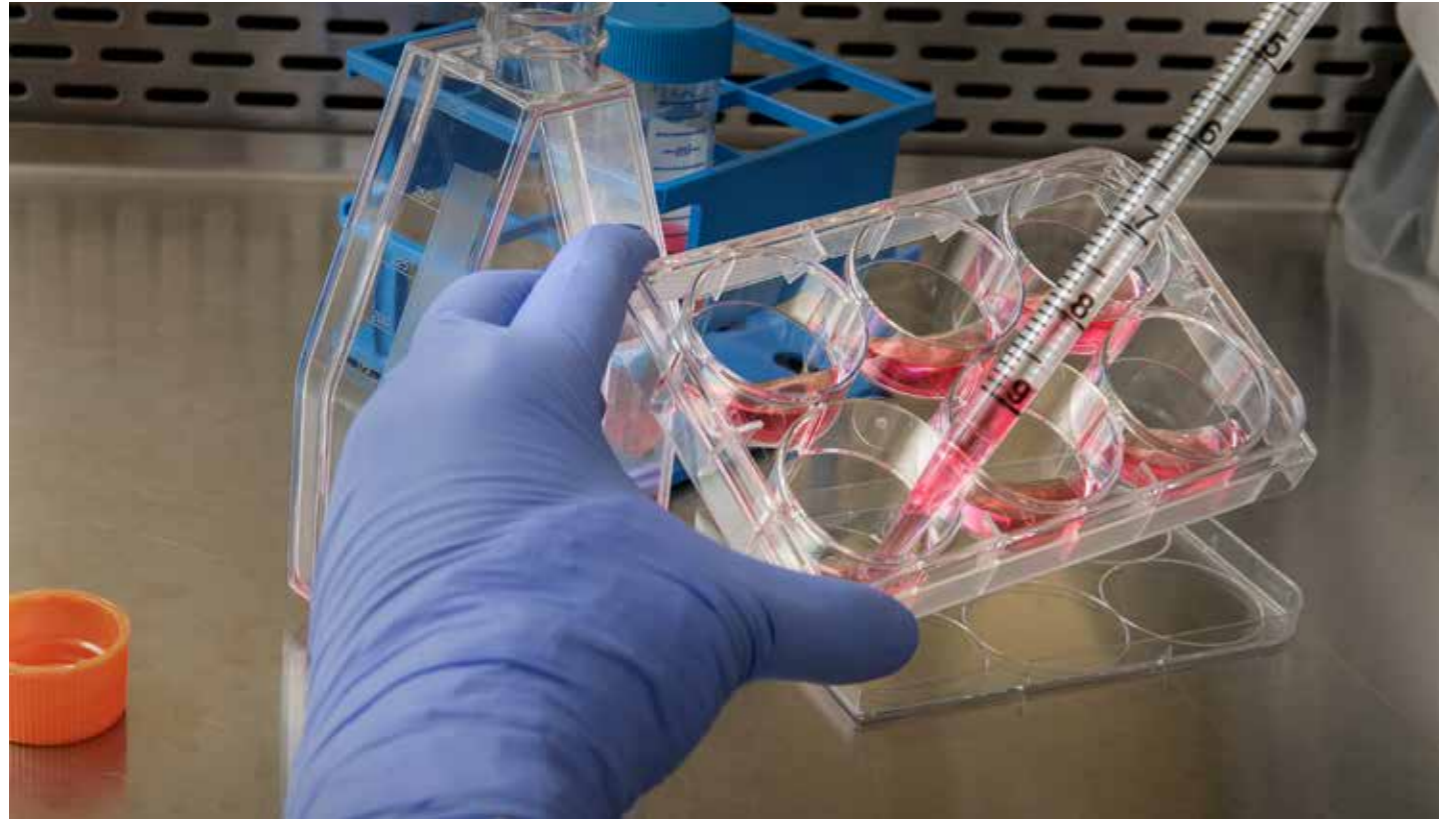
Innovative Immune Cell Engineering: Fighting Cancer with T Cells

T cells are a type of white blood cell called lymphocytes, which helps to fight infection and diseases. When a person has a new infection or disease, the body will make T cells to fight that specific infection. It also stores the T cells so it can replicate them if needed in the future. T cells, however, cannot always tell the difference between a cancerous and a normal cell.[17]

CAR T cell therapy is a promising treatment for cancer. T cells are extracted from a patient, genetically re-engineered to fight cancer cells, and then re-infused into the patient. CRISPR/Cas9 could be applied here to reduce the chances that the patient's immune system will attack him/her.[18]

A landmark clinical trial is underway in the US for the first-in-human, phase 1 trial for CRISPR-modified autologous T-cell therapy for patients with multiple myeloma, synovial sarcoma, and melanoma.[19] With the number of cancer sufferers rising worldwide, the spotlight is on this trial as well as the other 800 CAR T clinical trials currently running.[20]

Promising CRISPR/Cas9 Treatment for Sickle Cell and Beta Thalassemia

Sickle cell disease is a group of inherited disorders that affects haemoglobin, the red blood cells responsible for carrying oxygen around the body. It is caused by a mutation on the HBB gene.[15]

For treatment, doctors take hematopoietic stem cells (an immature cell that can develop into white/red blood cells, platelets and more) from bone marrow, and genetically modify them in a lab to produce high levels of haemoglobin. Once the cells are reintroduced to the body, they will produce many red blood cells containing fetal haemoglobin (as produced in new-born babies), this volume overcomes the deficit of haemoglobin caused by sickle cell.

A partnership between CRISPR Therapeutics and biotech firm, Vertex, has been working on an investigational CRISPR/Cas9 gene-editing therapy called CTX001. It is currently

in Phase 1/2 trials treating two patients suffering from severe sickle cell disease. As of November 2019, the partnership has reported positive safety and efficacy data for two patients. Says Jeffrey Leiden, MD, PhD, Chairman, President and CEO of Vertez, "The data we announced today are remarkable and demonstrate that CTX001 has the potential to be a curative CRISPR/Cas9-based gene-editing therapy for people with sickle cell disease and beta thalassemia".[16]

CRISPR-Based Therapy to Treat Most Common form of Inherited Childhood Blindness

Leber congenital amaurosis is an eye disorder that results in visual impairment. It affects the retina at the back of the eye, which detects light and colour. In November 2018, Editas, a genome-editing company using CRISPR to treat diseases, received permission from the FDA to start clinical testing to treat Leber congenital amaurosis, a common form of inherited childhood blindness.[21] Its EDIT-101 therapy is designed to correct a point mutation in the CEP290 gene affecting patients with the disorder.[22]

Allergan, Editas' development partner, spent $15 million to develop and commercialize the treatment and could receive an additional $25 million upon FDA acceptance.[23] Currently, the treatment is in a Phase 1/2 study and is testing on both adult and paediatric patients.[24]

The End of All Disease?
Expert Interview

xLabs interviewed Sunil Krishnan, Director in Life Sciences and Healthcare at Virtusa, about the revolutionary new gene-editing tool, CRISPR.

How does CRISPR work?

Gene-editing is a type of genetic engineering in which DNA is inserted, deleted, modified or replaced in the genome of a living organism. CRISPR/Cas9 is one of several methods of gene-editing that has gained popularity of late. It originated from the analysis of how bacteria fight viral infections by using the Cas9 protein to cut and degrade viral DNA in a particular way. The gene-editing method consists of two components: the Cas9 protein and a guide RNA that helps direct the Cas9 to break a specific DNA strand. Repair processes then take over to "fix" the break, and depending on the type of repair process, we get a modified DNA.

What impact is CRISPR having on basic research?

Beyond making targeted changes to the genome, CRISPR is helping researchers improve their understanding of basic biology. Although the complete map of the human genome has been available since 2003, researchers are still decoding the functions of genes and the roles of key regulatory elements. They are still trying to understand the causes behind certain disease phenotypes and how to cure them by correcting the mutations. To obtain this knowledge, you need to modify the genome.

As the authors of an annual review of CRISPR and human genome engineering noted, "The development of potent genetic tools that allow one to robustly and flexibly edit or modulate a genome is key to gaining a more comprehensive understanding of genetic function and to creating more effective therapeutics."[25]

How is the research field of gene-editing evolving? And what is prime editing?

The CRISPR tool kit is really growing. Most of us are familiar with the CRISPR/Cas9 enzyme, but there are so many other enzymes out there that are still being characterized. For instance, there is CRISPR/Cas12a, which it is thought to be better at making edits where you can rewrite a sequence, not just do deletes. There is a CRISPR/Cas13 enzyme, which cuts RNA rather than DNA, allowing researchers to control gene expression at another level.[26]

With respect to prime editing, it entered the scientific scene in October 2019. In a Nature article, researchers described a new gene-editing technique that can rewrite DNA by cutting a single strand to add, delete, or replace base pairs.[27] It addressed one of the problems of CRISPR/Cas9. Normally, when Cas9, the protein scissor, cleaves the double-stranded DNA, the cell detects damage done to the double helix and goes into repair mode to patch it back up. But sometimes the repair job doesn't go according to plan and mistakes occur.[28] Prime editing solves this problem. The upgraded Cas9 enzyme only snips a single strand of the double helix, so it is less invasive. A guide RNA named pegRNA directs both the Cas9 enzyme to the required spot on the genome, as well as a reverse transcriptase, which encodes the desired edit. Once that is done, the prime editor slices the unedited strand to trigger the cell to rebuild it to match the edited strand.[29] This technique is a major advance in gene-editing, as compared with the original CRISPR/Cas9 method. In essence, prime editing is significant because it offers the potential for high-precision genetic editing.

Who are the other actors in the therapeutics space?

Well, it's not just research labs that are working on CRISPR. There are also companies out there designing gene therapies that one day would be used to treat genetic diseases. Already several startups have commercialized CRISPR/Cas9 techniques or assets. Their customers, unsurprisingly, are pharma and biotech companies interested in the potential of CRISPR/Cas9 to experiment on disease models in animals, as well as the discovery of new cell-based therapies. Examples include:

• Horizon Discovery (collaborating with AstraZeneca and Glenmark)

• CRISPR Therapeutics (collaborating with Vertex Pharmaceuticals and Bayer)

• Editas Medicine (collaborating with Allergan and Bayer)

• Intellia Therapeutics (collaborating with Novartis and Regeneron Pharmaceuticals)

• Locus Biosciences (collaborating with Johnson & Johnson)

• Precision Biosciences (uses ARCUS, not CRISPR; working with Gilead Sciences and Cargill)

"Biohacking" and "citizen science" have been linked to CRISPR. What do these terms mean?

"Citizen science" and "biohacking", also known as DIY biology, are terms that denote non-professionals conducting do-it-yourself science experiments.

Citizen science is a type of science developed by citizens that takes place outside of traditional labs and institutions.[30] It is animated by open-source access and the notion of active public involvement in scientific research.[31] And it is a growing movement, with community biolabs cropping up far and wide to offer coworking spaces and outreach programs, such as Genspace[32] and BioCurious.[33]

With biohacking, individuals conduct experiments on their own bodies to make enhancements. This can quickly run amok, as when biohacker Josiah Zayner injected himself with CRISPR in front of a packed audience at a biotech conference to give him bigger muscles – it didn't.[34] In a world where DIY at-home CRISPR kits[35] can be accessed from Amazon at a click, and where competitive pressures in academia compel scientists to strive to be the first to make a scientific discovery, the potential for abuse is clear.

From Factory to App: Automobiles Take a New Route

Auto manufacturers become mobility as a service providers as the Fourth Industrial Revolution kicks in

Auto manufacturers are getting ready to offer "mobility as a service" (MaaS), as the technologies of the Fourth Industrial Revolution (4IR) reshape the concept of personal mobility.

These revolutionary technologies, such as IoT and AI, are forging "cyber-physical systems"[1] in ways that promise to unlock efficiencies across the entire value chain. Already many industries have overcome the "pilot purgatory" phase and are scaling up the technologies. Klaus Schwab, Founder and Executive Chairman of the World Economic Forum, predicts that the high-tech innovations of the 4IR will lead to a "supply-side miracle, with long-term gains in efficiency and productivity."[2] The auto industry shares that expectation, as it looks to overcome a decades-long torpor that has seen productivity levels plateau.

While the supply-side efficiency gains for automobiles look promising, a perfect storm of technologies is also paving the way to disrupt consumption patterns on the demand side.

The on-demand mobility revolution, kick-started by firms like Uber, has made MaaS offerings popular. There is no question that the number of miles consumed through such MaaS platforms will increase in the future. We believe this year auto manufacturers will enter the MaaS market, currently dominated by

tech companies. The shift will be evident as auto manufacturers extend their participation in the tail end of the value chain through new business models and product launches. In 2020, we will see more MaaS offerings, with auto manufacturers experimenting all the way from the factory floor to the app.[3]

How will this play out?

The Rise of the Ride-Sharing Industry

Ride-sharing brands have undergone verbification and become part of the global vernacular seemingly overnight. The convenience and ease of adoption has made ride-sharing services lucrative business, especially in developing markets. Not only have ride-sharing apps taken a fair share of miles traditionally captured by taxis, they have also cut into private vehicle miles.[4] Many studies have analyzed the comparative benefits of ride-sharing versus car ownership and the debate remains intense due to enormous variation in factors like fuel cost, and travel frequency.[5] Undoubtedly, ride-sharing has emerged as a viable alternative to ownership. According to ARK Invest, ride-sharing services have already affected auto sales, estimating that it may have caused a cumulative loss of 640,000 car sales globally.[6]

The ride-sharing industry is still in its infancy, with the largest share of the pie taken by the first-movers such as Uber and Didi. However, the industry is fast-evolving with more than 150 startups in the ride-sharing category raising more than $20 billion from investors to date.[7] We are seeing an industry in which consumer behavior is changing more than at any other time since the advent of automobiles, which is inspiring auto makers to offer MaaS.[8]

Advances in Shared Micro Mobility

In recent times, "last-mile" transportation options have been re-energized - which are journeys of under 5 miles that reach end-user premises. This dynamism is a consequence of technological breakthroughs in "micro mobility", a new category of vehicle that includes dockless electric scooters, bikes, and skateboards. Micro mobility is making big waves as one of the fastest growing transport modalities.

Furthermore, the future looks rosy: micro mobility options have the potential to monopolize last-mile journeys, which account for as much as 50-60% of total passenger miles today.[9] The largest share of mileage cannibalization for the auto industry may well come from shared micro mobility rather than ride sharing.

The market opportunity for micro mobility has resulted in startup investments of up to $5.7 billion and the rise of companies like Bird, Ofo, Lime, and Mobike. The market is flooded with startups, as the economics for setting up eScooters and bikes works more favorably than for cars.[10] The low cost, convenience and eco-friendly features of micro mobility make it popular among consumers as well. It has attracted a customer base at the rate of up to three times faster than ride-sharing firms, helping Bird and Lime attain "unicorn" status ($1 billion valuation) in less than a year.[11]

The lack of regulation around their usage still remains a challenge for their adoption. In 2019, after Germany legalized the usage of eScooters, we saw companies like BMW and Audi joining the micro mobility trend to launch their own eScooters.[12] Economic

Smart Vehicle Networks and Autonomous Vehicles

Automobiles have come a long way from "mechanical" to "electronic" to "intelligent." This progression is mirrored in the increasing importance of electronics within cars, wherein the cost of automotive electronics as a share of total costs has grown from 22% in 2000 to 35% in 2010, with the projection it will grow to 50% by 2030.[13] Nowadays, smart cars can stream over one megabyte of data per second.[14] The emerging "internet of cars" will provide an opportunity to optimize traffic networks and achieve greater efficiencies. For example, last year, Volkswagen launched its Quantum Shuttle Network project, which streams real-time data about traffic and passengers and sends it to a quantum computer for route optimization.[15] Automakers have a unique opportunity to leverage the data streams from their large fleets of vehicles to create smart networks, enabling them to develop innovative MaaS propositions.

Autonomous vehicles have emerged from their sci-fi origins and are set to disrupt the transportation sector. They are already a reality in the form of autopilots (e.g. Tesla) and pilots (test projects) in a few states like California. In 2019 we saw the biggest players in autonomous vehicles clocking more self-driving miles than ever. Alphabet's Waymo announced that it had streaked past 10 billion miles in simulation and 1.2 million miles on Californian roads, leading its next two competitors GM Cruise and Apple by a huge margin.[16] Tesla also announced that it will be approaching 2 billion miles on autopilot mode as its 780,000 vehicles have driven over 17 billion miles, enhancing its log of driving data.[17]

Apart from technical hurdles, players in the autonomous vehicle space will have to tackle regulatory and ethical challenges before they hit the road. Autonomous vehicles will be the biggest threat to traditional automobile miles as well as ride-sharing miles, as they could make ride-sharing services obsolete.[18] There is no doubt that all the major auto players (like Lexus, BMW, and Mercedes) are investing in the technology along with tech companies like Google, Tesla and Apple.[19]

Mobility as a Service in 2020

In 2020, automakers will join technology companies to claim a bigger share of the MaaS market. Last year, p0pTesla's ambitious announcement of Robotaxis – an autonomous vehicle network that offers rides on-demand - may well set a direction for automakers in the future. As part of the announcement, Elon Musk mentioned that Tesla might stop selling cars to individuals, and that Tesla owners could make up to $30,000 per annum by adding their cars to the Robotaxi network.[20]

In the ride-sharing space, we will see new players, like Canoo and Buzzbike, designing their products with a view to offering them as a service.[21] Other automakers will emulate the likes of BMW and Daimler's joint undertaking – Share Now – that provides services ranging from car sharing to multi-modal trip planning.

Higher adoption of MaaS platforms will have an impact on total miles traveled: in the long run it is also likely to impact aggregate automobile production levels. In 2020, we may very well see a peak in global automobile production as the benefits of the 4IR are being realized more by consumers than by producers.

"If you ask me what would be the total gross profit from a single robotaxi, I would say it would be around $30,000 per year."

- Elon Musk, Tesla

Examples

Audi's Electric Scooter is Designed for Your Daily Commute

"eTron", Audi's offering to break into the competitive eScooter market, is another example of the manufacturer's commitment to an electric vehicle future. The scooter, built for an urban environment, which may be used with existing transport options, is set to be released in 2020.

Unlike its popular eScooter predecessors such as Lime, Bird or Jump, the eTron will not be part of a scooter sharing service;[22] it will be marketed as a personal scooter with a price tag of around €2,000.[23] Its one handed control and dual axel steering offers the sensation of a mixture between surfing and skateboarding, which brings an element of fun into mobility.

Audi is not the first automotive company to move into the multi-modal/micro mobility market. Volkswagen is also developing production-ready eScooters, Streetmate and Cityskater,[24] whilst Ford acquired scooter company Spin in 2019. Whether these initiatives take off in 2020 will partly depend on the legalization and regulation of scooters in large populous areas, such as London and New York, where last-mile transport is becoming increasingly problematic.

eTron Scooter[25]
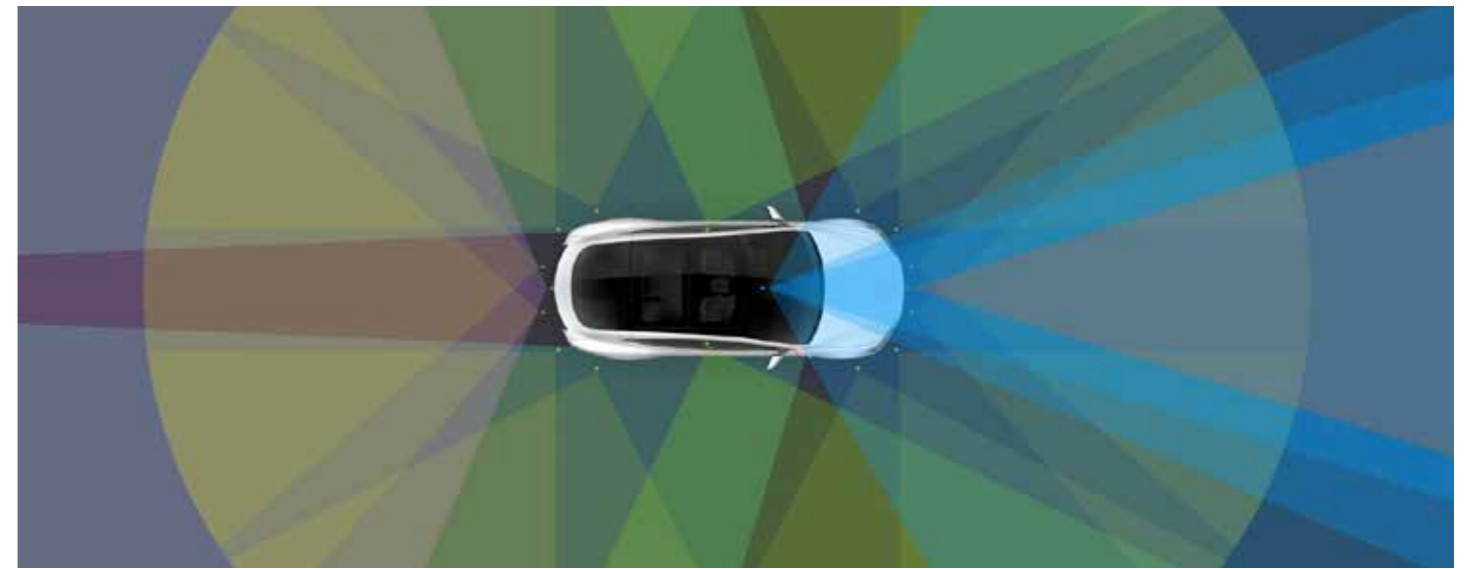
Tesla's Autopilot Scheme[26]

Tesla's Robotaxi Network

Tesla CEO, Elon Musk, is "very confident" that in 2020 his company will roll out an autonomous robotaxi network, marking its entry into the ride-sharing market alongside Uber, Lyft and Kapten (depending on regulatory approval within each of the jurisdictions). The robotaxi network will enable Tesla owners to lease their vehicle to other people in need of transportation, in return for a fee that would be split between the owner and Tesla. The service will take place without a driver and require little to no admin from the owner.

Tesla's "Autopilot" software installed on existing Teslas has recently been updated and is currently idle in "shadow mode".[27] Tesla claims this gives it a data advantage as it is racking up miles of simulation that will help it refine its technology.[28] Data utilization will be key if Tesla can create its fleet of self-driving cars this year, and the data collected will be a crucial metric in demonstrating its safety to governments and lawmakers.

The World's First Subscription-Only Electric Vehicle

Californian startup, Canoo, has an innovative business model for its electric vehicle (EV). Unlike other EVs, which tend to be high-end cars out of reach of the average customer, Canoo is offering a more affordable subscription service that may include maintenance, repairs and insurance[29] - and all of it is driven from its app.

The EV's appearance is somewhere between a car and bus. It is large and spacious with a modern interior,[30] and carries up to seven people. In addition, it is installed with seven cameras, five radars and 12 ultrasonic radars that can assist the driver whilst in use. Importantly, the technology equips Canoo vehicles with self-driving capabilities, positioning the company to offer electric ride-sharing services in the future.

Canoo's debut electric vehicle[31]

From Factory to App: Automobiles Take a New Route
Expert Interview

xLabs interviewed Prasanth Kancharla, Lead for 4IR Technologies at Virtusa xLabs, about our 2020 mobility trend that sees traditional automakers developing "mobility as a service" offerings.

What is the outlook for MaaS in the short term?

The auto ride-sharing market is projected to grow on average at around 20% CAGR over the next five years, according to a study by Mordor Intelligence.[32] The growth rates vary across geographies but, overall, we will see positive growth for the ride-sharing industry as more players enter the market.

A report by McKinsey labels the current phase "Ride-sharing 1.0" and, without any changes to the market, they foresee a plateau. Their research also suggests that advances in smarter design and user experience in this space could lead to higher participation levels from the broader population (Ride-sharing 2.0 and 3.0).[33] Also, other studies examining autonomous vehicle adoption estimate that the share of autonomous miles will exceed the human-driven by 2030.[34,35]

Turning to micro mobility, the market is where ride-sharing was five years ago, and it is attracting a lot of attention. I think the micro mobility market is driven by user enthusiasm. It is environmentally friendly and a nimble way to navigate through congested cities. So, this space is going to get a lot more exciting over the next few years.

Which markets are likely to be MaaS early adopters?

MaaS has been around for a while, of course. What has changed recently is the "personal transportation mix" of the users. The share of transportation consumed with MaaS in the mix has been rising and users are no longer exclusively traveling with the vehicles they own. Traditionally, auto manufacturers saw their users as buyers, and designed vehicles and campaigns to suit the requirements of different segments and needs. This is changing quickly, and manufacturers are reacting to design for MaaS now.

Most research on MaaS predicts that the impact will be greatest in China and other growing markets as compared to established markets like the US. MaaS miles as a percentage of total vehicle miles, globally, is currently 1% and estimated to reach 5% over the next five years.

This percentage is highest in China, followed by India and South East Asia.[36] These markets have a high proportion of millennials, who typically use smartphones and cannot afford cars. In addition, the accelerated adoption of MaaS will enable them to leapfrog the car-ownership phase, just as the adoption of smartphones and digital wallets helped them skip landlines and credit cards

What are the main barriers for MaaS facing auto manufacturers?

Agility will be a major challenge for large auto manufacturers. The automobile supply chain is quite complex and spread across multiple countries. We are seeing disruption occurring at the extreme end where consumption happens. It will take some time for the supply chain to adjust to these changes.

Also, this will be a new space for most automakers. The industry has an established product delivery mechanism via dealerships to target individual buyers. Delivering through MaaS will be an entirely new segment for the manufacturers and hence the challenge will be to adapt to this.

We know the auto industry has been in decline recently. Where will the funding for MaaS come from?

While auto sales have slowed down, we see a lot of investment from the auto sector in electric and autonomous vehicles. App-based services have really attracted investments from the technology sector, which is generally a key sector for most venture capital firms.

I feel one of the reasons for the auto sector's focus on MaaS is the growth that is happening in the segment. While adoption of MaaS might have long-term effects on overall automobile production, right now it is where a lot of innovation is happening. This will cause manufacturers to invest further to participate in the MaaS revolution.

What impact will this trend have on investments in public transport and urban planning?

The interesting part of this trend is that it reduces vehicle ownership and increases the usage of public transport. Some players like Grab are integrating public transport options and payments in their app, and Uber also suggests public transport alternatives. So, this trend will have an impact on investments in and usage of public transport.

Some of the shared micro mobility operators rely upon the ability of vehicle users to simply park on public roads. However, as uptake increases, this model will not be sustainable. There will be stricter laws for free-floating operators, and we could also see more station-based rental systems where vehicles may be docked.

What are the ramifications of MaaS for the auto-lending and auto-insurance sectors?

As MaaS adoption increases, the auto financing industry will be looking to serve this new segment. This is good for both the finance and insurance sectors as this segment is rich in data, enabling them to better assess risk. As per current business models, ride-sharing companies do not own vehicles: individual drivers do. Potentially, finance and insurance providers will obtain more data on the profitability and utilization of the vehicles in specific geographies and, consequently, will be able to better tailor their offerings.

Most ride-sharing apps are not profitable, so what sort of business models will emerge in the future?

It is true that ride-sharing apps are not yet profitable; some estimates say they might not be for the next five years. I think in developed countries, in the near term, the industry's focus will be on autonomous vehicles, as they have the potential to replace ride-sharing apps. Of course, the redevelopment of urban infrastructure to support autonomous vehicles will take a lot of time in most markets. However, the profitability for the ride-sharing apps segment will rise over time as the market share rises.

Ready, Set, Quantum!

Companies get ahead by taking the quantum leap
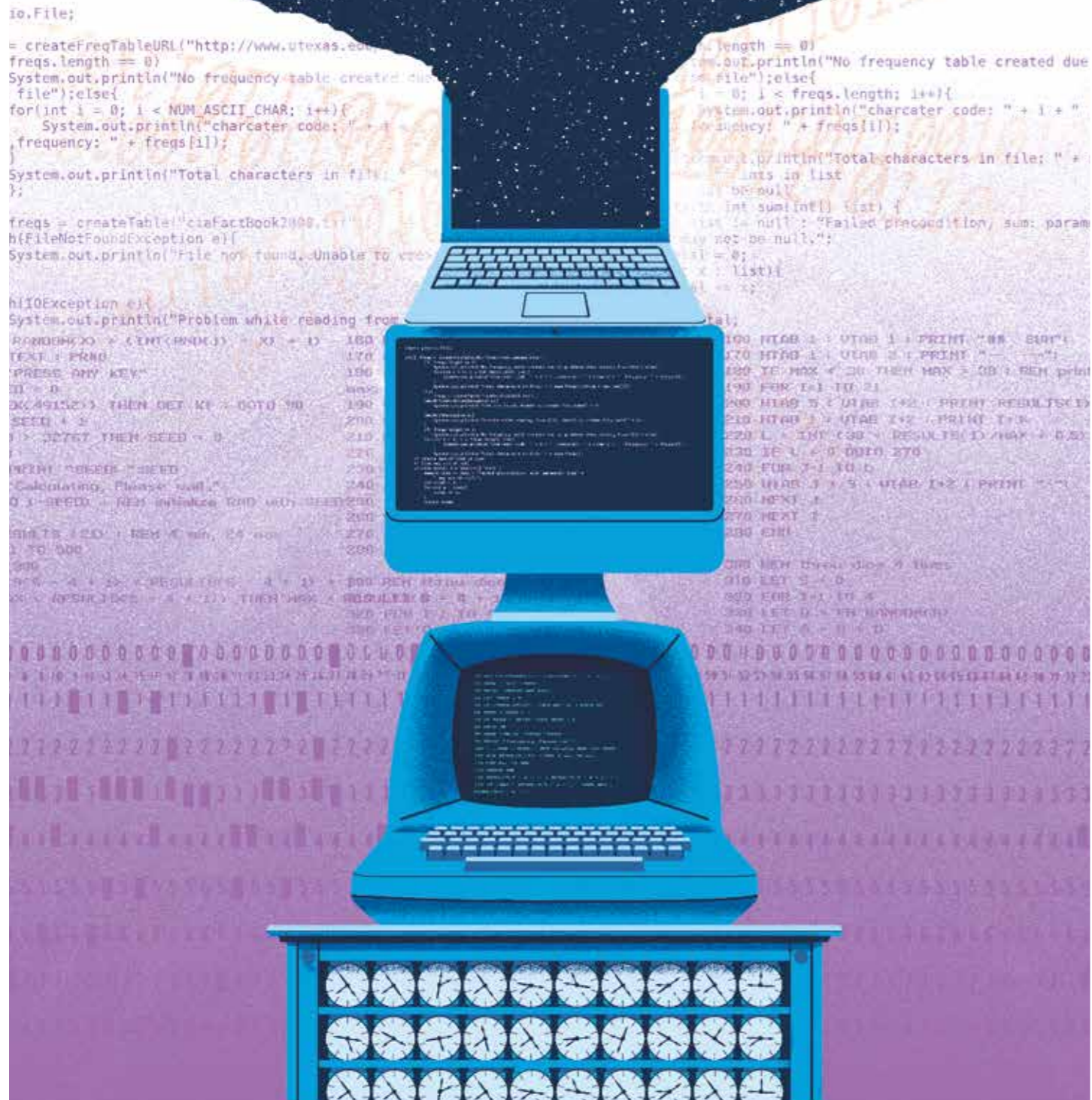
The era of quantum applications is coming.

For the longest time, the reigning view was that until scientists made vast improvements with the hardware, little progress could be made with the software. To perform calculations at exponentially faster speeds than classical machines, quantum computers would need many more error-corrected qubits – thousands more – to become general-purpose quantum computers able to crack some of the world's thorniest problems. Should scientists overcome these technical hurdles, quantum machines will have the power to revolutionize existing computing and business paradigms – although most experts put this prospect decades away.[2] For perspective, the best quantum computers today are around 50-80 qubits.

Over the past few years, however, traditional enterprises, startups, university labs, and tech giants have been experimenting with smaller, error-prone quantum machines: labelled "noisy intermediate-scale quantum" (NISQ) machines. And as it happens, they have made some remarkable advances.

Arguably the most significant of these was Google's bombshell revelation in September 2019 that it had achieved "quantum supremacy" – a term coined by John Preskill whereby quantum computers

outperform classical machines.[3] To reach the landmark, Google claims its 53-qubit quantum processor crunched a specialized computation in 200 seconds that would have taken a conventional computer 10,000 years to solve.[4] Not surprisingly, its biggest rival, IBM, has disputed the claim, saying the feat should not be taken as a credible demonstration of quantum supremacy since its Oak Ridge supercomputer could perform the computation in 2.5 days.[5] Whatever your views on this early "win," the excitement it has unleashed is fuelling growing interest.

The question on everyone's lips now is: what's next? If quantum supremacy "is not a single, sweeping victory to be sought – a broad Rubicon to be crossed – but rather a drawn-out series of small duels. It will be established problem by problem, quantum algorithm versus classical algorithm",[6] which problems will everyone be pursuing in 2020? How will it matter to business?

Last year, the notion that you could build a programmable quantum computer moved out of the realm of fantasy.[7] This year, companies will be asking themselves what they can do on these near-term computers. As the Nature journal reports, "although the results are still quite preliminary, algorithm designers are finding work for NISQ machines that could have an immediate impact in chemistry, machine learning, materials science and cryptography", adding that

"many researchers are focusing on what can be done with noisy, small-scale machines that are available now".[8] While work continues apace on building bigger, reliable quantum machines, businesses in the meantime will be pursuing innovations using the existing hardware. This direction was signaled in 2019.

Firstly, the levels of private and public investment have been escalating recently. In 2017 and 2018, private funding of quantum technology companies reached some $450 million, more than four times the previous two years.[9] Most of that came from VC coffers, prompting many to draw comparisons with the AI investment boom a decade earlier.[10] Of course, tech giants like Google, Intel, Microsoft and IBM have been sinking huge sums into quantum computing for years.

On the public side, another dimension to this story is the growing strategic importance of quantum computing for nation-states. The technology poses a sovereignty threat, owing to its potential capability to break current public key encryption algorithms, which today protect most of the world's data. Accordingly, countries around the world have been driving forward with an aggressive stance to build their quantum computing competence. The European Union is funneling €1 billion into its Quantum Technologies Flagship program.[11] In December 2018, the US passed a law for $1.2 billion to be invested in quantum computing
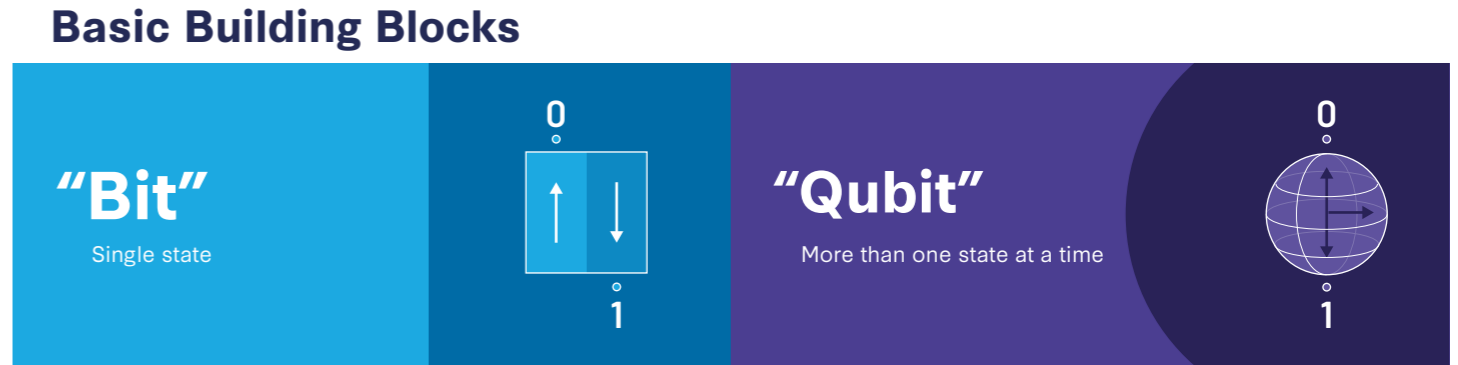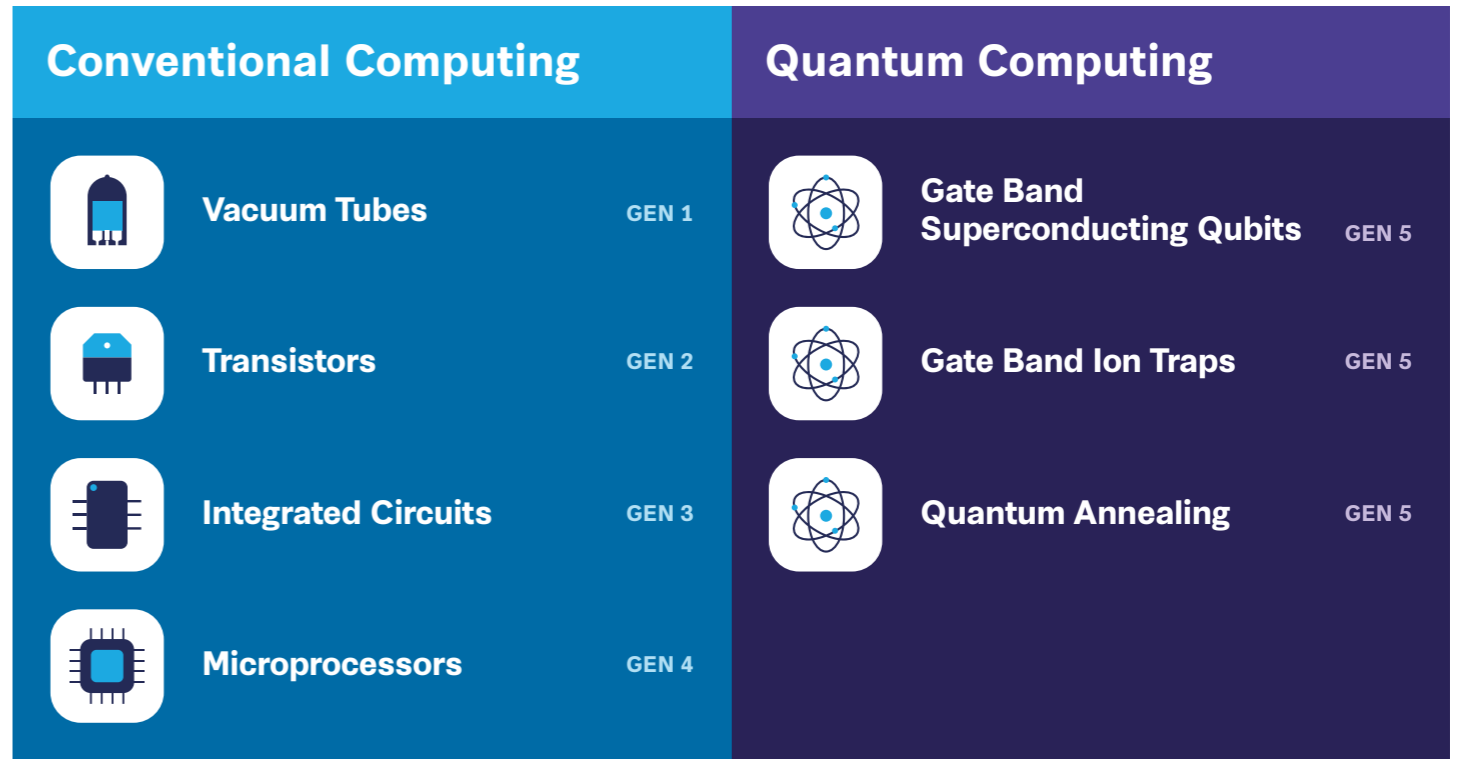
over five years.[12] China, for its part, is committing billions in a quantum-computing mega project, as well as building institutions and infrastructure to attract quantum talent and further its R&D ambitions.[13]

Secondly, 2019 was marked by the increasing availability of quantum computing via the cloud.[14] For example, the IBM Q Experience is IBM's cloud platform that provides public access to the company's quantum processors.[15] Last year, Google shared plans to grant cloud access to its quantum technology in the wake of declaring quantum supremacy.[16] Also, Microsoft[17] and Amazon[18] unveiled initiatives to provide customers hands-on experience with an actual quantum computer. Such initiatives reduce the barriers to entry, paving the way for hordes of bright minds to apply themselves to quantum computing problems, which should spark rapid progress in the field.

Thirdly, companies as diverse as banking giants like JPMorgan Chase and auto incumbents like Volkswagen have been immersed in numerous pilots, especially on optimization problems that they see as key to their continuing strength as firms. Volkswagen captures the mindset underpinning this kind of work:

"We see our quantum computing team at Volkswagen as an investment in the future. Our goal is always to put the best products on the market, and the easiest way to accomplish this is by leading the industry through research and development.... We cannot wait for quantum computers to impact the market before we learn how to use them. That is why we are constantly learning and developing internally, connecting quantum computing to different branches in Volkswagen, to assess where it can be most effective."[19]

In 2020, the quantum computing ecosystem will rapidly evolve. Partnerships and collaborations will multiply, bringing together quantum technology startups, research centers, tech giants and big firms to share capabilities and knowledge, devise post-quantum standards, and enhance the effectiveness of their pilot projects. This emerging ecosystem will explore different modalities of quantum computing, and build out the underpinning infrastructure, such as programming languages, algorithms, software development kits, and more.[20]

Conventional Computing		Quantum Computing	
Vacuum Tubes	GEN 1	Gate Band Superconducting Qubits	GEN 5
Transistors	GEN 2	Gate Band Ion Traps	GEN 5
Integrated Circuits	GEN 3	Quantum Annealing	GEN 5
Microprocessors	GEN 4		

Basic Building Blocks

"Bit"
Single state

0
1

"Qubit"
More than one state at a time

0
1

Why does quantum computing matters?

Quantum computing is based on quantum mechanics where it is possible (for an electron or ion) to be in more than one state at a time, contrary to classical computing where there are only two states (on or off). While classical computers have achieved a lot over the past 50 years, the superposition and entanglement of qubits allow quantum computers to perform certain tasks with exponentially higher efficiency.

What kind of tasks are quantum computers good at?

1. Optimization Problems

- Involves finding the best option among the possible configuration of options, faster.

- Think about searching a phone number from a directory: conventional computers search the numbers one after the other sequentially; quantum computers search the entire directory instantaneously by searching each line simultaneously.

2. Simulations

- Quantum computers are ideal for simulating quantum processes in physics and chemistry due to their ability to natively manipulate quantum mechanical states.

-Simulation of quantum states have applications in drug discovery, molecular biology, material science, and high-temperature superconductors.

3. Machine Learning

- Quantum computing may offer substantial speed-up in machine learning by improving the efficiency of learning algorithms typically used in "classification" and "recommendation" systems

- Applying quantum methods to machine learning techniques, such as clustering, neural networks, decision trees, and support vector machines, seem to be more efficient than their classical counterparts.

Examples

Quantum Computing-as-a-Service

In December 2019, Amazon Web Services launched Amazon Braket, a fully managed service that allows corporate customers to access quantum computing over the internet. The single development environment will enable researchers and developers to build quantum algorithms, test them out on simulated quantum machines, and a range of quantum hardware architectures.[21] Unlike Google and IBM, however, the Cloud giant has not yet built its own quantum machine. Rather, it is partnering with hardware providers D-Wave Systems, Rigetti Computing, and IonQ and offering online access to their prototype quantum processors. This initiative gives users with limited knowledge of quantum computers a way to gain experience with the machines in a single place.[22]

Settling High-Speed, High-Volume Trades with a Quantum Algorithm
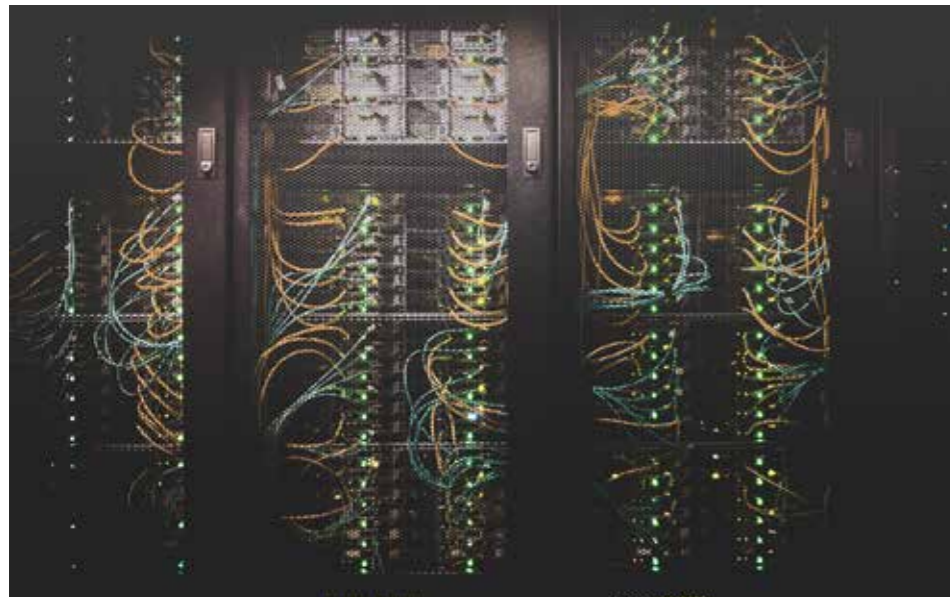
Barclays Bank joined forces with IBM to develop a proof-of-concept quantum application to optimize securities transaction trading, which is a computationally complex problem. Essentially, the trading process is as follows: X submits her trade details; Y submits his; they are matched, which is the transaction; and then it sits in a queue. The settlement can occur transaction-by-transaction, or processed in batches, where the objective is to settle as many trades as possible during the batch window. Classical computing architectures find it hard to deal with the associated scaling problems of these trades. The team explored the optimization problem with a seven-qubit system and found promising evidence that quantum processors could get better results, faster, from handling tens of thousands of trades.[23]

"Quantum supremacy is not a single, sweeping victory to be sought – a broad Rubicon to be crossed – but rather a drawn-out series of small duels."

- Ariel Bleicher, Quanta Magazine

Corporate Innovation Labs Grow Up

Commercial impact trumps innovation theater

THE IMAGINERIUM CENTRE FOR CREATIVE INNOVATION

IDEATION

AFFORDABLE
MARKETABLE

As the initial wave of hype surrounding corporate innovation subsides, businesses are re-evaluating how best to stimulate and support long-term innovation programs. They are also assessing the role of centralized innovation labs and how these need to evolve.

Going forward, viable labs will focus less on slides and tree-house meeting rooms and more on empowering and enabling a network of affiliate labs. This federated model will enable labs to maintain their focus on innovation, rather than incremental optimization, and generate the commercial returns that will ensure long-term funding.

After the Big Bang

Around 2000, the idea that "Innovation" was a discipline that could be fostered within corporations started to surface on corporate agendas. R&D operations had always been part of product companies but, as digital technologies and new, nimble digital-native competitors began to reshape the business landscape, innovation became the theme "du jour" for traditional industries; permeating the service sector, and eventually even the notoriously change-resistant public sector. The adoption of corporate innovation programs, and the construction of innovation labs – their physical manifestation – followed a predictable hype cycle.

First, in the "Innovation Trigger" stage, early adopters engaged specialist consultancies to help them embed the processes and drive the cultural change that encouraged innovation, enabling them to create new products and dominate new niches.

Next, the agenda of leading adopters focused as much on creating competitive advantage as on making visible the fact that they were "innovating": there was PR capital to be had in building an innovation lab and capitalizing on the next new thing to drive growth.

Mainstream adoption swiftly followed, reaching the "Peak of Inflated Expectations." For this group the barriers to adopting "Innovation" were low. It wasn't difficult to secure funding to build a lab, convert an existing space, or re-badge an existing team: at one point, over 65% of Fortune 500 companies had labs.[1] Building a lab, however, was the easy part and did not automatically equate to launching innovative new products and service lines. Changing culture, establishing the right success metrics, and creating the right processes, competencies and teams needed to generated returns from innovation investments were all relatively harder to put in place.

As with many emerging disciplines, the corporate interest in "Innovation" (with a capital "I"), has slowly flowed along the adoption hype curve. Today it feels as if the penchant for innovation labs has reached the "Trough of Disillusionment". Now businesses are considering their options. If we listen to HBR and believe that, despite the ubiquity of labs, 90% fail to deliver, then we'd expect few labs to emerge from the Trough.[2] But this is not the case.

In 2020, we will see continued investment in corporate innovation programs but less focus on creating the "Innovation Theater" associated with the first-generation labs.[3] Commercial pragmatism and a recognition of the real factors that drive innovation RoI mean that centralized approaches to innovation, with a core lab, will give way to a more federated approach. This will ensure there is greater alignment between a business unit's objectives, the funding invested by that business unit, and the activities of innovation programs.

Examples

Citibank Treasury and Trade Solutions Innovation Lab

Citibank set up its first Global Innovation Lab in Dublin in 2009 to focus on Trade and Treasury solutions. From its inception the lab has focused on engaging the business and bringing multidisciplinary teams together to drive tangible business outcomes. There has been a conscious decision to eschew the creation of an outlandish space. This has not had a negative impact on its business results. Along with delivering new products, including an AI Chatbot for CitiDirect BE and an ML-powered payment outlier analysis tool, it has encouraged the adoption of design principles within the wider organization. Labs looking to last a decade should consider emulating this focus on practicality, ensuring that good ideas make it to production, not just the prototype portfolio.

TD Bank's Central Innovation Agency

In contrast to the majority of innovation labs, Canadian bank TD's Central Innovation Agency started out as a grassroots movement, with staff focusing on innovation and engaging with emerging fintech partners in parallel with their day jobs. The CIA (pun intended) gained such traction, it attracted executive sponsorship and evolved into a formal team. This runs in parallel with TD's Waterloo, Ontario-based central innovation team, which focuses on running design boot camps and hackathons with a small team of innovation staff supported by a squad of interns.[4] This is an extreme example of a federated lab model that challenges the "build it and they will come" concept, showing that bottom-up pressure can also forge a productive lab.

"Over the coming years we will see innovation labs become more formally structured."

Corporate Innovation Labs Grow Up
Expert Interview

xLabs interviewed Stephen Wood, Vice President at Virtusa xLabs, about the growing maturity of company innovation labs, and their exploration of more supportive organizational models.

Is the appetite for corporate innovation programs waning?

Although there are reports of high failure rates for innovation programs, two factors indicate that the demand for innovation is continuing to grow.

It's fairly obvious that large consulting companies don't acquire niche companies without being sure that clients will soon demand (and be willing to pay a premium for) their services. We saw this in the rush to acquire design firms last decade as the Big Four looked to shift their brand as blue-chip business consultancy towards full-service digital agency. Over recent years, we've seen a spate of pure-play innovation consultancy acquisitions, with ?WhatIf! (now Accenture), Continuum (now EPAM), Idea Couture, and Red Associates (both now Cognizant) being snapped up. We see this as a signal that the pressure on corporations to innovate will continue to grow.

In parallel, we can see tech pressures continuing to stimulate corporate innovation programs. The rise of disruptive tech, the proliferation of platforms, and the widespread adoption of open tech standards have increased the rate at which commercial niches are redefined and reinvented. With this shift in pace, the shelf-life of competitive advantage has shrunk from decades to quarters. The possibility of capitalizing on new technologies immediately, or creating a new joint venture for the smallest window of opportunity, means that firms will need to foster the capacity to innovate at speed.

These factors will contribute to the survival of corporate innovation programs, despite a high rate of perceived failure. However, the period that innovation labs have spent in the Trough, combined with the reduction in "hype equity" and the increasing scrutiny of commercial RoI, will mean that they emerge changed.

What factors are reshaping next generation innovation labs?

The first change to take into account is that the desired outcome for labs has shifted away from Innovation Theater toward quantifiable commercial benefits.

Image influences perception: Google's slide,[5] Microsoft's tree-house meeting rooms[6] and everybody's foosball table, all attempted to signal a change in culture, a shift in convention and a willingness to adopt "the new." However, there's no correlation between interior design craziness and an innovation lab's RoI. Adopted in isolation, the tactic of wacky interiors is counterproductive and xLabs teams have spent many an hour sitting at the bottom of Google's slides seeing just as many employees emerge from it as viable proofs of concept from their labs.

In contrast to this, we've seen labs (such as Citibank's innovation lab in Dublin) eschew Innovation Theatre trappings yet work effectively with their wider business stakeholders and still attract good talent.

Labs that feature design promoting collaboration and good ergonomics do generate positive benefits, but they will lose their contrived "crazy" features. Just as these features signaled a shift towards creativity and away from business as usual constraints, their rejection signals a greater emphasis on productionizing implementation and driving innovation.

What about the human perspective? How are labor factors reshaping next generation labs?

Over the coming years we will see labs become more formally structured. We've seen an increasing number of people with innovation qualifications enter the workplace, while the installed base of innovation pioneers has continued to learn from their experiences. These human factors will result in a formalization of innovation lab process and governance; but, as a consequence, could mean that labs are less fun for maverick creatives.

In the early days of labs it was common to find that lab staff and management had little experience in fostering innovation and almost none had any formal innovation qualifications. In some cases, the head of innovation badge was given to a keen junior member of staff with no experiences of navigating the diplomatic landscape of a large matrix organization. This lack of competency and experience typically resulted in the failure to affect change in long-established

business units, and few commercially positive outcomes emerged. A decade on, most MBA courses now feature innovation modules,[7] (with the requisite tools and case studies,): there are even MA courses focusing on "managing the processes" of innovation.[8] The rise of formal qualifications has had an impact on labs. Positively, people entering the industry have a clear understanding about the multiple factors that need to be put in place to assure the viability of programs. This will help to establish better expectations for labs from the outset and will materially reduce failure rates. Negatively, as labs are seen as the natural landing spots for those with formal innovation qualifications, the diversity of the background of lab teams has become more homogeneous and the biases of lab staff must be actively managed. When staff diversity diminishes, and people start talking about applying "best practice", the chances of generating game-changing outcomes reduce.

Do central innovation labs still have a role within large organizations?

Given the high failure rates of labs, it's unsurprising to read about a number of labs being dissolved. This does not equate to disillusionment with the concept of labs;[9] it merely reflects the fact that labs evolve iteratively, as organizations explore which of the multiple formats of labs works best for them at a point in time. Common innovation lab organizational models found today include:

• The disconnected skunkworks model: typically, a physical lab that acts as an autonomous unit, maximizing its ability to avoid the gravitational pull of "business as usual" and subsequently discover truly disruptive ideas. These units thrive during periods of prosperity, and where a cult-of-personality leader gives them highly visible sponsorship and air cover. Often these units are seen as focused on abstract long shots, unaligned with corporate strategy. When prosperity turns to austerity, skunkworks are often axed, as was the case with Philips' legendary Design Probe unit, which shut its doors in 2012.

• A hub-and-spoke model, in which the lab acts as a "center of excellence" supporting innovation agents in the wider business. Here the key risk is that the CoE becomes a toothless watchdog. With no power to fund, resource or veto projects, or even to orchestrate collaboration between "spokes," the hub becomes irrelevant, leading to a loosely federated model.

• A federated model, in which separate business units fund and run their own labs. Citibank successfully operates a federated model with Treasury and Trade Solutions operating labs in Dublin and Singapore, while Markets and Security Services operate a lab in London.

• The evangelical model, in which everybody in the organization is viewed as an innovator, provided with training and then sent back to their business unit to spread the word. Catherine Bessant, Chief Operations and Technology Officer, Bank of America, has stated "it's more powerful to capture innovation from 10,000 people than to put 10 people in a lab." This may be true to an extent, but creating the cultural change and shift of mindset required to drive innovation can be difficult if you're one zealous innovator trying to convert hundreds of colleagues who are fairly happy with their "business as usual."

A brief web search will show that most large organizations operate multiple labs. These wax and wane, and often focus on objectives with vastly differing scope, ranging from incremental innovation, managing

a venture fund for investment in emerging tech partnerships, through to fostering moon shots. Given the fluidity and diversity of objectives and agendas, the natural future format for labs does not appear to align with the centralized "funky" lab, so prevalent in the past.

What tactics will enable innovation labs to pursue moon shot projects that disrupt and generate growth?

As Innovation Labs emerge from the Trough of Disillusionment with diminished PR value, businesses are working out how to get the best value from their innovation investments. Fundamentally they come back to economist Theodore Levitt's key question "What business are we really in?" For innovation labs, the answer will determine their trajectory and longevity.

Some labs, facing extreme pressure to show their commercial impact in the real world, talk about blending "incremental innovation" with "moon shots". This tactic means that they get products into production, but "incremental innovation" is often a euphemism for "optimization." This is a slippery slope. As labs shift into the traditional realm of effectiveness and efficiency consultants, the number of products that they launch increases, but their ability to deliver 10x moon shots erodes. Commercial pressures force them further down the slope and, as more of their resources focus on projects that generate incremental revenue, the lack of major disruptive innovation means that the lab neither delivers on expectation, nor fulfils its purpose. This makes its future as an innovation lab uncertain.

Labs that continue to focus on moon shots will probably adopt a federated model. If the moon shots take greater effort and have greater risk of failure, then they'll be done in smaller numbers. If you're funding a central pot there's a risk that your moon shot won't make the cut. Funding somebody else's project may be magnanimous, but it won't give you a return or assure your budget for next year. Federation gives labs autonomy, but there are still some tasks that work better in a centralized model. Trying to organize venture funding is prohibitively difficult to do multiple times in separate business units, and we've seen organizations such as ING Group operate separate Innovation Labs and Venture arms.[10] Similarly, it makes sense to engage academic incubators and large tech partners centrally, given the massive number of potential partners. Barclays' Rise initiative offers a good example of this model.[11] In this model, a central unit does exist, but its role is to fund and facilitate partnerships, rather than to operate and govern individual projects.

The razzmatazz of Innovation Theaters has helped us move the theme of innovation onto corporate agendas. Now, as focus shifts to how labs can best deliver commercial outcomes from innovation investment, this sparkle becomes less important. Over the next phase of innovation lab's evolution, we'll see less LEGO and outrageous statement furniture; instead we'll see more federated labs launching better products.

Self-Aware Infrastructure

Smartening up the foundation of our networked world
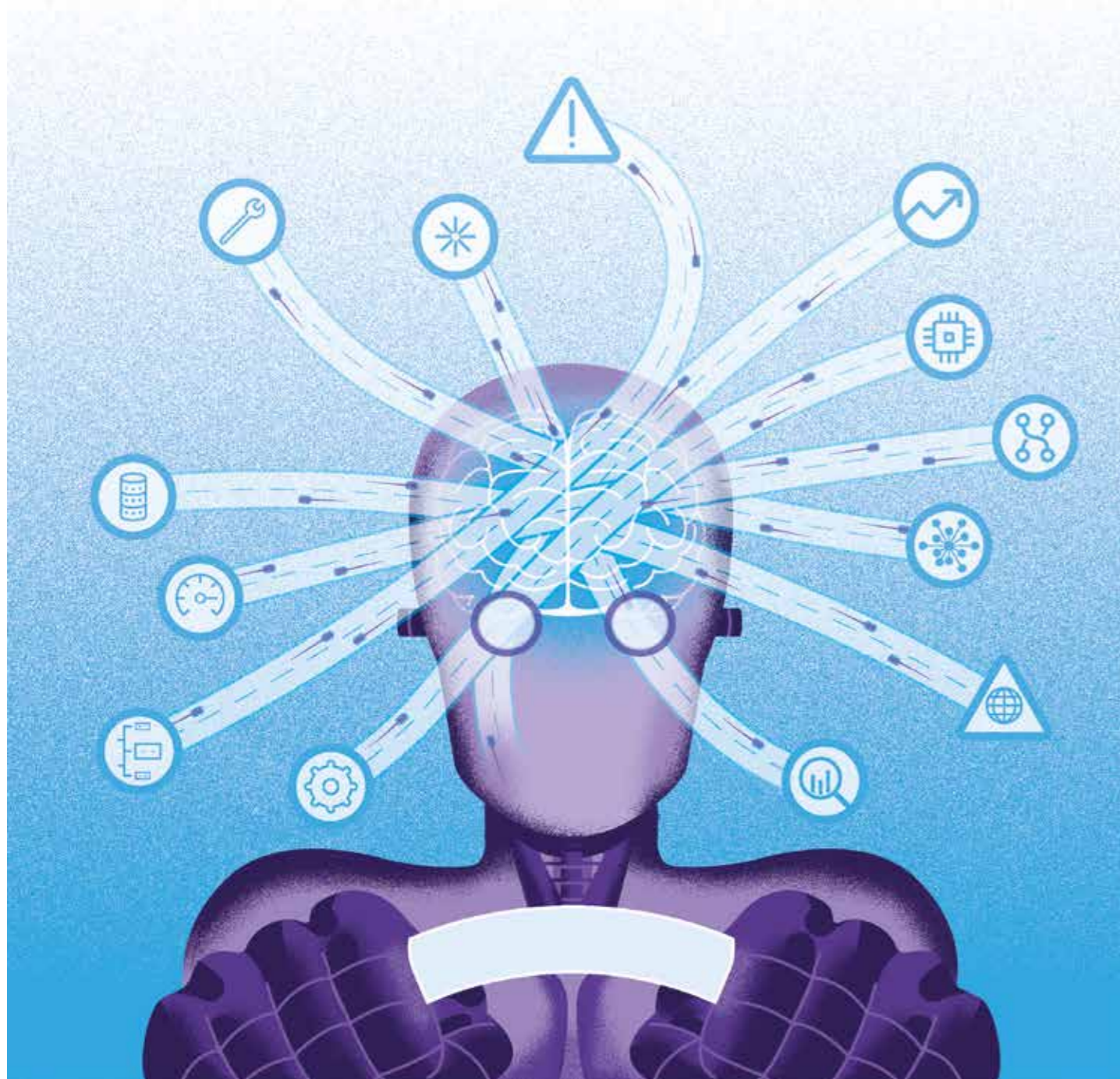
In the world around us, all our digital and technology services are run by technical infrastructure, which is the collection of servers, networks, and storage (among other elements) powering our digital services.

This infrastructure might be running on-premise (the traditional privately-owned hardware), on hyper-converged infrastructure (software-defined infrastructure using virtualization), or on the public cloud (such as that provided by Amazon, Google, or Microsoft).

Over the past decade, infrastructure has undergone a profound transformation in how it is managed, controlled, and marketed. While infrastructure has traditionally relied on human management and supervision, the advent of automation, cloud and now machine learning (ML) is weakening that dependency. In 2020, we believe the ecosystem of smart infrastructure will start to grow and evolve.

How did we get here?

Architects and administrators have long been responsible for creating and managing infrastructure (and their configurations) manually, including the governing policies and processes around how that infrastructure should operate securely.

In 2006, infrastructure technology started to change in the wake of the launch of the first public cloud by Amazon Web Services (AWS), followed by Google's application engine in 2008, which introduced self-service infrastructure to technologists. However, the real step change for less manual infrastructure occurred in 2011 when both Jenkins (a well-known automation application)[1] and Infrastructure as Code (IaC) became a reality, with AWS also releasing CloudFormation the same year. This allowed cloud infrastructure to be defined in code by engineers, providing ("spin-up") the infrastructure resources required on Amazon's servers.

For businesses that had the resources and capacity to adopt early on, this provided a much more manageable infrastructure (due to the level of automation available) and enabled a much smaller team to oversee it. As a result, operations and implementation were simplified, which had a positive impact on the costs of running such infrastructure.

This set in motion a trend, at the time called "software-defined infrastructure" (SDI), which led to the emergence of "hyper-converged infrastructure" (HCI) in 2014, the concept of having well-managed infrastructure minimizing the need for human supervision. By 2017, companies such as Hewlett Packard and Cisco had launched their HCI offerings to the market.

What exactly is "Smart Infrastructure"?

The next phase in the evolution of infrastructure has been termed "smart infrastructure." Cloud machine learning as a market proposition, which was introduced in 2014-15, began to gain market adoption around 2016.[2] Since then, the ability to use the full capabilities of ML has been implemented in infrastructures such as the cloud and HCI.

As cloud and HCI uptake started to grow massively in the global tech market, the volume of data available exploded. This data recorded every type of hardware and software engagement within the infrastructure, which made it more amenable to ML.

Today, the possibility of capturing and analyzing all (transient) infrastructure data via the logs, using ML (a subset of artificial intelligence), has become desirable in the market, as it provides valuable insights.

Smart infrastructure uses this data differently, by leveraging ML to report and highlight optimizations in how any given infrastructure should be operated. This ML will be looking at: database optimizations; network and security recommendations; observed security threats and fixes; and cost optimizations. This is significant to business as it presents a cost optimization by having an autonomous driven resource that can be replicated, running 24/7. It would also continuously check the systems for opportunities to optimize costs. It

"In 2020, the first signs of a highly optimized ML-driven infrastructure will be visible."

does this by, firstly, creating more efficient infrastructure and, secondly, by offering 24/7 security and performance observations.[3]

Where have we heard of smart infrastructure in the market so far?

Looking at the market headlines right now in this space we see Hewlett Packard Enterprise (HPE) looking to differentiate itself in HCI by using its AI called HPE InfoSight. The tool assesses and reports on virtual machine usage and enhancements to streamline and simplify infrastructure setup.[4]

AI-driven continuous performance optimization was something that also appeared on the market. It looks to be continuing to gather industry support, with the angle that it is looking at the application resource requirements directly. This also impacts the infrastructure requirements. The Cloud Native Computing Foundation is teaming up with DevOps specialists Opsani to develop this concept.[5]

We will also start to see AI-driven principles affecting both cloud and data center infrastructure. As discussed, this will initially take a more suggestive format (rather than AI directly controlled infrastructure). Examples of this include Nutanix, which has AI-driven optimization solutions, and Prism Pro, which advises on operational refinements.[6]

At the AWS cloud conference, re:Invent 2019, several new AWS platform-as-a-service (PaaS) offerings were introduced that use ML behind the scenes, which underlines how AI- and ML-driven infrastructure offerings will be coming into the picture in 2020. These include Amazon Detective, which uses ML to identify security threats within a customer's

infrastructure;[7] Contact Lens, which is a set of ML capabilities for AWS Connect (a contact center PaaS offering) to drive insights into customer sentiment, trends and compliance risks;[8] and Amazon Fraud Detector, for product companies conducting business online concerning fraudulent payments, accounts, and overall engagement using the companies' data.[9] It has also integrated the ability to quick-start ML capability.

What's on the horizon?

Looking towards the future, both the operation and management of smart infrastructure will become seamless. Progressively, these smart architectures may be able to self-govern, self-optimize and self-heal with limited human involvement, resulting in highly optimized, fault-tolerant and low-cost infrastructures.

We will also see companies exploring scenarios involving AI-enabled networks. So, as these AIs become trained on both actual and simulated environments, we will see them becoming as much a cybersecurity asset as a cost-optimization solution for compute and storage.[10]

In 2020, the first signs of this highly optimized ML-driven infrastructure will be visible.

The Evolution of Infrastructure

Year	Event
2000	On-Premise and Data Centers
2001	
2002	
2003	
2004	
2005	
2006	Introduction of first public Cloud (AWS)
2007	
2008	Google launches app engine Platform-as-a-Service (PaaS)
2009	
2010	
2011	Adoption of automation using Jenkins, launched on 2 Feb 2011
2012	Cloud formation - Infrastructure-as-Code (IaC)
2013	
2014	Hyper Converged Infrastructure (HCI) projects start
2015	Cloud Machine Learning is introduced
2016	ML is launched by Google
2017	Major suppliers start HCI offerings (HP)
2018	ML usage since 2018 / ML gains enterprise adoption
2019	HP uses AI-based products for HCI / Amazon launches multiple ML PaaS products
2020	Smart Infrastructure

Manual Human Requirement

Source: xLabs

This graph shows the timeline of key milestones on the road towards ever smarter infrastructure. Clearly, there have been significant innovations in infrastructure management over the past two decades, as businesses increasingly look for ways to reduce costs and extract greater intelligence from their data. They have progressed from utilizing software and technology that is located on-premise in data centers, to running remotely on hosted servers or in the cloud. ML and AI will be the next game-changers in this space.

Examples

Pandora Knows Your Musical Taste Better Than You Do

Pandora is a music and podcast discovery platform. Similar to other music streaming services such as Spotify or Apple music, Pandora offers song suggestions based on the user's personal music taste. Pandora has been collecting musical details on every song – 450 musical attributes at last count – as part of its Music Genome Project.[11] With these micro-attributes, the service, which is driven by machine learning, can find commonalities in songs that aren't obvious, so it can offer musical suggestions that are of higher quality and more suited to each user.

Even at the sign-up stage, Pandora gathers user data on gender, age, and location, and on this basis offers "cold-start recommendations." Users can thumbs-up or thumbs-down the suggested songs, helping the service to improve its understanding of the user's musical tastes.[12] With 65 million monthly users, Pandora is well-placed to gather vast amounts of data, both implicitly and explicitly, to train its machines.

More recently, Pandora has introduced voice-enabled technology and, by utilizing the data, a user can request "play me something I love" or "surprise me with something new" and receive a tailored response.[13] This "Voice Mode" feature also takes advantage of the smart speaker trend.[14]
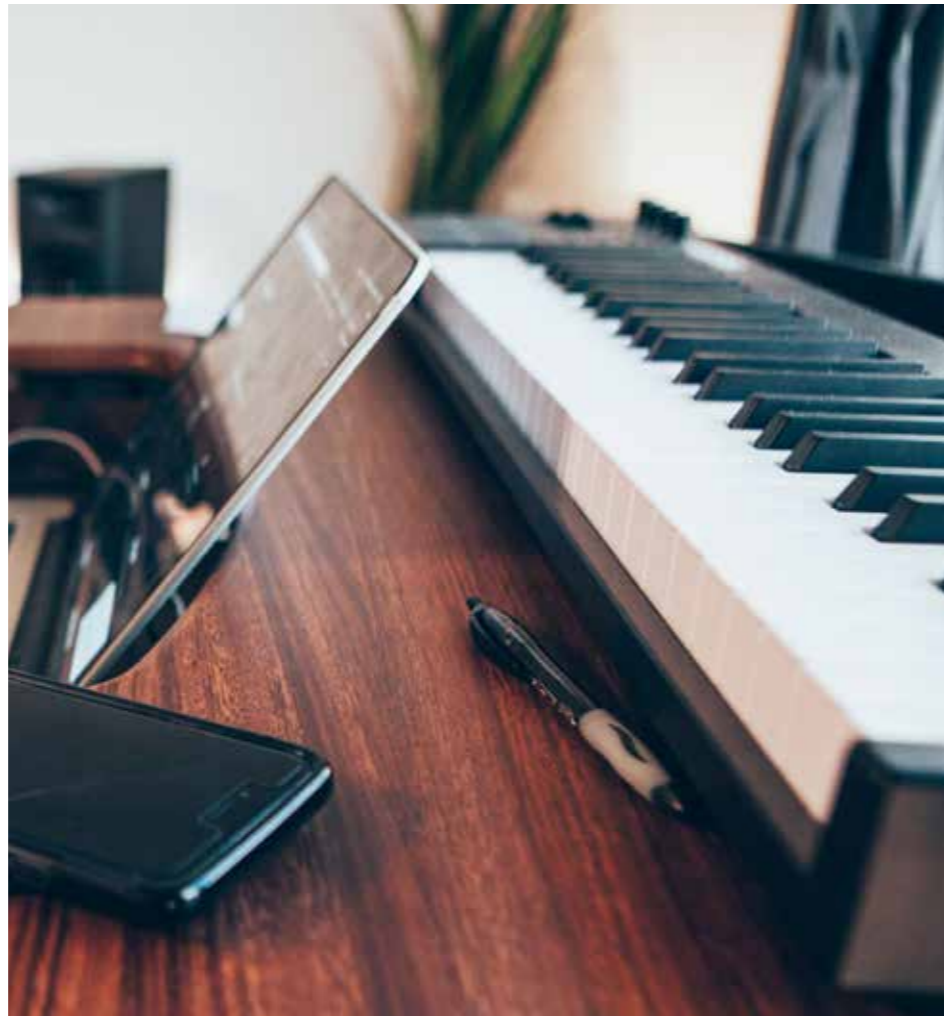
Algorithmia's AI Layer

Algorithmia, backed by Google and Norwest Venture Partners, started out as a marketplace for algorithms. However, with the surge in investment in machine learning and artificial intelligence in recent years, it has morphed into a DevOps platform where firms can take their ML models into production.[15]

Even though most Fortune 500 companies have an AI initiative, companies still find it challenging to deploy AI and ML models. 90,000 data scientists and engineers use the Algorithmia platform for their work. Recently, the United Nations worked with its AI platform to create a repository of algorithms to help countries understand trends in their social, health, environmental, and economic data to inform better decision-making.[16]

According to Algorithmia, 75% of data scientists' time is spent on infrastructure tasks.[17] The platform tackles this problem by being flexible. It works in multiple languages (e.g. Python, Scala, Java, and Ruby) and processing units (CPU or GPU). Furthermore, it is Cloud-agnostic and can run on most workbenches (e.g. Kubeflow, Tensorflow, and Spark).

Netflix's AI-driven Approach

Netflix's business is a subscription service model. It uses an AI-driven recommendation engine to deliver personalized experiences based on user behavior. Some factors the recommendation engine considers include: the user's interaction with Netflix (likes, viewing history); information on the media (genre, actors, release year); and the behavior of other Netflix subscribers with similar tastes. Netflix also takes into account contextual information, such as the viewing time, device used, and the duration of the user's attention for a Netflix show.

But it's much more complex than these high-level factors: Netflix has devised over 1,000 tag types to classify content into micro-genres, which had reached 76,897 by 2014.[18] Furthermore, the media company has developed "taste communities", which carve up its subscriber base, in light of their viewing habits, into clusters. This helps them see patterns and move to a near real-time recommendation process, which fast-tracks the learning process and makes the algorithm even stronger.[19]

Machine Learning for All

Automated Machine Learning and the rise of the citizen data scientist

To exploit the digital revolution that is transforming all industries, firms are thinking more seriously about how to wring insights from their data.

Companies are increasingly prioritizing advanced predictive and prescriptive analytics: a shift that is heightening the demand for data scientists adept at the latest tools for artificial intelligence (AI) and machine learning (ML).

The problem is highly skilled data scientists are both expensive and in short supply. In recent years, citizen data scientists have arisen to help close this skills gap. Citizen data scientists do not replace highly trained data scientists; rather, their role is complementary. Even though they lack specific, advanced data science expertise, they are able to generate models using state-of-the-art diagnostic and predictive analytics.[1] They have that capability in part because of new, accessible technologies that have automated many of the tasks data scientists would normally perform.

Over the past few years, some key technology advances have occurred to support this citizen data scientist trend, such as "automated machine learning" (AutoML). AutoML is a set of algorithms that automate the writing of other ML algorithms:[2] it automates end-to-end the process of applying ML to real-world problems. A standard ML pipeline involves the following: data pre-processing, feature extraction,

feature selection, feature engineering, algorithm selection, and hyper-parameter tuning (to validate the model accuracy). Implementing these steps demands ML expertise and considerable time: there is a high barrier to entry.

AutoML removes some of these constraints. Not only does it slash the time it would normally take to implement an ML process under human supervision, it also often improves the accuracy of the model[3] as compared with hand-crafted models that are trained and deployed by humans. It provides a gateway into ML for firms, while also releasing ML engineers and skilled data practitioners from the mundane tasks, leaving them to focus on higher-order challenges.

In 2020, we believe AutoML adoption at the enterprise level will start to become mainstream, supporting the ever-growing reliance of corporates on civilian data scientists. This should elevate the knowledge of business leaders about ML processes and capabilities, as AutoML will compel them to prise open the "black box" now that it is so much easier to access. AI and ML tools and processes will therefore start to infiltrate ever deeper into the everyday thinking and practices of firms.

As a Harvard Business Review article said in October 2019, "More recently, organizations have shifted towards amplifying predictive power by coupling big data with complex, 'automated machine learning'. AutoML, which uses machine learning to generate better machine learning, is advertised as affording opportunities to 'democratize machine learning' by allowing firms with limited data science expertise to develop analytical pipelines capable of solving sophisticated business problems."[4]
This trend started around 2012 when "deep

learning" resurfaced and swiftly rose to become the dominant approach to solve ML problems. This catalyzed a boom period in the generation of new software, tooling and techniques that altered the workload and workflow associated with large-scale ML.[5] For instance, entirely new ML tool sets were created, such as TensorFlow and PyTorch.

Increasingly, people began to engage much more with graphics processing units from Nvidia, which accelerated their work.[6] At last companies had a way to deal with the scalability problems associated with running ML algorithms on huge data sets that had long stymied their efforts. The biggest winners were the BigTech powerhouses, who quickly developed sophisticated internal tooling capable of building world-class AI applications. Before long, they had streaked ahead of their Fortune 500 peers in terms of realizing the benefits of smarter data-driven decision-making and applications.[7]

AutoML is the next phase in broadening the ML revolution: it promises to help non-tech companies access the capabilities to build ML applications quickly and cheaply. In 2018, Google launched its Cloud AutoML[8] based on Neural Architecture Search (NAS) and transfer learning, with Cloud AutoML Vision as the first release.[9] According to former Google Cloud AI/ML executives Fei-Fei Li (Chief Scientist) and Jia Li (Head of R&D), this "will make AI experts even more productive, advance new fields in AI and help less-skilled engineers build powerful AI systems they previously only dreamed of."[10]

One downside for some is that Google's AutoML is a proprietary algorithm. As an alternative, many open-source AutoML libraries have been released,[11] such as AutoKeras, which was developed by researchers at Texas University last year

and powered by the NAS algorithm as well. In all, these technological breakthroughs have given companies the capability to build production-ready models easily, without having to draw on expensive human resources. Furthermore, greater AutoML adoption across industry should motivate leaders to figure out what AI can do for their company – providing them AI learning and development opportunities, as well as empowering them to identify the relevant AI projects to drive better decision-making.

To get a rough sense of the surge of interest in AutoML, Google reports there was a 115% increase in the adoption of its Cloud AutoML in 2019.[12] In terms of industry take-up, see this graph (right) that shows which industrial sectors have utilized Google's AutoML products to date.

Number of companies using Google Cloud AutoML by Industry

Industry	Count
Technical	13
Business Services	10
Manufacturing	6
Retail	6
Finance	6
Education	3
Consumer Services	2
Telecommunications	1
Transportation	1
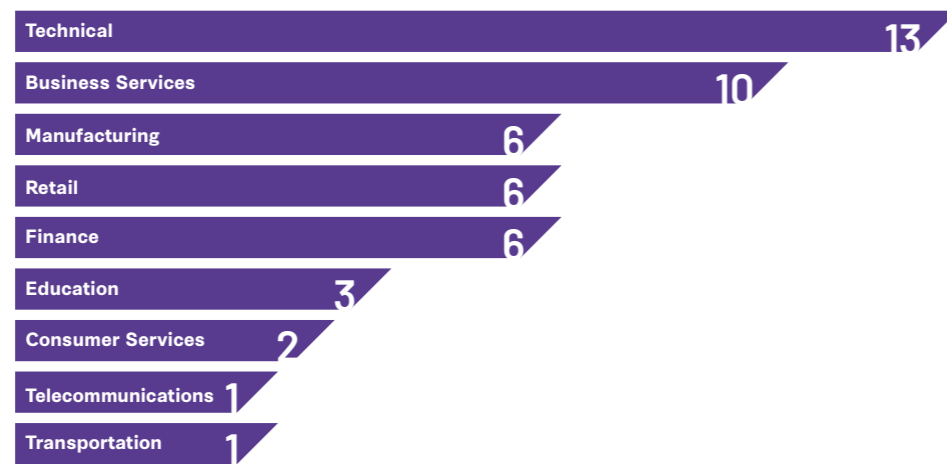
Source: HG Insights[13]

Number of companies using Google Cloud AutoML based on Revenue

Revenue	Count
Above $1B	23
$500M - $1B	3
$200M - $500M	4
$100M - $200M	3
$50M - $100M	2
$10M - $50M	4
$1M - $10M	6
Below $1M	1
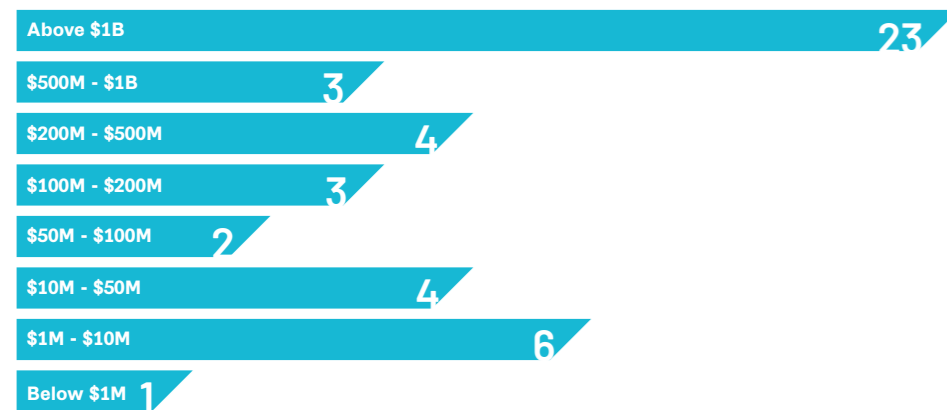
Source: HG Insights[14]

For a sense of the size of American companies experimenting with Google Cloud AutoML, consider this graph (left).

As the world continues to digitize, companies must reckon with new tool-sets and systems to help them engage with the fast-evolving digital ecosystems that have emerged. AI, ML and deep learning are proving to be key capabilities – some might argue they are the new table stakes of the digital economy. AutoML leverages these capabilities to give firms from every industry the opportunity to benefit from data-driven applications powered by statistical models: it can do so even in today's talent-scarce environment with non-experts like citizen data scientists. Crucially, AutoML can be a wellspring of completely fresh insights. For companies bent on innovation and R&D, AutoML will be an important process for leading-edge product development in 2020.

"In 2020, AutoML adoption at the enterprise level will start moving into the mainstream, supporting the ever-growing reliance of corporates on civilian data scientists."

Examples

Automating the Design of ML Models for Autonomous Driving

For self-driving tech company, Waymo, machine learning is fundamental to its self-driving system. Its neural nets enable vehicles to interpret sensor data to understand their surroundings, predict how others will behave, and make decisions.[15] However, creating neural nets is extraordinarily time-consuming, so Waymo began a collaboration with the Google AI Brain team to speed up optimization of its neural nets. The team wanted to know if AutoML could produce "a high quality and low latency neural net" for its car, given AutoML's aptitude for producing "a large set of ML solutions efficiently and continuously". Here, "quality" is important as it measures the accuracy of the answers generated by the neural net; and "latency" measures how quickly the net generates its answers.[16] Both these dimensions are essential because autonomous driving requires real-time, safe vehicle information. The team found they were able to find better nets with 20-30% lower latency with results of the same quality, as well as neural nets of higher quality, with an 8-10% error rate.[17]

Waymo Self-Driving Car[18]

AutoML for Improved Personalization

LendingTree is America's largest online lending marketplace, which connects borrowers to lenders so they can source the best deals on loans, deposit accounts, insurance, and so on. With its fast-expanding network, the company realized providing consumers with more choices was not enough: it wanted to offer more personalized recommendations to enable them to be more confident with their financial decisions. So, LendingTree used Datarobot's AutoML platform for model development, evaluation, comparison and testing. Overall, it has achieved business value through improved targeting, which has reduced its marketing costs, and a better experience for consumers. By standardizing its process, it has also reduced manual interventions.[19]

Predictive Analysis by Automating the ML Pipeline in the Healthcare Sector

Steward Health Care is America's largest for-profit private hospital operator. It collects a lot of data, which feeds into its ML models to help it make big decisions about staff and patients, reduce costs, and improve patient outcomes and experiences. One of its goals was to improve its predictions on hospital volume and staffing. However, building a predictive analytics system is often time-consuming and not very accurate. So, the hospital used an AutoML platform to build an accurate enough predictive analytics system in a short time-frame. As a result, Steward Health Care were able to optimize staffing according to the volume of patient intake and surgeries. Thanks to AutoML, they were able to predict the number of patients per day for the following month, which slashed administrative costs and improved patient outcomes and satisfaction.[20]

Machine Learning for All
Expert Interview

xLabs interviewed Niladri Bhandari, R&D lead at Virtusa xLabs, about our 2020 trend, the rise of the citizen data scientist and AutoML.

Will AutoML replace data scientists?

No, the main purpose of AutoML is not to remove data scientists, but to assist and free them from the burden of performing repetitive and unchallenging tasks. So, AutoML services are more aimed at citizen data scientists. The idea is to use AI to build models that increase the productivity of employees, enabling them to concentrate on value-adding activities, and augment their domain and technical expertise.

Also, certain stages in the ML pipeline may not be so easily automated, such as feature engineering, which is often problem-specific and calls on human creativity and imagination. Besides which, domain expertise remains important. You still need experts to ensure the machine is outputting sensible results. There is actually a deep shortage of data scientists and ML specialists, which is not likely to improve anytime soon.

Who are likely to be the first adopters of AutoML from industry?

The first customers, not surprisingly, have tended to be internal customers of the BigTech firms – for example, Waymo, which is an autonomous vehicle company operating under the Google/Alphabet umbrella group. Other early AutoML adopters are companies already well-acquainted with ML but wish to graduate to the next phase of becoming more data-driven and automated. Typically, they're drawn from industries that heavily rely on large data sets and have been actively trying to create value from them, such as pharmaceutical drug discovery companies, medical imaging and gene sequencing firms, and banks and financial institutions.[21] These companies are sophisticated ML users that are always on the lookout for more powerful tools and processes to help them be more productive.

Overall, I'd say AutoML has become an attractive option for companies wanting to scale their ML capabilities. Businesses can worry less about devoting time to building complex models, and more on developing solutions and productizing them.

As with ML, the array of use cases for AutoML is broad. Nowadays, data is the lifeblood of many companies – for most, it's the source of their competitive edge. In the absence of skilled data scientists who are good at using statistical models, AutoML would be useful.

What are some of the pitfalls associated with AutoML?

AutoML is vulnerable to the same sort of limitations associated with ML and big data. Due to some high-profile disasters, issues to do with algorithmic bias, explainable AI, transparency, privacy, and fairness have come into the public eye recently. For example,

Google Flu Trends claimed to be able to predict the prevalence of flu in a population, based upon large-scale search query data and using ML. But it overestimated peak flu levels dramatically and was quickly shut down.[22]

Ethical considerations relating to fairness and privacy aren't as straightforward as you might think. There are many definitions and understandings of these terms that can conflict with each other, but it's good to see that ethics has become a vibrant research area. When applying AutoML, it is important to take these ethical concerns into consideration, and ensure there is proper expertise, contextualization, and very high standards of data management.

What steps should firms take if they are interested in utilizing this tool?

The adoption of AutoML tools within an organization requires deep reflection about current ML practices as well as the company's future roadmap of machine learning objectives. As ML is a hybrid ecosystem of open-source, cloud services, data tools, and custom-built internal platforms, it needs to be analyzed from a few perspectives: companies need to identify the stage at which AutoML should be applied; and they need to select the tool that is most appropriate for the need.

For the process of onboarding AutoML, different tools in the market offer diverse levels of performance, coverage, customization capabilities, and control features. Organizations can take a two-step approach that involves building an internal AI platform, comprising the end-to-end needs of ML projects, and then producing the business-use cases on top of this platform. Organizations can onboard a variety of AutoML tools efficiently at the first stage by providing ML application developers the flexibility to choose and apply appropriate AutoML frameworks (such as auto-sklearn, TPOT, AutoKeras, and Google AutoML) within the AI platform boundaries.

Organizations that are locked into a certain product or platform for most of their ML needs stand to gain from the AutoML feature of that platform. For example, an organization using Azure cloud or H2O.ai for building their ML use cases could respectively adopt the Azure Automated Machine Learning capabilities or H2O.ai's AutoML services, which compares a wide variety of ML algorithms to recommend the most optimized data and ML pipeline.

For the suitability framework and use-case mapping: companies need to analyze and segregate the use cases on different parameters, such as the amount of data required, the type of model and training controls needed, the typical optimization time, the retraining needs, and the end-user impact. This will enable businesses to understand the applicability of a range of AutoML tool in distinct scenarios. For example, to train an Image Classification Model, which takes a prodigious amount of data and requires complex deep learning models, the Google AutoML framework could be chosen. This framework not only helps in neural architecture search but also provides the transfer learning capabilities to reduce the amount of training data needed. However, for building a financial-risk scoring model, which requires the compliant sample dataset with deeper level of model controls, one can experiment with AutoML frameworks such as auto-sklearn or TPOT.
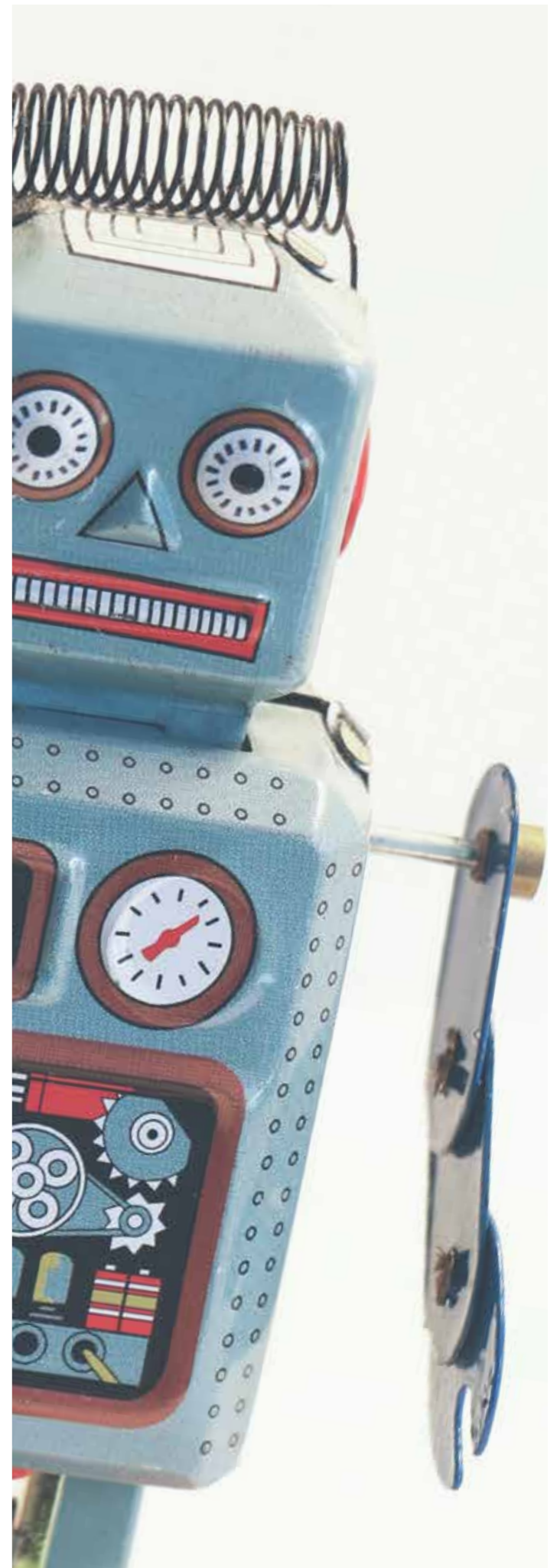
Left-Field Trends

Way-out trends making their way-into our lives

Wondering what is happening at the bleeding edge of innovation? Clamoring for a dose of inspiration, for a key-hole look at some of the most thought-provoking trends around? As hardline innovation fanatics, we were restless to find out too. Scouring trend pieces, consultancy papers, and analyst reports, we zeroed-in on six disruptive trends.
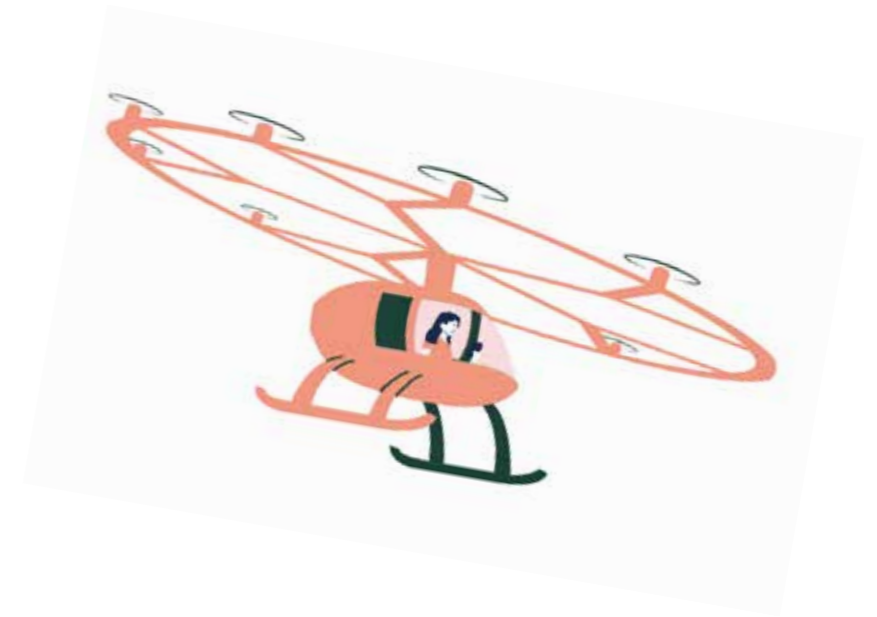
Turbo Trend Map

A bite-sized digest of 2020's trendscape

Our annual trend snapshot, compiled from the weighty tomes published by trend spotters and analyst firms, gives you a steer on the biggest innovations shaping your future. xLabs has trawled through more than 500 trend articles and reports, crossing the gamut of industries, and divvied them up into ten categories. As we enter a new decade, take a look at the key predictions everyone is talking about.

Subject Area

Themes

Legend

ACC	Accenture
AD	Adobe
AX	Axios
B2C	Business 2 Community
BBC	British Broadcasting Corporation
BI	Business Insider
BMC	BMC
CB	CB Insights
CRB	Crunchbase
DE	Deezen
DT	Digital Trends
FB	Forbes
FC	Fast Company
FJ	Fjord
FR	Forrester
FT	Financial Times
FGCP	Future Generation Computer
FU	Futurice
HP	Huffington Post
I	Iflexion
IBM	IBM
JWT	J.Walter Thompson Intelligence
MCR	Microsoft Research Blog
MIT	Massachusetts Institute of Technology
MK	McKinsey
MT	Mintel
NYT	New York Times
OM	Omidyar
TFL	The Future Laboratory
TG	The Guardian
TNW	The Next Web
TR	Technology Review
TV	The Verge
WI	Wired
ZDN	ZDNet

Life Science

Healthcare On Demand
- The Apple Watch is now the control center for your health — WI
- Prescription-grade apps are putting the future of medicine in the palm of patients' hands — JWT
- Apple puts the promise of health innovation in the hands of consumers — FR

Preventative Healthcare
- How Big Data can help you choose better health insurance — FC
- AI Doctors: Better tools to detect and diagnose conditions before they arise — JWT
- Model predicts cognitive decline due to Alzheimer's, up to two years out — MIT

BabyTech
- Quantified Baby — WI
- The 'smart' baby technology raising today's children — BBC
- Baby Tech: Parenthood cool, calm and connected — JWT

Human 2.0
- Life-centered design — FJ
- Hacking humanity has never been more ethically fraught — FC
- Bionic shorts help turn an epic hike into a leisurely stroll — TR

Digital Reliance

Robotic Social Care
- Social robots for children — MIT
- Smart speakers for the retired community — TR
- Social robots as social catalysts — MIT

Lonely Tech
- Better tech can be the solution to loneliness in older people — HP
- Mental health pandemic: Is the world getting more addicted, anxious, and lonely? — OM
- Loneliness in Tech: Nothing beats vulnerability — CRB

Autonomous Workers
- Walmart's robot army has arrived — FC
- Postal robots take to the streets — ZDN
- Laundroid: A home robot that folds and sorts clothes — ZDN

IoT In The Supply Chain
- Blockchain and IoT together can take supply chain management to the next level — IBM
- Lighthouse manufacturers lead the way — MK
- IoT solutions help Vodafone recover almost 1,000 vehicles — ZDN

Finance

Mainstream Cryptocurrency
- Get ready for China's digital currency — TG
- Facebook's endgame: Getting inside your wallet — FC
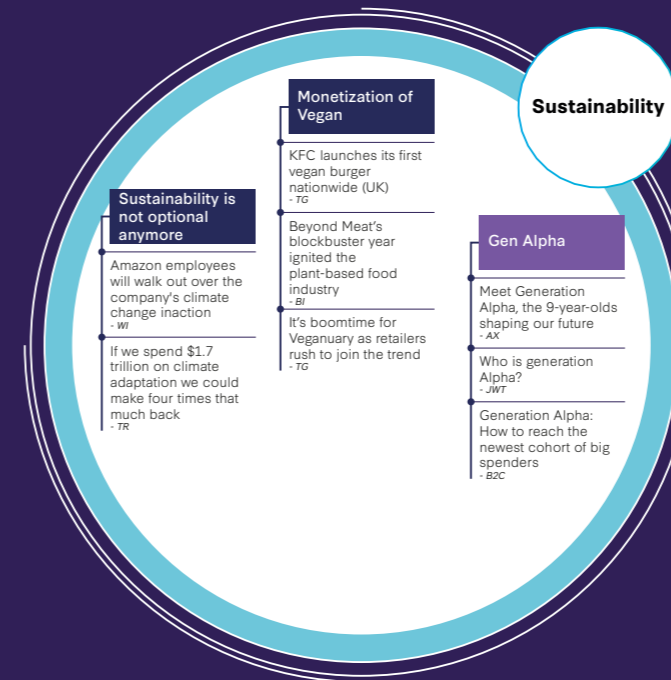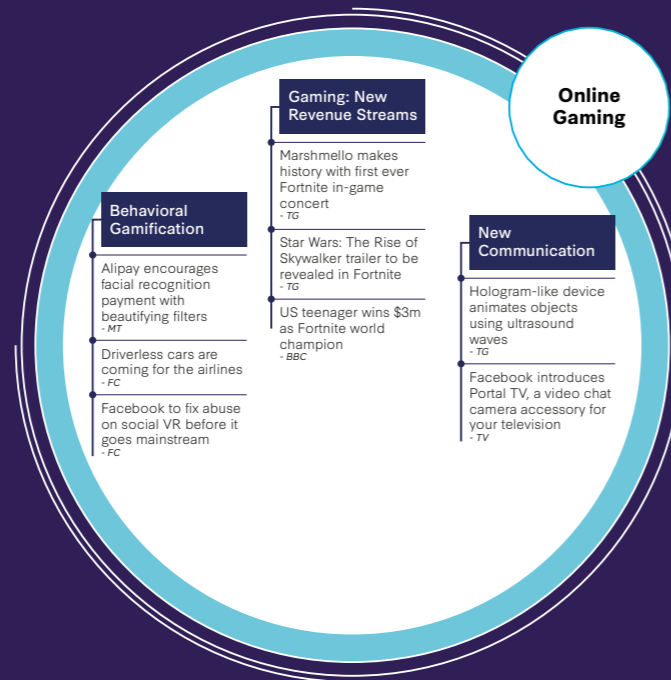- Libra has raised the stakes for national regulators — FT

China Invests In Africa
- Chinese investors double down on African startups — TC
- Chinese entrepreneurs set up in Africa — FT

Cross-Border Instant Payments
- Getting ready for Europe's new payments architecture — FT
- SWIFT clocks 13 second cross-border instant payment in global trial — ZDN

Self-Driving Finance
- Machine lending up to $10m — FC
- How AI will change the way you manage your money — FT

Online Gaming

Gaming: New Revenue Streams
- Marshmello makes history with first ever Fortnite in-game concert — TG
- Star Wars: The Rise of Skywalker trailer to be revealed in Fortnite — TG
- US teenager wins $3m as Fortnite world champion — BBC

Behavioral Gamification
- Alipay encourages facial recognition payment with beautifying filters — MT
- Driverless cars are coming for the airlines — FC
- Facebook to fix abuse on social VR before it goes mainstream — FC

New Communication
- Hologram-like device animates objects using ultrasound waves — WI
- Facebook introduces Portal TV, a video chat camera accessory for your television — TV

Sustainability

Monetization of Vegan
- KFC launches its first vegan burger nationwide (UK) — TG
- Beyond Meat's blockbuster year ignited the plant-based food industry — BI
- It's boomtime for Veganuary as retailers rush to join the trend — TG

Sustainability is not optional anymore
- Amazon employees will walk out over the company's climate change inaction — WI
- If we spend $1.7 trillion on climate adaptation we could make four times that much back — TR

Gen Alpha
- Meet Generation Alpha, the 9-year-olds shaping our future — AX
- Who is generation Alpha? — JWT
- Generation Alpha: How to reach the newest cohort of big spenders — B2C

Turbo Trend Map

A bite-sized digest of 2020's trendscape

Subject Area

Themes

AI Ethics

Artificial Creativity
- AI bot creates images from a dozen words - MCR
- Creative types say AI will help, not hurt, their jobs - FB
- AI software turns rough doodles into realistic landscapes - TV

Zero Privacy
- Facebook has leaked 419 million phone numbers - TR
- AI can reconstruct a rough likeness of a person via a recording - FC

AI Ethics
- AI drives the circular fashion movement - FB
- AI's next ethical challenge: how to treat animals - FC

Emotional AI
- AI can read your emotions. Should it? - TG
- AI: How Emotion AI Is Making Robots Smarter - FB
- AI detects 11 types of emotions from a selfie - TNW

Data

Interpreting Data
- Expand the power of AI with new data sources - ACC
- Drag-and-drop data analytics - MIT
- Unlocking value from unstructured data - ACC

Digital Twin
- Farming's digital doubles will help feed a growing population using less resources - IBM
- Digital doubles: Digital twins are evolving beyond their role - FJ

Data Ownership
- Putting a price on your personal - FC
- How much is your data worth? - FB

Open Source
- How open source software took over the world - TC
- The impact of the tech giants on open source - FB

Bespoke Experiences

Single Age Of Behavior
- The new singles lexicon - JWT
- Uncoupled living - TFL
- The single age: On finances - JWT

Zero UI
- Voice technology and the lure of zero UI In healthcare
- Amazon adds wearables to voice-controlled Alexa collection - DE
- What next for CX? - FU
- A long path to zero UI - FB

Automated Digital Experiences
- The Power Of "Now" CX - FR
- Emotion AI: The happiness algorithm - NYT
- IBM's Wimbledon watching AI is poised to revolutionize sports broadcasts - DT

Internet Of People
- Walking barcodes - FJ
- Internet of behavior - BMC
- Internet of People: Human-driven Artificial Intelligence and internet for smarter hyper-connected societies - WP

Digital Profile

Rejection of Surveillance
- The new battle in Hong Kong isn't on the streets; it's in the apps - TR
- This jewelry is a brilliant shield against face-recognition intrusions - FC
- Hong Kong exposes both sides of China's relentless facial recognition machine - FB

The Era Of Deep Faking
- Google has released a giant database of deepfakes to help fight deepfakes - TR
- Bogus Putin interview reveals a real deepfake threat - AX
- Thieves are now using AI deepfakes to trick companies into sending them money - TV

The Regulated Internet
- Twitter bans political advertising - WI
- US tech titans prepare for Brussels' regulation - FT
- UK queries Facebook decision to exempt political statements from fact-checking - TG

Online Protection
- YubiKey has the future of security all locked up - FC
- 2019 Cyber Threatscape Report - ACC
- Debit card with built-in fingerprint reader begins trial - TV

Digital Assistance

AR & VR In Education
- How VR in education will change how we learn and teach - AD
- How Mercedes, Walmart, and Honeywell use AR and VR for employee training - M

Tech Tailored Teaching
- Value of data: Teaching the future with AI - ACC
- China has started a grand experiment in AI education - TR
- "Machine teaching" is a thing, and Microsoft wants to own it - FC

Human Machine Collaborations
- Human+ Worker: Change the workplace or hinder the workforce - ACC
- Companies must start creating human-machine collaborations - FR

Autonomous Driving
- Self-driving cars take the wheel - TR
- How autonomous vehicles will change car ownership - ZDN
- How autonomous vehicles and hyperloop are scooting along - TC

ACC	Accenture
AD	Adobe
AX	Axios
B2C	Business 2 Community
BBC	British Broadcasting Corporation
BI	Business Insider
BMC	BMC
CB	CB Insights
CRB	Crunchbase
DE	Deezen
DT	Digital Trends
FB	Forbes
FC	Fast Company
FJ	Fjord
FR	Forrester
FT	Financial Times
FGCP	Future Generation Computer
FU	Futurice
HP	Huffington Post
I	Iflexion
IBM	IBM
JWT	J.Walter Thompson Intelligence
MCR	Microsoft Research Blog
MIT	Massachusetts Institute of Technology
MK	McKinsey
MT	Mintel
NYT	New York Times
OM	Omidyar
TFL	The Future Laboratory
TG	The Guardian
TNW	The Next Web
TR	Technology Review
TV	The Verge
WI	Wired
ZDN	ZDNet

BabyTech

Womb-to-tomb data collection

Millennials are already accustomed to tracking

their fitness, sleep cycles and nutritional intake on a daily basis. When this cohort enters parenthood, carrying this over to their babies seems like a natural continuation of the habit. Driven not only by Millennials' digital nativism but by their lifestyle, in 2020 we will continue to see more interconnected products and platforms emerge that utilize IoT and AI to help parents from double-income households analyze and stay connected remotely to their newborns.

At CES's 5th annual BabyTech Summit in Las Vegas this year, vendors showcased numerous products and services for young parents that turn nurseries into connected data centers. From connected socks that track oxygen levels, through air-quality measuring baby monitors, to intelligent nappies (yes, they measure exactly what you think they do), it seems that there is no part of a baby's natural functions that cannot be quantified. Prenatal solutions – in the shape of bellybands that monitor the baby's heart rate or Fertile Girl, an online community for women trying to get pregnant – offer the possibility to start data capture and exchange even before birth.

The CEO of South Korean smart nappy company, Monit, illustrates that their product is designed to help new parents change nappies faster to prevent rashes and infections and, beyond this, offer them peace of mind to "free [them] to leave their baby in another room, or spare them the worry of misinterpreting cries".[1] There is a line however between feeding the neuroses and anxieties of young parents and offering useful input to simplify parenting. While the creators of the Owlet Smart Sock claim that their products have been shown to reduce stress in parents by 96%,[2] experts voice the concern that stress is a natural part of becoming a parent and key to learning how to deal with uncertainty and the lack of control when caring for another human. As children grow up, parents who have gotten into the practice of keeping close watch over every aspect of their baby, may face difficulties letting go of this habit. A scenario reminiscent of Black Mirror and 24/7 child-surveillance is not the goal of this trend.

A successful response to this trend does not lie within the frenzied collection of data-points on babies but in offering analyzed data, translated into actionable and meaningful information. Contextualization and anonymized comparison of the captured data holds the potential to not only simplify the everyday life of stressed parents but opens up opportunities within disease prevention and to further our understanding of human development.

Lumi Smart Diapers

Pampers entered into babytech with a smart product called Lumi. It is an expansive connected system that allows a parent to see and understand their baby's development 24/7 and equipped with features that provide data-points that can be easily turned into insight for more confident decision-making.[3]

The product is stacked with settings that allow a parent (through the activity sensor worn by the baby) to detect wet diapers or track sleeping patterns. A wide-angle video monitor supports two-way audio and live streaming, and monitors room temperatures and humidity. All the data becomes useful through the visual app that tracks and displays the baby's day-to-day and long-term behavioral trends.

The sensor works only on specific Lumi diapers and up to size 4, which is around one year old.

At Home Pregnancy Monitoring with Owlet Band

Data-driven decision-making is now starting in the womb. Owlet has announced its newest innovation, a prenatal wellness product called Owlet Band. The sensors on the Owlet Band hug the mother's body from 24 weeks to full term, using passive and trusted ECG technology; the signal quality "casts a net" of sensors over the entire abdomen to gather information on her baby's development. Owlet tracks the sleep position, provides the facility to hear the baby's heart rate, automatically counts the baby's kicks, notifies the mother regarding contractions and a sends her a wellness report to share with family and friends. Owlet's aim is to introduce innovative technology into all parts of a family's everyday life in an accessible and easy-to-use form that is meaningful to health and wellness.[4]

In the health industry, this could become a game changer in understanding the health and wellness of a fetus.

Owletcare Band and App[5]

The Regulated Internet

How algorithms sounded the death knell of online democracy

In 2020 we bid farewell to the internet as we knew it.

Web 2.0 has revolutionized not only the way we communicate but the way we live our lives. With its promise of decentralized speech and collaboration, the web gave birth to social media networks and the sharing economy. However, what started as a tool for empowering the masses – a force of direct democracy that let anyone create content and have their voice heard – is now shown to be a two-edged sword, with a seemingly dark and dangerous side that may need to be controlled before it can cause further damage to society.

Over the past few years we have observed numerous cases of deliberately false advertising to influence political outcomes, especially on Facebook, where the platform has refused to intervene and remove these ads, citing "free speech" and "belief in self expression" (according to Katie Harbath, Facebook's public-policy director).[1] However, as social media platforms and online advertising have grown beyond just influencing people's purchasing decisions but also their political opinions, the platforms' power brings a significant risk of influencing millions of people with misinformation if ads are not reviewed and regulated.

In the coming year we will see the concept of social media being purely a broadcaster and passive host for people's wide ranging opinions laid to rest, as regulators and governments are stepping in to make platforms more responsible for the curated and micro-targeted content their algorithms present to people. Facebook's algorithms and tools allow marketers to test various approaches to identify users who are most susceptible to their message. If false statements circulate solely among people who are most susceptible to them, an open debate around a topic becomes unlikely. Likewise, inconsistent moderation policies paint social media platforms as less than neutral arbitrators of public debate.

As the first companies to respond to the pressure of reviewing their policies, Google has introduced new rules that no longer allow political advertisers to target users based on their political affiliation[2] and Twitter has banned political advertising altogether.[3]

Concurrently, local lawmakers are stepping into cases worldwide, to review and rule on platforms' brushes with national policies and legislation. Brussels has announced a Digital Services Act, planned for the end of 2020, to clarify rules on misinformation and transparency for companies operating in the EU, while the California Consumer Privacy Act (CCPA) is designed to protect Californian residents in a GDPR-like fashion from January 1, 2020.

Highly localized rules on data and content moderation not only make it more difficult to navigate the legal landscape for companies operating internationally, but also give new meaning to where companies and internet users are located geographically, further contributing to the fragmentation of what used to be the "world wide web."

Equality online is not only challenged by geographic borders; differentiation also takes place on the level of status and occupation. The US Second Circuit Court of Appeals has confirmed that, in line with the First Amendment, public officials in the USA are not allowed to block people on social media, as this would exclude them from an otherwise open dialogue.[4] On a platform level, Twitter (which as a private company can make any moderation decisions it wants) treats the tweets of politicians differently to those of other people: tweets by world leaders are seen as being of public interest, even if they violate the platform's rules.

The internet has served as a symbol of and space for freedom of speech and self expression for the past decade but, as more aspects of our lives shift to be online, necessary regulations need to be put in place to ensure safety and fairness in our society, but also to protect people's rights.

As the rules of engagement on the internet are being rewritten, in the coming year expect to have to gear up to ensure your company is up to date on the various data policies emerging in different geographies. Beyond this, platforms, forums, and networks will have to rethink their own policies with regards to moderation and content responsibility; and public debates will look at the meaning of "freedom of speech" for AI-generated text, imagery, and videos.

Comment Moderation with Perspective API

Perspective provides an API that helps to reduce abuse and harassment in online conversations by detecting comments and discussions perceived as "toxic".[5] Using ML models, the API evaluates the impact each word might have to give real-time feedback to moderators and those who leave comments.

The free product was created in a collaborative project (called Conversation-AI) between Jigsaw and Google's Counter Abuse Technology team and is open for public use. Developers can use Perspective API to: create new tools to assist moderators in doing their job; help readers to more easily find relevant information and apply filters in a comment search, and provide instant feedback to authors on their comments.

Saving the World Wide Web with a Contract

The Contract for the Web is a global action plan to make the internet safe and empowering for everyone,[6] saving it from misinformation, political manipulation, privacy violations, and other threats leading to "digital dystopia." The Contract has been worked on by 80 organizations for more than a year: it consists of nine core principles divided into categories for governments, companies, and individuals. The principles serve as a contract to build trust, ensure web accessibility, and respect privacy rights on all levels.

The idea of the project is to lay the foundation of a global movement that requires governments and companies to be more supportive and responsive to citizens' digital needs and rights.

The Contract is the initiative of the World Wide Web Foundation (founded by Sir Tim Berners-Lee) and it has the backing of more than 150 companies, including Google, Microsoft, Twitter, Facebook, and the Electronic Frontier Foundation, which focuses on digital rights.[7]

Artificial Creativity

AI conquers the creative frontier

For the longest time, artists and designers were seen as the least likely to lose their jobs to machines.

After automation mastered cognitive, white-collar tasks, creativity was hailed as profoundly human: an intangible quality that distinguishes our species from other beings. Now it seems that AI has conquered even this frontier – so long, human uniqueness.

Explorations around creativity and AI date back as far as 2011, when an AI-written poem was published in a literary journal.[1] AI tools that aid the creative process have been steadily working their way into the everyday workflow of creative professionals. Adobe has introduced tools (e.g. automatic colorization and one-click selection of objects in images) to simplify tedious tasks and free up time for creativity; Autodesk utilizes AI to explore effective design solutions for structural projects within seconds.

While these instruments are designed to enable collaboration between humans and machines, and place AI in the role of an assistant rather than a designer, AI programmes that act as an independent creative persona are on the horizon. In 2018, Christies sold an AI-painted artwork for $432,500 (USD) and Google's Magenta endeavors to push AI imagination beyond human imagination with NSynth, a synthesizer that invents new instruments to create sounds that no human has heard before. Magenta also created an AI drummer, designed to jam along in real-time with a human musician.

In the coming year expect to see applications of AI move progressively into previously unchartered creative territory where artists and designers will collaborate more closely with creative machines. Many of your marketing tasks will not only be automated next year but optimized, as your AI creative will be able to create timely and appropriate content for different segments of your audience.

Tailor Brands - An AI Graphic Designer

Tailor Brands is one of the world's biggest online platforms committed to help small businesses with the branding process. The platform uses AI to generate custom logo designs within 30 seconds that can be further customized to clients' tastes. Tailor Brands serves more than 10 million users and has created 400 million designs to date.[2]

Logos and other branding documents are just part of Tailor Brands' offering, it also provides additional services, such as: Tailor Social, a social media management platform with curated content and post scheduler; and Tailor Ads, tailored ads with many variables according to the nature of the client brief.

Tailor Brands Platform Interface[3]

The Multitalented AI Creative Called Magenta
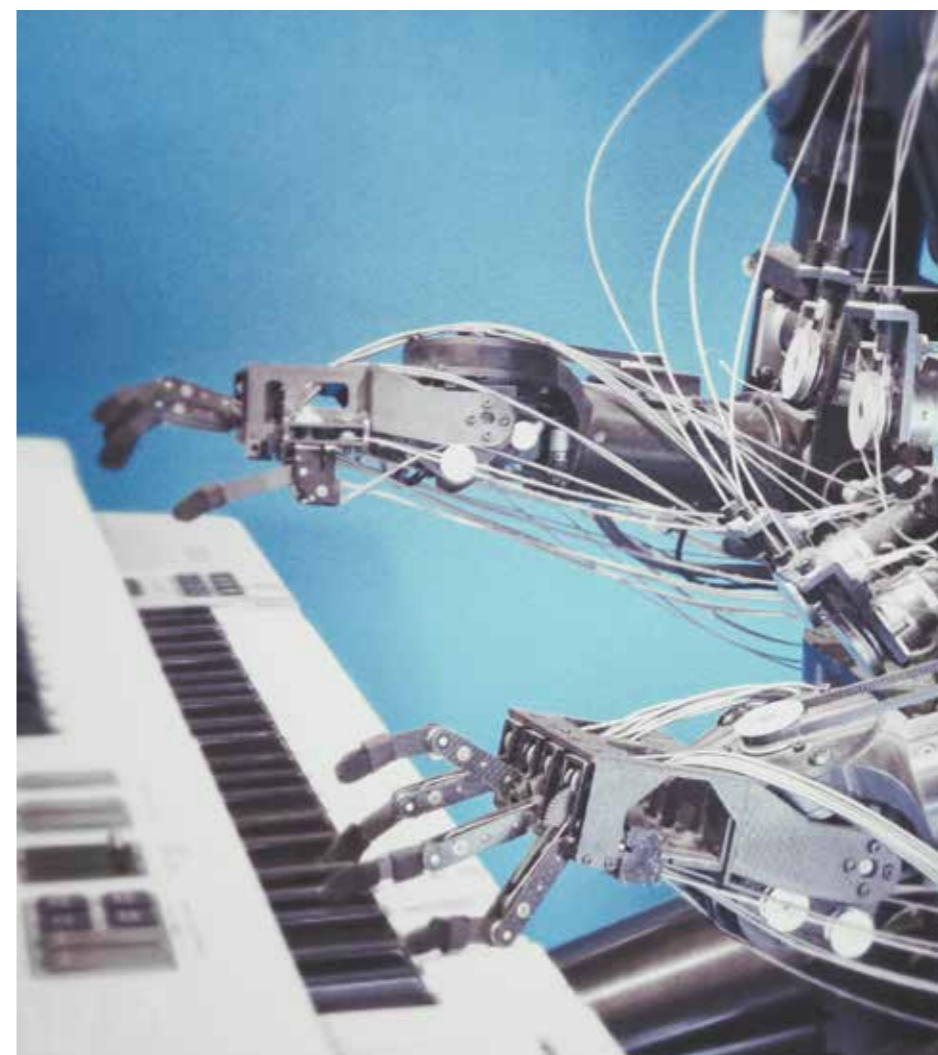
Google's Magenta is an open source platform and an ongoing research project for creating music and art using Machine Learning in the creative process. There are two main aspects of the project:

• Magenta Python Library containing utilities for manipulating source data to train ML models and eventually generate new content.

• Magenta.js – an open source JavaScript API allowing developers to use the pre-trained Magenta models in browsers, as well as seeing how these models have been used in existing applications.[4]

There are a variety of Magenta tools designed for musicians and artists to extend their creative process and create songs, images, drawings and more.

The LA based dance-pop band YACHT released an album in collaboration with Magenta that makes full use of the platform's tools: lyrics were created by the neural network, music was composed using Magenta's MusicVAE model and parts of the songs were performed on the Lab's NSynth Super instrument.[5] Even the album cover art was designed with the help of neural networks, using "SVG VAE" (a generative model for creating scalable vector graphics) to produce typography and graphics.

"Whatever [brands] start doing now needs to be built around what Gen Alpha customers expect"[1]

- Hugh Fletcher, Head of Thought Leadership (EMEA) and
UK Marketing at Wunderman Thompson Commerce

Gen Alpha

Still targeting Millennials? Your youngest customers are in the cradle

Move over Millennials and Generation Z, Generation Alpha will change the consumer landscape in 2020.

The term Gen Alpha was coined by Australian demographer Mark McCrindle in 2015: it describes the offspring of Millennials, born between 2010 (the year that both the iPad and Instagram launched for the first time) and 2025. "Alphas" will account for a projected figure of two billion people globally before the youngest members of the generation are born in 2025.

Having started to use their parent's smartphones before even uttering their first word, Gen Alpha is a totally digital generation and the youngest generation to make autonomous purchasing decisions: Amazon and app stores are so easy to use that even babies get it.

The influence that Gen Alpha kids are already having on the marketplace already is undeniable: a survey revealed that 28% of American Millennial parents ask their children's opinion before purchasing a new TV, laptop, iPad or smartphone;[2] number three and 11 on the list of most subscribed YouTube channels in 2019 are accounts for toddlers and pre-schoolers – and the highest paid YouTuber of 2018 and 2019, earning $26 million, is an 8-year old boy who reviews toys for other kids.[3]

Alphas will also be the most formally educated and wealthiest generation in history.[4] With AI revolutionizing the classroom (see our "Tech Tailored Teaching" trend), they will have a different education experience from any previous generation, as education will be personalized to their individual needs. Being born into a society with shifting values towards gender norms and sustainability defines the expectations that Gen Alpha kids will have of businesses: leading companies are having to rethink their approaches to traditional toys. For example,

"Barbie" manufacturer, Mattel, is releasing its first line of gender-neutral dolls in the toy's 61-year history.

As an AI-native generation, Alpha kids have a different attitude towards technology. Siri, Alexa and Google Assistants are familiar voices around the home, with most children describing them as "friendly and trustworthy".[5] Concurrently, lines need to be drawn to ensure the protection of these young customers. YouTube has taken first steps by limiting targeted advertising on videos for children.

Looking ahead, organizations will need to understand and embrace the Gen Alpha perspective, and think of ways to engage this generation early in order not to miss out on the youngest active consumer group.

GoHenry - A Payment Card for Kids

GoHenry is a prepaid card designed to teach children (aged 6-18) financial independence early on, complemented with an app. There already more than 700,000 parents and kids using the service.[6]

GoHenry aims to teach young children positive habits whilst it provides parents with control over their children's access to money and spending behavior. The app provides parents with real-time notification of the card's usage, and allows them to set spending rules, as well as tasks and chores to be completed by the child. Parents can also top up, block and unblock the card. GoHenry can be used anywhere in the world where Visa is accepted. Parents can also set limits to the card online, at main-street banks, and at ATM cash machines.

Moving Children FitBit Ace

As one of the brands aiming to build a long-term relationship with Alphas by engaging them and build habits early, Fitbit has launched Fitbit Ace, their solution to get children under 13 exercising. Designed to inspire a generation that is glued to their screens to move, Ace send kids reminders to stretch their legs if they are stationary over a long stretch of time, and builds on learned behaviors through game-playing by encouraging friendly competition with friends, and setting and celebrating goals. Just like the Fitbit for grown-ups, it also offers sleep tracking and bedtime reminders. Parents can use the family profile in the app to keep track of their child's achievements and, for kids' safety, parents also have full control over friend requests.

Fitbit Ace[7]

Self-Driving Finance

Letting AI manage your money

It's becoming increasingly difficult for consumers to make informed decisions given the proliferation of challenger banks, energy startups, as well as new insurers.

Financial decisions have, furthermore, been shown to cause high amounts of stress in people as financial literacy and confidence is low globally. Only 16% of UK adults rate themselves as highly knowledgeable about financial matters;[1] and 60% of Americans wouldn't be able to cover an unexpected $1,000 expense in an emergency.[2] In 2020, AI will come to their rescue. Moving beyond smart product recommendations, AI assistants now make financial decisions and take action on behalf of their busy human masters to ensure they always get the best deal. The time for customers making poor financial decisions is over.

AI and machine learning enable all banking customers (independent of their income or net worth) to benefit from a "virtual, private relationship manager" that will look over their finances. These virtual financial managers will work 24/7 to provide the best financial returns by making optimal use of idle money, switching bills, optimizing account and credit card choices, and reviewing subscriptions. Decisions are not only tailored to the customer's financial picture, but also take personal information into account, such as life-stage, family, goals as well as smaller indicators like upcoming holidays or birthdays.

While people are gradually accepting AI in their lives, when it comes to decision-making in a field as critical and personal as finance, banks and businesses still have to overcome the hurdle of trust. People will expect companies offering autonomous finance services to be transparent about how their algorithms reach decisions. Finance companies will have to work toward diminishing AI bias, fully disclose their motives, and explain how they monetize their services. Firms that can offer guarantees on these issues will be front-runners in building trust with people: having a safety net in place should the algorithm betray them, offers reassurance to customers.

Automated Bill Switching

Look After My Bills is a UK-based service that uses algorithms to auto-switch users' energy providers by finding the best deal amongst a network of providers, ensuring savings for customers. The service is free of charge for users. Look After My Bills earns a commission every time an energy company assigns a new customer to its offering.[3]

Look After My Bills was pitched to Dragons' Den (BBC TV program) in the summer of 2018. The company received offers from all five Dragons and was funded by two of them, who paid £120,000 for a 3% share of the business. Starting with only 1,000 members in January 2018, now having over 200,000 customers two years later, marks the success of the startup.[4]

Plum Brings AI Investing to the Masses

Plum is an AI-assistant app, which analyzes users' daily transactions to learn about their income and spending behavior, and then automatically sets money aside. After only a few days, the app identifies potential savings and informs the user with an in-app notification. To obtain the benefits of the service, users must link their bank accounts with Plum's app.[5]

Beyond just saving, users can grow their money using Plum ISA, a service that automatically invests money in other companies, based on user preferences. For instance, they can select companies or markets they would like to invest in, as well as their risk levels.

Tech Tailored Teaching

The future of learning is personalized

The world is facing a learning crisis, with students everywhere falling behind

despite regularly attending school, as classroom education fails to identify and respond to individual needs. In the US, "nearly 30 percent of students do not finish high school" and "only 42 percent of young people who enrol in college complete a bachelor's degree by the age of 26".[1]

Digital tools will play a key role in overcoming the problems the education sector is facing; AI-driven tools in particular will help make one-size-fits-all education a thing of the past. So far, most digital education tools have been based on decision trees, which lead students down pre-programmed paths that may appear to adapt to their skill level but lack the sophistication of responding to students' diverse educational needs. ML is changing the landscape, as new software now has the ability to identify students' specific strengths and weaknesses, to tailor educational material for them and use data from past performance to create an ongoing teaching strategy.

China currently sits at the forefront of AI education, with tens of millions of students already engaging with AI to learn, either directly at school, through digital learning platforms, or via AI-tutoring platforms. The Chinese EdTech unicorn, Squirrel, has devised a system where each subject is divided into 10,000 learning elements in order to pinpoint students' knowledge gaps as precisely as possible. A textbook by comparison may divide the same topic into only 3,000 points.[2] This strategy allows Squirrel to assess a student's knowledge of a subject with a short diagnostic test, before building a personalized curriculum for each learner that is continually refined as the student works through the lessons.

Designed to complement rather than replace teachers, classrooms and classmates, AI tools also find application in helping teachers manage classrooms more effectively and ease their workloads. Algorithms can take over repetitive task, such as grading papers and optimizing coursework, to free up teachers to focus on the more interpersonal and creative elements of their jobs.

AI-enabled education is equally important to businesses as it has the potential to improve continuous employee training. Not only does it help with the more targeted development of skills but it promises to shorten the time taken to adopt new skills: Silicon Valley startup Acuitus for example claims it can train IT experts in months, rather than years.

AI Graded Schoolwork

Bakpax is a software package for teachers that automates the process of grading schoolwork. Teachers simply upload an assignment to Bakpax and get the system to convert it into formatted, interactive text. As the software has the ability to read handwriting, students are able to take a picture of their work to receive instant feedback on what they got right and what they got wrong. This process lends itself especially to math assignments where responses to questions are numerical or take the shape of graphs; for questions that require a text-based response, a manual grading option is available. Beyond freeing up time for teachers, Bakpax provides analytics that helps teachers to gain an overview of class performance over time, making it easy to spot where pupils need additional support. While data is encrypted and anonymized, the company asks schools to inform parents about how their children's data is used, while also giving them the choice to opt out.

Acuitus IT Training

The Silicon Valley firm Acuitus started as a government-funded program to train IT experts for the US Navy. Using AI, Acuitus has created a system that trains people at entry level to become experts in their field in only five months by focusing on understanding and teaching concepts, rather than building on memory and pattern-matching. The learning experience is centered on a tutor model shaped around how "good" human tutors behave, including how and when they give feedback. More than 900 students have completed Acuitus' IT course successfully. Building on the program's fundamental belief that any student can excel at any subject, Acuitus' AI system is built to be subject-agnostic and scalable.

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About Virtusa xLabs

xLabs is the digital innovation hub within Virtusa, set up to help organizations accelerate their tech innovation and cloud transformation and leverage disruptive technologies to deliver the best value for them. xLabs combines design thinking and digital engineering to reduce time and costs associated with identifying, evaluating and exploiting new technologies to create competitive advantage for its clients. The hub provides a cloud-based environment with a built-in Open API layer and microservices sandbox, modular AI components, blockchain capabilities and a banking model data set enabling organizations to run quick experiments and turn ideas into MVPs.

About Virtusa

Virtusa Corporation (NASDAQ GS: VRTU) is a global provider of Digital Business Transformation, Digital Engineering, and Information Technology (IT) outsourcing services that accelerate our clients' journey to their Digital Future. Virtusa serves Global 2000 companies in Banking, Financial Services, Insurance, Healthcare, Telecommunications, Media, Entertainment, Travel, Manufacturing, and Technology industries.

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