BANK OF THE FUTURE

The ABCs of Digital Disruption in Finance

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THE BANK OF THE FUTURE
The ABCs of Digital Disruption in Finance

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At the end of 2017, when typically the most asked questions include 'Are you going to the company holiday party?' and 'What present am I going to get Uncle Billy this year?', one question seemed to dominate: 'Do you think I should buy Bitcoin?' Without most people knowing what it was, it was suddenly something you were afraid to miss out on. That's how fast FinTech and disruption can come at you.

In our first Citi GPS report on FinTech, Digital Disruption: How FinTech is Forcing Banking to a Tipping Point, we compared the amount of investment in FinTech and the uptake of product in China and the West. We found that Internet giants had moved into financial services and gained considerable market share in e-commerce and third-party payments in China, while only 1% of North American consumer banking revenues had migrated to new digital models. China was found to be past the tipping point with FinTech companies having a similar number of clients as major banks but North America and Europe were just coming up to the tipping point with rising revenue impact from digital disruption.

One year later, in our second report Digital Disruption Revisited: What FinTech VS Investments Tell Us About a Changing Industry, we took a harder look at China and the huge influx of global FinTech Venture Capital investments that were feeding the Chinese FinTech dragons and analyzed how these dragons were able to rise under unique circumstances. We did notice at the time that FinTech investments in the U.S., although slow vs. China, were seeing a shift away from lending and towards InsurTech, RegTech, and Blockchain.

Fast forward one more year, and the question for banks today is how do they become Digital Banking Superstars versus going the way of the dinosaurs. The future of finance is an ever increasingly converged ecosystem where consumer and small and medium enterprise (SME) financial services are provided by banks and by platform companies with roots in e-commerce and social media. For an incumbent bank to become a Bank of the Future and not remain stuck in the past, they must look not only at new technologies such as artificial intelligence, machine learning, and other forms of automation, but they must also look to overhaul their operational systems and technology systems.

This new report identifies what we believe are the ABC's of digital disruption in finance — Artificial Intelligence, Big Tech, Core Banking & Cloud, and Digital Assets — and identifies ways that incumbent banks can adopt/embrace these disruptive factors and drive their businesses forward.

For an incumbent bank to evolve into the new landscape will require (1) senior leadership teams to be focused on digital transformation; (2) relatively simpler business mix by geography and products; and (3) the cushion of better existing financial returns that allows management to divert their attention from near-term firefighting.
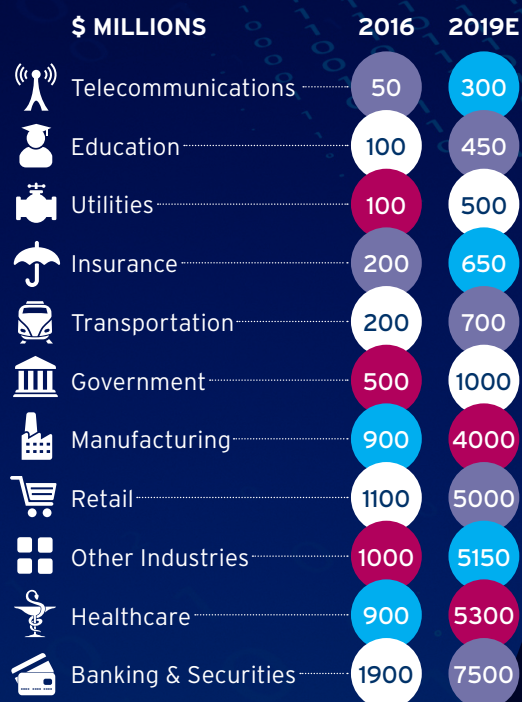
We also take the opportunity talk to a range of different FinTech players to get their views on everything from the potential use-cases in AI and the biggest challenges traditional financial institutions face with AI to what are the problems banks face with legacy systems and what makes emerging markets so exciting for FinTech.

The Alphabet Soup of Creating Digital Banking Stars

A — ARTIFICIAL INTELLIGENCE AND AUTOMATION

Outside of Technology, the Banking and Securities sector is the biggest spender on external AI services and has fast growth [1]

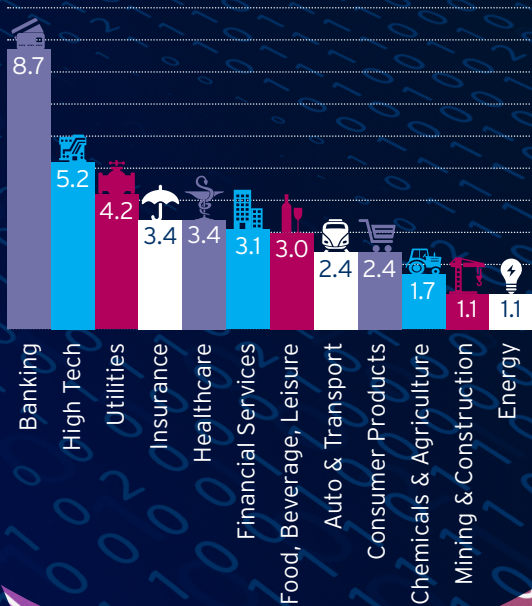| $ MILLIONS	2016	2019E
Telecommunications	50	300
Education	100	450
Utilities	100	500
Insurance	200	650
Transportation	200	700
Government	500	1000
Manufacturing	900	4000
Retail	1100	5000
Other Industries	1000	5150
Healthcare	900	5300
Banking & Securities	1900	7500

B — BIG TECH

Traditional banking is being challenged not by small FinTech startups, but by established tech giants because of...

- Large and captive user bases
- Low online acquisition costs
- Big data customer insights
- Internet banking licenses

C — CORE BANKING, CLOUD AND CHALLENGERS

Nearly 15-25% of Bank annual budgets were allocated to IT in 2016 and Banks have one of the highest median IT expense as a % of revenues — almost 2-3x other major industries [2]

| Industry	Value
Banking	8.7
High Tech	5.2
Utilities	4.2
Insurance	3.4
Healthcare	3.4
Financial Services	3.1
Food, Beverage, Leisure	3.0
Auto & Transport	2.4
Consumer Products	2.4
Chemicals & Agriculture	1.7
Mining & Construction	1.1
Energy	1.1

D — DIGITAL ASSETS

Cryptocurrency and Blockchain are disruptive technologies designed to facilitate the exchange of value

The value of Venture Capital (VC) funding for companies developing blockchain use cases remains small (total amount of VC funding is $2.1 billion) [3]

	Deals	Value
2013	50	$99m
2014	139	$357m
2015	153	$506m
2016	125	$537m
2017	188	$831m
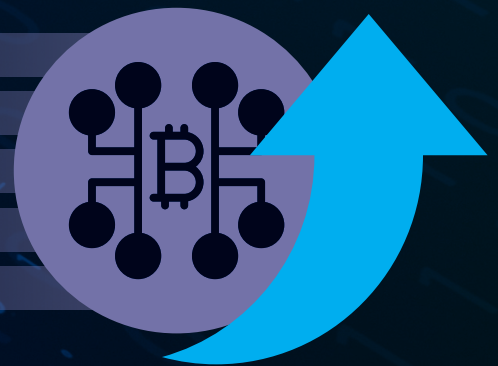
While the total amount Raised via Initial Coin Offerings has grown steadily [4]

2016
41 Deals
$263m

2017
202 Deals
$3.88bn

Q1 2018
71 Deals
$2.78bn

Contents

The Bank of the Future

"I still remember my first day at DBS. When I told the Singapore taxi (driver) where I was going and he said, "DBS - Damn, Bloody, Slow." There's no doubt that in 2009 DBS had a well-earned reputation for being a bureaucratic, unimaginative and unresponsive bank."

– Digital Innovations in a Singapore Bank: 10 lessons learnt when DBS came out of the Stone Age, by Paul Cobban, Chief Data and Transformation Office, DBS Bank, April 2017)

DBS in Singaporean culture was called damn bloody slow and worse. But it wasn't the only bank living in "the Stone Age" relative to efficiency and speed levels in best-in-class manufacturing or technology companies. As the Great Financial Crisis pushed banks, especially in Europe and the U.S., into a period of conservatism, introspection, and de-risking, a tsunami of technological change was shaking up the rest of the world, especially the mobile consumer world.

Client experience in banks is still "Stone Age". Opening a small business account at a major U.K. "high street" bank can take over a month. At a U.K. neo-bank, the same process can take minutes. And client experience at banks is often lousy, as incumbent banks are built on "Stone Age" technology. Combined with bureaucratic and siloed organizational structures and regulatory burdens, it is no surprise that banks have very slow metabolic rates.

Product cycles in banks take a long time. One U.K. bank we know has a three-fold approach: (1) 8-12 weeks is its fastest rollout; (2) 6-10 months for large product changes, such as mortgage agreements in principle; and (3) 3-5 years+ for large waterfall programs. The best-in-class Emerging Market financial company moves at a speed 5x-10x that of a typical larger bank. And BigTechs and FinTechs move even faster still.

We recently discussed the topic of speed with the technology chief of one of the leading Emerging Market financial firms. In his view, the difference in metabolic rates between his current tech-geared employer and his previous long-established bank employer was due to "soft factors," such as clear ownership of decision making, accountability for results, and a speed-imbued culture as well as "hard factors," such as automation, agile development, and Cloud-ready deployment.

Bill Gates famously said over two decades ago, "Banks are dinosaurs, they can be bypassed" (*American Banker*, January 9, 1995). Yes, the banking dinosaurs still exist. But a technological meteor hit the industry, especially in consumer financial services, with the arrival of the mobile-first smartphone era from around 2008 and the growth of Internet platform conglomerates.

The Bank of the Future is emerging in front of us. Amazon isn't the Bank of the Future, nor is WeChat. These companies have goals bigger than banking. But they are already part of finance. And they and their peers will be part of the financial services ecosystem of the future.

To quote Bill Gates again from 1994-95, "we need banking, not banks." The future of finance is an increasingly converged ecosystem where consumer and small and medium enterprise (SME) financial services are provided by banks and by platform companies with roots in e-commerce/social media. So how do incumbent banks stay relevant? They have to become faster. They have to become smarter. They have to become more efficient.

Staying relevant will require an ongoing transformation of the incumbent bank's existing business model, organizational structure, culture, and technology infrastructure. Among other factors, the banks' strategic game plan will have to include the greater use of artificial intelligence (AI) and automation and the related overhaul of Core Banking systems and increased adoption of Cloud-based services. These are some of the key topics we cover in this report, "The Bank of the Future: The ABCs of Digital Disruption in Finance."

A is for Artificial Intelligence and Automation

The acquisition of Kensho in March 2017, the largest AI acquisition to date, illustrates how AI is having a finance moment. Banks are exploring AI uses in consumer and wholesale banking with the help of robotics (automation of routine tasks), analytics (big data mining), chat bots (digital dialogue with customers), and cognitive (changing rules and adapting). This should make the banks smarter, faster, and more robust.

Outside the tech sector itself, financial services are one of the leading early adopters of AI in terms of spending, and in our chapter on artificial intelligence, we do a deep dive into some of the use cases of AI in banking and finance today. We also include interviews with the CEOs of two AI-based private companies: Active AI, a conversational banking service provider, and Behavox, a people analytics company primarily focused on compliance and risk.

As we discuss in our interview with Ramneek Gupta from Citi Ventures, the successful implementation of AI at an enterprise level for banks includes good data. Banks have a lot of data. Banks have more data than most other institutions. But most incumbent bank data assets tend to be siloed and not easily accessible. This is due to regulatory constraints but also poor technology stacks and organizational structures. Banks in markets such as the U.S. and Europe are often built on 1960s-70s mainframe technology that is product-based, not customer-based.

Most banks lag digital natives, such as the some FinTech upstarts, which are ahead at implementing AI, as their systems are based on machine learning (ML) and AI and require minimal human intervention. For the FinTechs, data generation begins from the time a client is onboarded; subsequent transaction history is accessible easily, and product cycles are fast. FinTechs such as Square are built on data being a key foundational building block (along with customer-centric product design) that is widely leveraged across the board from customer acquisition, servicing, operations, risk management, and compliance.

Banks are, of course, aware that their technology stacks are not fit for competing in a world that is mobile first (for some regions and demographics, mobile only) and increasingly dominated by Internet platform-based conglomerates. Several banks are beginning to centralize their data assets and are leveraging hybrid cloud architectures to speed up the transition. Banks that are typically single country or have relatively simple business lines, such as Capital One or USAA, are often cited at the forefront of digital transformation.

And once banks have improved data, the next step is to speed up product development cycles. Banks usually move at a glacial speed, with product updates measured in the months or even years, as we noted at the start of this chapter. Such long product development cycles render AI implementation moot, as the new data insights gleaned cannot be incorporated into the business in time. Our comment on glacial speed is primarily about incumbent banks in consumer and commercial banking. Capital markets product development and technology cycles, in the wholesale banking units, is often much faster.

We believe wide adoption of AI and automation will have a profound impact on banks' distribution and servicing channels. As discussed in our earlier 2016 GPS report ([Digital Disruption; How FinTech is Forcing Banking to a Tipping Point](#)), banks in developed markets are expected to cut their number of branches by another 30-50% from 2014 levels. The Nordic banks have exceeded our expectations with branch density down nearly 25% in just two years. Europe has overall tracked our expectations. The U.S. banks have initially lagged our expectations, with branch densities not changing much from 2014 to 2016, but we believe we may be reaching an inflexion point in 2017-18.

We are definitely past "peak banker," especially in markets such as Europe and the U.S. Increased use of automation and AI-driven systems is likely to help banks improve cost efficiencies by employing fewer workers as repetitive human tasks are replaced by machines that can understand human behavior and make decisions. As far back as 2015, Antony Jenkins, former Barclays CEO, noted that "the number of branches and people employed in the financial services sector may decline by as much as 50% over the next 10 years, and even in a less harsh scenario I predict they will decline by at least 20%."

In 2017, John Cryan, Deutsche Bank CEO, told a Frankfurt conference: "In our bank we have people doing work like robots. Tomorrow we will have robots behaving like people."

B Is for BigTech, Especially in Asia and Emerging Markets

When bankers worry about the future, the fear is BigTech, not FinTech. The old question was, will banks become innovative before the new entrants (FinTechs) get scale. A decade after the Great Financial Crisis, banks struggle with innovation and speed. But they can try and "buy innovation" via partnering or acquiring new entrants. And banks can buy innovation faster than FinTechs can acquire new clients.

But when the new entrant is a BigTech, the equation changes: it comes with pre-existing scale and client reach, sometimes greater than the banks themselves. BigTech is the B in the ABC of Digital Disruption in financial services, and in this report, we consider the revenue and cost challenges BigTechs create, directly and indirectly, for incumbent banks.

The Internet-based platform companies – such as Amazon, Alibaba, Facebook or Tencent – have captured an ever-increasing share of consumers' time and attention. These platform companies view payments and financial services not as an end in itself but as a tool to further enhance client stickiness, and they monetize via advertising, e-commerce, or other services (such as AWS). And when these platform companies have gone into payments and finance, mainly in emerging markets so far, they have gone big.

Finance is being re-imagined and re-created in emerging markets by BigTech players with the proliferation of mobile platforms, a growing middle class, and favorable government policies. Ten-fold improvements are more likely in new markets that can "leapfrog" established technology – e.g., go mobile first/only, skipping the landline phase in telecom. When it comes to BigTech in finance, Zennon Kapron notes in his Chapter B interview that "we are seeing the future today" in China. New entrants have made a mark in the consumer payments and finance space in Asia, especially in China, but also increasingly in markets such as Korea and India.

Case Study 1: Kakao Bank launched in Korea, backed by the KakaoTalk messaging app with ~42 million clients, gained 2 million banking clients within two weeks of its launch and recently had ~5 million clients. Kakao Bank offers a better user experience, such as easy access/online-only authentication, as well as lower loan rate/fees. The first Internet bank in Korea, K-Bank, has grown more slowly – platform company support matters.

Figure 1. Korean Internet-Only Banks – Aggregate Number of New User Accounts
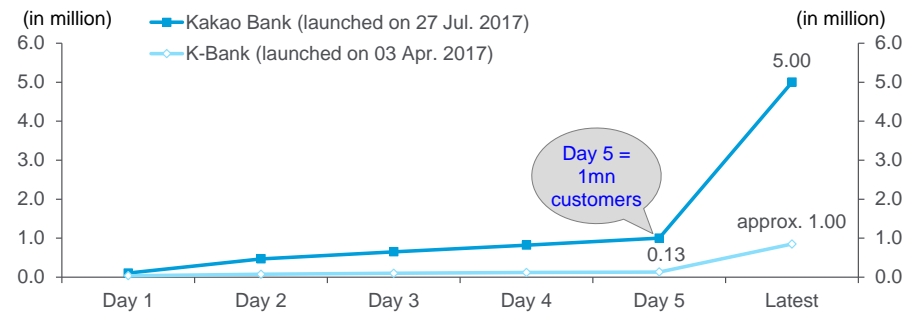
Source: Press Reports (Business News Daily Korea), Citi Research

Case Study 2: WhatsApp has been beta testing its Indian payments offering with ~1 million clients. Currently, over 200 million Indians use WhatsApp for messaging: by 2019, many (perhaps most) of these social users could also be payments users. WhatsApp doesn't currently have an advertising revenue model to support its payments growth, but its parent, Facebook, does.

FinTechs are likely to be service providers to the banks, and in certain niches (for example, remittances or cross-border retail payments), they may also be competitors to banks. But FinTechs today are more friends than foes of the banks. And many could "exit" as purchases by the incumbents. We see BigTech as the major future competitor, as well as collaborator, for the banking industry. We discuss this in greater detail in Chapter B.

C Is for Core Banking, Cloud, and Challengers

Banks are aware they face a customer expectations revolution – and it is not just from millennials! Cloud and more modern architecture offer solutions to legacy IT issues and could help improve efficiency, agility, and speed to market. And while they may offer cost and marketing gain opportunities in the future, in the near term, banks' IT costs (already the highest of any sector) are going even higher.

Figure 2. Median IT Expense as % of Business Entity Revenue (2016)
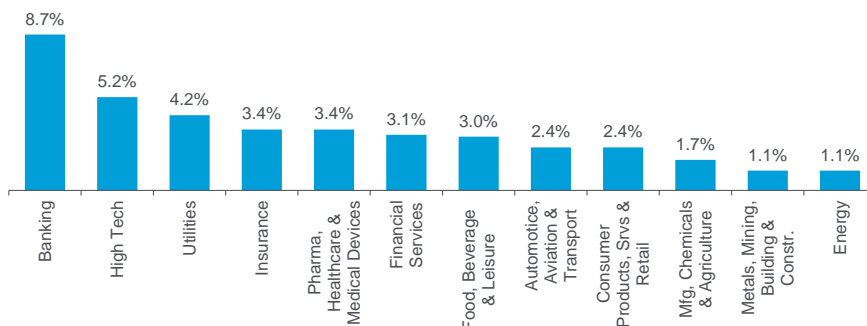
Total IT expenditure includes operating expenditure and IT capital expenditure
Source: Citi Research, CEB, CEB IT Budget Benchmark, Arlington VA, 2016, p. 6

Interestingly, the U.S. and Australian banks have increased their IT spend since the global financial crisis, whereas the Europeans in aggregative have not. This is probably not surprising, as banks operating in a better financial environment have had the resources and the management time to spend more on long-term planning. The implications for European banks are stark: after many years of fire-fighting and rationing investments, it is time to expand time horizons and focus on long-range transformation. IT cost spend increase appears to be here to stay.

Figure 3. Europe, U.S., and Australia Banks' Tech & Communication Opex as % of Total Opex (change in ppts since 2009)
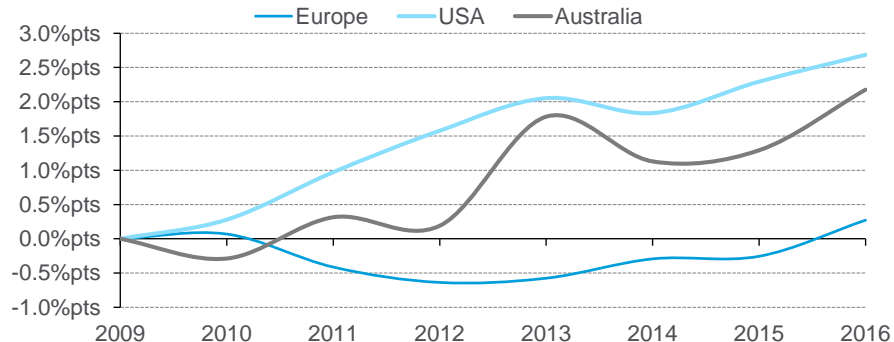
Bottom-up analysis based on company disclosure where available consistently
Source: SNL Data, Citi Research

And what are banks spending on? A survey by Temenos identified core banking systems (deposits, lending, and transaction processing) as the main focus area for banks. This is no surprise, as it is a key driver of long-term efficiency and a prerequisite to maximizing return on investment (ROI) in other areas. Investment in digital channels was a close second.

Figure 4. New Bank IT Investment Priorities, 2014-2016
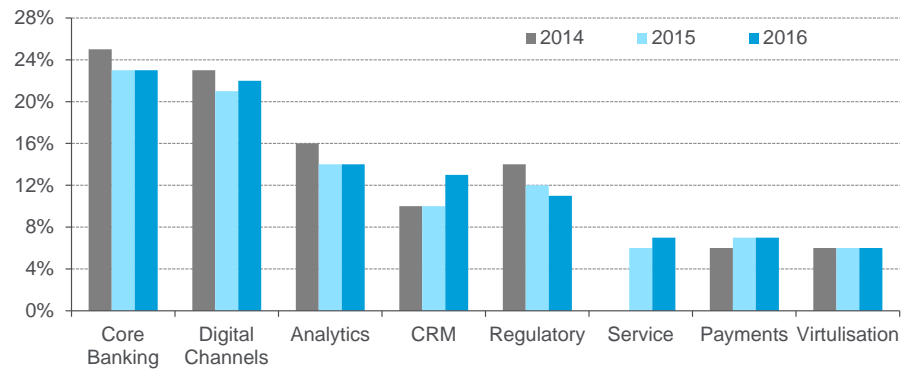
Source: Capgemini, Temenos

As Jonathan Larsen, Chairman/CEO of the Ping An Voyager fund, notes in Chapter C, "Legacy platforms relying on mainframe systems are a big problem holding the banking industry back and making any changes is very complex/cumbersome. As a result, Antony (Jenkins) started with a blank paper and created a new system from scratch to improve the banking experience, incorporating machine learning, cloud services, encryption at all states etc." The Voyager Fund led the last funding round by 10X Technologies run by Antony Jenkins.

For a deep dive into core banking IT infrastructure, cloud-based services, competition from challenger banks, and the cost implications of all the above, turn to Chapter C of this report.

Where in the World?

The geography of innovation is increasingly decentralized. The U.S. is likely to remain an important player in building the future of finance, but as Peter Thiel has now said for several years, Silicon Valley has no monopoly on innovation (Zero to One: Notes on Startups or How to Build the Future, 2014). The Bank of the Future is being shaped as much by companies headquartered in Shenzhen (Tencent, Ping An) or Hangzhou (Alibaba) as by firms from the U.S. or Europe.

In fact, BigTech firms are most active in financial services today in China rather than the "West," when measured by number of financial services clients or breadth of products. And the U.S.-origin BigTech giants could actually become more active in finance in emerging markets such as India (see the entry into payments by WhatsApp or Google) than in the U.S. or Europe.

To quote from the 2015 Gates Annual Letter, innovation will "trickle up" to so-called developed countries from emerging markets that are leap-frogging stages of technological and business model development. In emerging markets, new entrants have grown rapidly in finance. Where society is changing rapidly, but banks are not, new entrants in finance lead the change. China in recent years has been a great example of this trend. Markets with savvier banks can have incumbent-led change, as in Scandinavia and perhaps neighboring Northern European markets.

Figure 5. Mapping the Risk of Digital Disruption
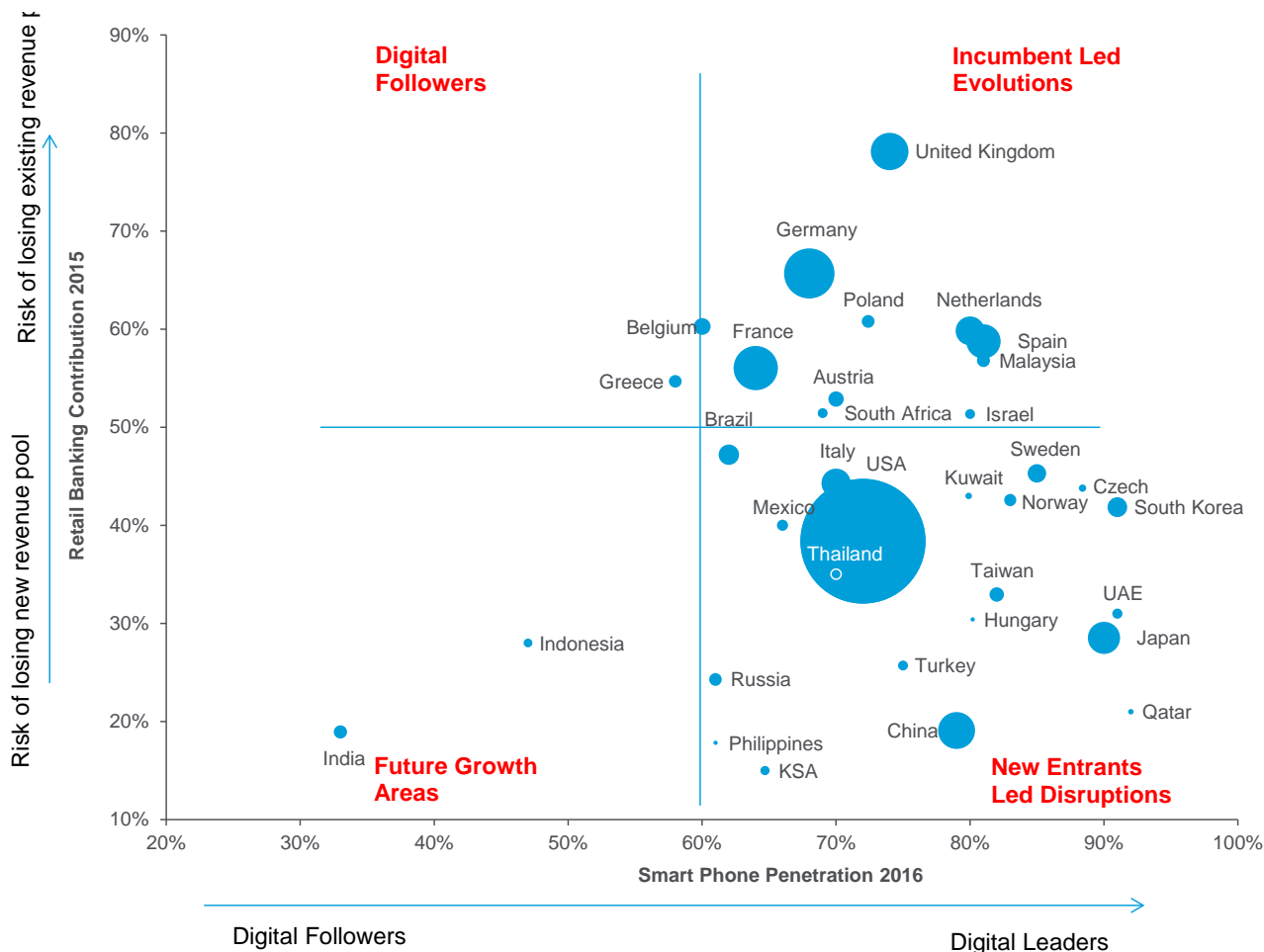
Retail bank penetration is measured as retail loans % of total loans. Size of bubble is retail bank loans; the larger the bubble, the higher the retail bank loans.
Source: Consumer Barometer with Google (smartphone penetration), Company Reports, Citi Research

Disruption by Product and Geography

Payments and investments are expected to be the financially most impacted by "disruptive business models" from BigTech, FinTech, and neo-bank players (the latter can include challenger propositions set up by incumbents as well). Up to one-third to half of all payment volumes may be lost by incumbent banks. As we discuss in Chapter B, players such as WeChat and WhatsApp are already investing heavily.

By geography, the more diverse financial ecosystem of the U.S. and Asia, and also wide variations in pricing, may make the entry of disruptive business models more likely in these markets and put pressure on banks' long-term revenue outlook in consumer banking and financial services.

Figure 6. Estimated Volume Lost to Disruptive Models by 2025

	North America	Europe	China	Developed Asia	Emerging Asia
Payments	6% **34%**	6% **34%**	9% **50%**	6% **34%**	2% **36%**
Investments	6% **34%**	6% **34%**	9% **50%**	6% **34%**	2% **36%**
Personal Lending	6% **34%**	2% **17%**	6% **34%**	2% **17%**	1% **24%**
Credit Card Lending	2% **17%**	2% **17%**	2% **28%**	2% **17%**	1% **24%**
SME Lending	6% **34%**	6% **34%**	2% **28%**	2% **17%**	2% **36%**
Mortgage	6% **34%**	2% **17%**	1% **14%**	2% **17%**	0% **12%**

* Disruptive models vary across product – **Investments:** low price, digital only brokerage and robo-advisor; **Mortgages:** digital-only robo-mortgage, new credit scoring; **Personal, credit card, and SME lending:** digital only, P2P marketplace; **Payments:** digital payment via wallets; P2P or A2A and digital only cross-currency exchange.
Source: Citi Global digital Strategy, "Bang and Fuse" model, Citi Research

A dissection of global banks' profits by product shows that lending accounts for over 50% of the banks' total risk-adjusted revenues, f   ollowed by savings and investments (21%), capital markets (16%), and payments (7%). Interestingly, personal and SME is the most profitable segment for banks, accounting for nearly half of profits, followed by corporate (35%) and investment banking & markets (~20%).

Figure 7. Global Banks Profit Breakdown By Product and Customer Segments

	Payments	Savings and Investment	Lending	Capital Markets	Overall
Personal/SME	4%	12%	29%	1%	46%
Corporate	3%	6%	21%	5%	35%
IB/Markets	0%	3%	6%	10%	19%
Overall	7%	21%	56%	16%	100%

Based on banks under Citi coverage; Profit split by customer segments based on company reports or analyst estimates; the profit is then allocated across products. Profit splits by product segments estimated based on selected banks that disclose revenue splits by products.
Source: Citi Research Estimates

Re-imaging versus Re-engineering Finance

Finance is being re-imagined and re-created in emerging markets by FinTech and BigTech players. New entrants have made a mark in the consumer payments and finance space in Asia, including the likes of Alipay and Tenpay (WeChat) in China and Kakao Bank and Paytm in India.

In developed markets, Business-to-Consumer (B2C) FinTech plays have not reached the scale of their Asian peers with a few exceptions, most notably PayPal. "10x" improvements are more likely in new markets that can "leapfrog" established technology – e.g., go mobile first/only, skipping the landline phase in telecom.

To date, FinTech is generally used in developed markets for re-engineering rather than re-imaging incumbent financial services, with the focus being primarily on efficiency and process improvements at the incumbent firms. It is no surprise that developed market FinTech investment has pivoted to Business-to-Business (B2B), but Asia remains, for now, heavily B2C focused.

Figure 8. Re-imagination vs. Re-engineering
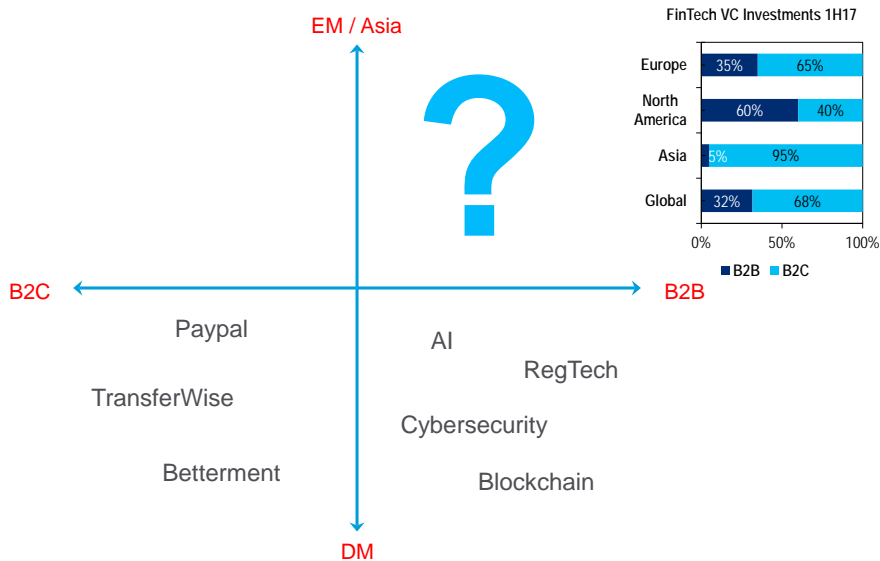
\# Based on the number of FinTech companies that raised funding in 1H 2017 (NOT value)
Source: CB Insights, Citi Research

Bank of the Future

Banks of the Future will include Banks from the Past. Some of the dinosaurs will evolve. Which are best placed to do so? A checklist to identify potential winners among incumbent banks would include screening for banks with the following:

1.   Senior leadership team focused on digital transformation;

2.   Relatively simpler business mix by geography and product;

3.   The cushion of better existing financial returns that allows management to divert its attention from near-term fire-fighting; and

4.   Banking regulator/government supportive of digital transformation of the finance sector

It is no surprise that banks in Australia or Scandinavia have done more than many others on digital change. These markets screen well on many of the criteria above – management is focused on the digital agenda, the banks are relatively simple, and they have the financial cushion to invest.

Singapore also screens well, especially for regulatory support for digital and fintech. The pro-digital agenda of the Singapore policy makers is shared in the U.K., but the banks' managements do not demonstrate as much of a pro-digital agenda as their peers in Singapore. In EM, we are also impressed by Poland and South Africa.

Figure 9. Checklist to Identify Potential Winners Among Incumbent Banks Would Include Screening for Banks With:

Rating Parameters:	[1] Incumbent Bank senior leadership team focused on digital transformation (High; Medium; Low)	[2] Relatively simpler business mix by geography and product (High = simple mix; Low = complicated)	[3] A cushion of better existing financial returns that allows mgmt. to divert its attention from near-term fire-fighting (Based on current ROA)	[4] National regulator / govt. supportive of digital transformation
ASIA PACIFIC:				
Australia	High	High	Medium	High
China	Medium	High	Low	Medium
Hong Kong	Medium	Medium	High	Medium
India	Medium	High	High	High
Indonesia	Medium	High	High	Medium
Korea	Low	High	Low	Medium
Malaysia	Medium	Medium	Medium	Medium
Philippines	Medium	High	High	Medium
Singapore	High	Medium	Medium	High
Taiwan	Medium	High	Medium	Low
Thailand	Medium	High	High	Medium
EUROPE:				
BeNeLux	High	Medium	High / Medium	Medium
France	Medium	Low	Medium	Medium
Germany	Medium	Low	Low	Medium
Italy	Medium	High	Low	Medium
Poland	High	High	Medium	High
Russia	High	High	Medium	High
Scandinavia	High	High	High	Medium
Spain	High	Medium / High	Medium	Medium
Switzerland	Medium / High	Medium	Medium	High
Turkey	High	High	Medium	High
United Kingdom	Medium	Low	Low	High
LATIN AMERICA:				
Brazil	High	Medium	Medium / High	High
Mexico	Medium / High	Medium / High	Medium	Medium
MIDDLE EAST, AFRICA:				
Saudi Arabia	Low	High	Medium	Medium
South Africa	High	High	Medium	High
UAE	Medium	High	Medium	High
NORTH AMERICA:				
Canada	High	Medium	High	Medium
US	Medium / High	Medium	Medium / High	Medium

Source: Citi Research

Incumbent banks are still in the early innings of a digital overhaul and are likely focusing on select IT components where ROI is most compelling. In contrast, the Neobanks with their agile platforms and speed to market are simplifying finance by creating more customer-centric experiences and providing an experience challenge.

The client experience at many incumbent banks can be horrible. Recently we came across this anecdote from Huy Nguyen Trieu, a U.K.-based internationally active entrepreneur, about how painfully slow the bank account opening process is for U.K. small businesses ("Why SME Banking is a huge untapped market,, www.disruptivefinance.co.uk)

"When I started The Disruptive Group (in 2016), one of my first tasks – like any entrepreneur – was to open a bank account. My experience? Onboarding: horrible experience! It took more than a month to open the bank account, including waiting for hours on the phone. The worst was to wait on the phone just to book a slot for another call! Overall, it was exactly like all the horror stories we had heard."

"After this experience, when we launched CFTE (in 2017), I decided to take a radically different approach. I decided to go with Tide. My experience? Onboarding: this is what it should be! All from a mobile phone, it didn't take more than three minutes to enter all the information. Modern user interface: exactly what I would expect from a user interface (UI) in 2017, easy to use … mobile friendly."

Why is the client experience often so bad? Banks in "developed markets" are built on 1960s-1970s mainframe computers running legacy core banking systems that were developed by product and lack the agility, modularity, and scalability that today's banks need.

We believe core infrastructure overhauls will only gain importance over the next few years as legacy banks' IT systems have arguably reached the point of redundancy with complex integration of outdated systems becoming too costly and often keeping banks from imitating the digital experiences provided by the BigTechs.

An industry where an incumbent operates at a time scale of over a month and new entrant in minutes is ripe for disruptive change. We started this introduction with a taxi driver in Singapore exhaling, "Damn, Bloody, Slow." To survive and thrive in the years ahead, banks will need the letters D.B.S. to stand instead for Digital Bank Superstars. Is this possible?

In the rest of this report, we take a more detailed look at the ABCs of the Bank of the Future:

1. AI and automation;

2. BigTech and their increasing role in finance, especially in emerging markets;

3. Core banking transformation and cloud deployment;

4. Digital assets, including cryptocurrencies;

5. Epilogue: Emerging Markets beyond China and India

Interview with Exponential View: Azeem Azhar

About Azeem Azhar

Azeem Azhar is Chief of the *Exponential View* technology newsletter. He is a strategist, product entrepreneur, and analyst. He also serves as a member of the editorial board of the *Harvard Business Review*. As an investor, he invests in tech startups (specifically in AI). He also founded Peer Index in 2010 (applied machine learning to large-scale social media graphs to make predictions about web users). Brandwatch acquired Peer Index in 2014.

Q: How is the geography of innovation changing? The U.S. has been a magnet for innovation in the past. Do you believe it is likely to stay this way?

The U.S. has been a magnet of FinTech and broader innovation. But three key themes will put pressure on this U.S. hegemony going forward: (1) U.S. domestic policy decisions are making it less appealing to geographically mobile entrepreneurs; (2) competing centers have become more appreciative of start-up innovation (e.g., security-related in Israel or crypto-related in Berlin); and (3) China is on the rise, with significant innovation in AI / FinTech as well as deployment of manpower and capital.

Q: Singapore has been pushing itself as a FinTech Hub – do you think State-sponsored FinTech innovation is an oxymoron?

I do not agree with that. In fact, Silicon Valley was initially state-sponsored as well – see, for example, the benefits from defense-related spending. Even elsewhere, most early innovation – such as canals, railways, etc. – was state sponsored. "The Entrepreneurial State" by Mariana Mazzucato argues that the private sector often invests only after the State has made the initial high-risk investments. Singapore has been very supportive of FinTech and Blockchain. And other financial centers, from London to Dubai, are following in promoting FinTech.

Q: Shifting from State-sponsored to decentralized tech, a popular theme for the past year has been cryptocurrencies. Are you a bull or a bear on crypto?

One definitely cannot deny that Bitcoin has a utility (and likewise Ethereum) – to this effect, there could always be a use-case market for these products. Today, there are dozens of pilots and proofs of concepts taking place all over the world that are showing positive results – this is surely good news. But I believe we are still in the Internet of 1993, wherein Yahoo and Netscape haven't yet shown up. There is surely much more scope for expansion of crypto-technology. At the same time, I don't see crypto disintermediating traditional currencies in the next couple of years.

Q: Switching to Artificial Intelligence, why has AI gained prominence recently? What are some of the use cases you are seeing of AI in finance?

AI includes a very broad class of technologies, but if we break it down into more granular techniques, some of the prominent ones are targeting (1) improving the interface (i.e., Natural Language processing); (2) speech generation, (3) data analysis; and (4) signal processing. The benefit of these techniques were shown in the lab four to five years ago, and today they are increasingly mature and ready for mainstream application and commercialization. I expect interfaces to have significant AI implementations in the years to come – these could be in the form of chat bots or AI handling document discovery, among others.

Chapter A: Artificial Intelligence – the Finance Moment

"What stocks go up the most when a Category 3 hurricane hits Florida? Which stocks go up when Apple releases a new iPad?" Google-style, you can type these questions into Kensho's platform and receive real-time answers based on machine learning. Kensho's algorithm, originally called Warren after Warren Buffet, crunches millions of market data points to discover correlations and investment opportunities.

Daniel Nadler, founder of Kensho, notes: "Artificial intelligence is a misnomer. It's accelerated intelligence. It's about doing things, which historically you thought were impossible for a human being to do, at a blinding speed." (*Forbes*, March 6, 2018). "The coming era will be looked back upon as the 'AI era,' when AI became the defining competitive advantage for corporations, government agencies and investment professionals" (David Nadler, Kensho press release, February 2017).

AI is having a finance moment. Earlier this month, when Kensho was purchased by S&P Global for approximately $550 million, it was noted that "the biggest A.I. deal comes out of Wall Street (from a 158-year institution no less) and not Silicon Valley" (*Forbes*, March 6, 2018). In this chapter of our report, we take a deeper dive into some of the use cases in banking and finance today.

Evolution of AI – Why Now?

Advances in computing power, data volume, and connectivity are core components of the industrialization of AI, and together they are leading an explosion in AI applications, including in financial services.

- **High-Performance Computing**, with the adoption of new algorithms and new computing tools, has improved the learning ability and usability of AI.

- Increases in the number of devices and sensors connected to the **Internet of Things** are facilitating enormous amounts of data over the Internet.

- **Big Data** generated by digitalized processes at economical prices are helping accumulate enormous amounts of data, which can then be processed to generate high-value insights with machine learning.

Figure 10. Trinity of Artificial Intelligence
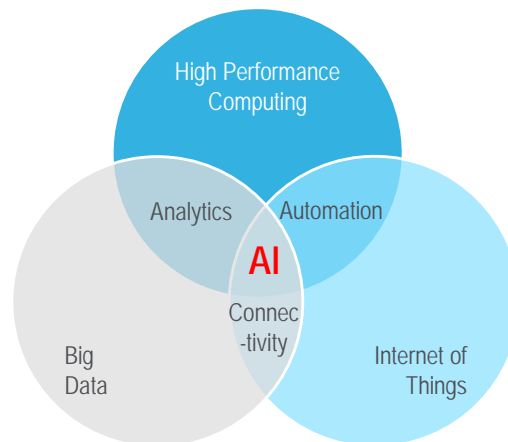
Source: Citi Research

Automation and AI are sometimes used interchangeably, but there are, of course, some large differences. Automation is software that follows pre-programmed rules, allowing machines to perform repetitive monotonous tasks, freeing up time for humans to focus on tasks that require a personal touch.

AI, on the other hand, is designed to simulate human thinking by constantly seeking patterns, learning from experience, and providing responses based on situational awareness. **Machine learning** refers to a set of algorithms that enables it to recognize patterns from large datasets and then apply these findings to new data.
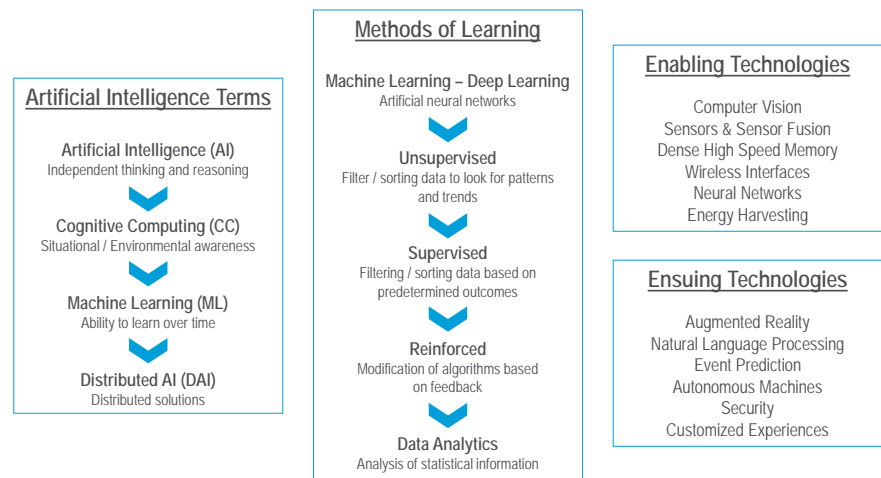
Deep learning is a sub-field of AI, where machine learning is based on a set of algorithms that attempt to model high levels of abstractions into usable data, mimicking the human brain. It requires the use of neural networks to learn from data and extend the ability of machines to react to nuances or the introduction of new data.

Figure 11. Some Terminologies and Methodologies

Artificial Intelligence Terms

Artificial Intelligence (AI)
Independent thinking and reasoning

Cognitive Computing (CC)
Situational / Environmental awareness

Machine Learning (ML)
Ability to learn over time

Distributed AI (DAI)
Distributed solutions

Methods of Learning

Machine Learning – Deep Learning
Artificial neural networks

Unsupervised
Filter / sorting data to look for patterns and trends

Supervised
Filtering / sorting data based on predetermined outcomes

Reinforced
Modification of algorithms based on feedback

Data Analytics
Analysis of statistical information

Enabling Technologies

Computer Vision
Sensors & Sensor Fusion
Dense High Speed Memory
Wireless Interfaces
Neural Networks
Energy Harvesting

Ensuing Technologies

Augmented Reality
Natural Language Processing
Event Prediction
Autonomous Machines
Security
Customized Experiences

Source: Citi Research

Artificial Intelligence has been discussed in academic circles for many decades. A 1956 workshop at Dartmouth College in the U.S. is credited with coining the term Artificial Intelligence. Alan Turing's 1950 paper on "Computing machinery and intelligence" opened with the sentence "Can machines think?"

However, after the initial enthusiasm in academia and popular culture, as with many emergent technology hype cycles, AI entered a slump. The first "AI winter" in academic funding and popular interest began in the early 1970s and after a brief recovery was followed by a second "AI winter" in the late 1980s.

AI gained the limelight in the media and popular culture in 1996-97, after IBM's "Deep Blue" supercomputer beat world chess champion Garry Kasparov. But it is in the past few years that we have seen several mainstream applications of AI, driven by:

1.   research reducing AI error rates to human levels;

2.   GPU-increased calculation power; and

3.   increased power and capacity to store data and reduce costs.

The way we use AI in our everyday life is rapidly changing — from static image recognition and tagging in social media platforms (Facebook, Google) to automated bots and complex natural language processing of voice commands (Siri, Google Now, Amazon Echo) to autonomous driving and fully functioning robots.

Industrialization of AI – Spending and Investing More

Banking & Securities Is the Largest Non-Tech Industry for AI

Outside the tech sector itself, financial services is one of the leading early adopters of AI. According to the IDC, the banking and securities sector is not only the biggest spender on external AI services but is also expected see fast spending growth over the next five years. Most bank investments are focused on risk management, fraud prevention, and compliance activities.

Figure 12. Market Sizes for Various AI Vertical Markets (2016-2019E)
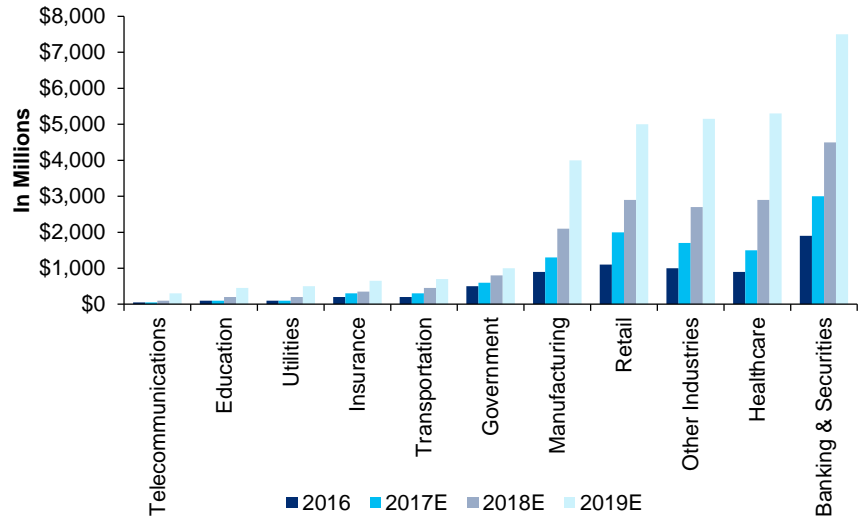
Source: IDC, Citi Research

AI startups seem most focused on applying AI solutions to verticals such as FinTech, insurance, healthcare, cybersecurity, and developing general-purpose/predictive analytics. Within FinTech, we are seeing use of AI for credit scoring/direct lending, regulatory/compliance & fraud detection, business finance & expense reporting, insurance, quantitative & asset management, assistants, and personal finance.

According to data from CB Insights, total AI funding in 2017 reached $15.2 billion (+144% year over year), spread over 1,349 deals. By geography, the U.S. still leads globally in terms of the number of AI startups and total equity deals but is gradually losing its previous overwhelming dominance.

Figure 13. Artificial Intelligence – Funding and Number of Deals
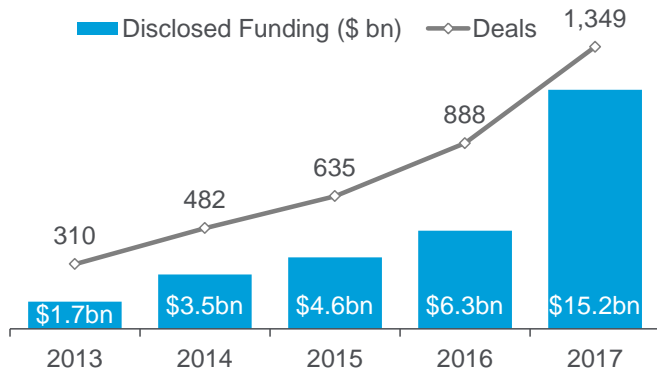
Note: Excludes hardware-focused robotics startups
Source: CB Insights, Citi Research

Figure 14. Artificial Intelligence Funding by Geography, 2016
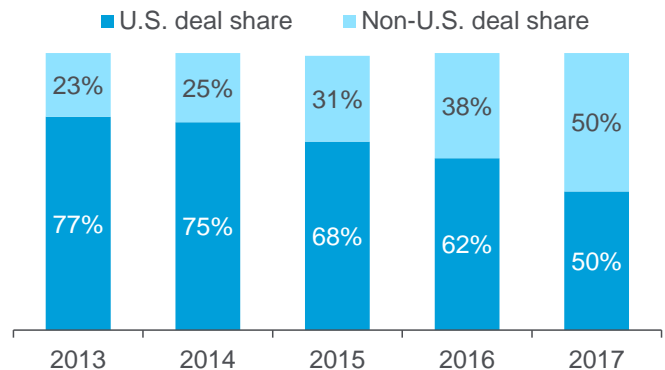
Source: CB Insights, Citi Research

AI in the U.S. is dominated by tech companies such as Amazon (predicting and analyzing customer shopping patterns); Google (strong AI push, acquired 50+ AI startups in 2015-16); IBM (high-profile Watson AI service); Apple (acquired four AI startups in 2015-16 for its digital assistants, facial/voice recognition); and Facebook (analyzing big data on social media).

AI in China is driven by the three Chinese tech giants – Baidu, Didi, and Tencent – that already possess advanced image/voice recognition and have set up their own AI research labs. Chinese financial institutions are also active here, with players such as Ping An utilizing AI for customer service, investments and insurance products, and fraud detection in the cards business.

**Rising M&A** – BigTech giants such as Google, Baidu, Apple, Intel, Facebook and Microsoft have increased their focus on AI, with more spend on internal R&D and deployment as well as targeted acquisition of startups. Since 2012, over 300 private firms using AI across different verticals have been acquired, not just by BigTech companies but also by traditional insurance, retail, and healthcare incumbents.

Figure 15. AI-related Merger & Acquisition Activity

Source: CB Insights, Citi Research
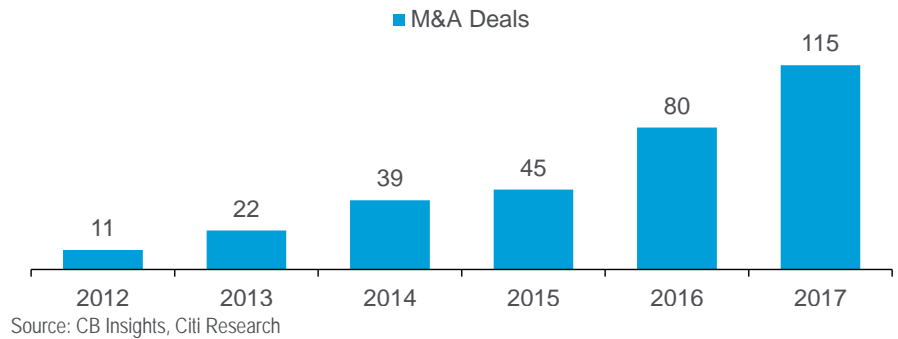
Race for patents – The number of AI-related patents filed by tech giants has steadily increased since 2014, with leading players such as Google and Microsoft filing as many as over 300 patents, individually, since 2009. By geography, we find U.S. and Chinese companies on top with the most registered patents.

Figure 16. AI Patents Filed by Tech Giants

Source: CB Insights, Citi Research
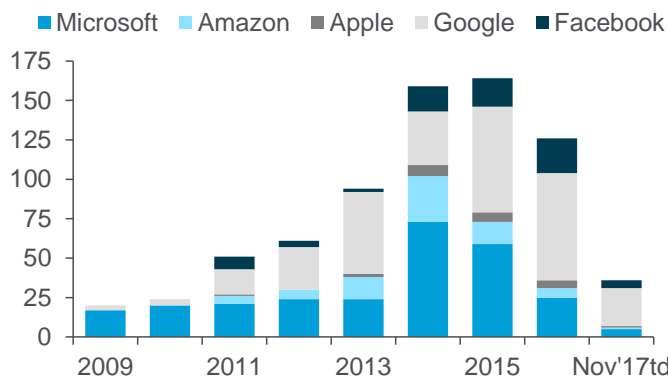
Figure 17. Patent Application Priorities

	Google	Amazon	Facebook	Apple	Microsoft
AI / Automation	✔	✔			✔
Behavioral Analytics	✔	✔	✔		
Cybersecurity	✔	✔	✔	✔	✔
Hardware	✔	✔		✔	✔
Cloud Computing	✔	✔			✔
Mobile	✔		✔	✔	
Unmanned Aerial Vehicles	✔	✔	✔		✔
AR / VR	✔		✔	✔	✔

Source: CB Insights, Citi Research

Interview with Citi Ventures: Ramneek Gupta

About Citi Ventures

Citi Ventures makes strategic investments in startups that are developing solutions across commerce and payments, data, analytics & machine intelligence, financial services & technology, marketing & customer experience, and security & enterprise IT.

About Ramneek Gupta

Ramneek co-leads the Venture Investing team at Citi Ventures. In this role, he leads investments in companies strategic to Citi and drives commercialization efforts between these companies and Citi businesses. Ramneek started his professional career as a design engineer at PMC Sierra and worked on the hardware design team at TiVo. He has an MS in Mechanical Engineering from Stanford University and a B-Tech in Mechanical Engineering from Indian Institute of Technology (IIT) Bombay. Prior to Citi, he was a Partner at Battery Ventures.

Q: What are the key characteristics that distinguish winners from laggards while implementing AI at an enterprise level?

I think it is important to understand that successful AI implementation is set up around a virtuous cycle, which begins with (1) creating great products, which drives (2) greater customer engagement with these products that results in (3) more data to run and train AI models and leads to (4) further improving the product, thereby completing the virtuous cycle. Enterprises that distinguish themselves as data-native companies are often those that succeed in each of the below four categories:

- **Acquisition of data** – Data is the most important component of any AI implementation, as it is the quality and depth of data that will determine the level of AI applications one can achieve. The leaders are highly strategic about how they design, build, and instrument their products to maximize the acquisition of data while following guidelines about what and why data is collected for each product type.

- **Easily accessible data** – Once companies have acquired data, they need to identify ways to make this data more accessible across the entire organization, in order to facilitate the generation of meaningful insights. This often represents a challenge, especially for large corporates, as most of their data tends to exist in silos across different departments (often due to regulatory restrictions and legacy systems). Companies that have implemented AI successfully have managed to break down these silos and create central data warehouses accessible throughout the company. Most enterprises, especially the U.S. banks, lag in their ability to make their data assets widely accessible. They suffer from silos that arise from the organizational structure, technology stacks, regulatory frameworks, and geographies. The picture has improved tremendously as several banks have started to centralize their data assets and are leveraging hybrid cloud architectures to speed up the transition. In comparison, most leading FinTechs, such as Square, are built on data being a key foundational building block (along with customer-centric product design) that is widely leveraged across the board from customer acquisition, servicing, operations, risk management, and compliance.

■ **Agile product development** – The next important aspect that differentiates success in AI involves how companies incorporate generated data insights into actual product development. For this, companies need to have an agile product development cycle wherein changes can be made more quickly and with less lag time. For instance, a product development cycle of two years would render any AI implementation inappropriate, as new data insights cannot be incorporated into products in time. Thus, ideal product development cycles need to be short and flexible to incorporate continuously generated changes from the AI models fueled by newly generated data. Most U.S. banks are only now adopting agile development frameworks (shrinking development cycles from several years to weeks/months) alongside efforts to digitize and automate their processes to be able to incorporate AI/ML.

■ **Reimagining of product management functions** – In order to succeed in AI, companies need to rethink the product management function. Simply put, the product management function is the art of communicating/translating what customers want to the engineers who can then build the same. Currently, a lot of this communication is done via wireframes for visual representation of the product. However, in the AI world, this is not possible. For example, how do you create a wireframe for a voice translation engine application? Instead, product managers need to be able to work with data sets to communicate inputs and desired outputs, efficiency measures, error and precision bounds, etc.

Q: What is the biggest challenge traditional financial institutions face with AI? Is it all of the above four aspects you have mentioned?

Availability of data is often the least of the problems for most financial institutions, as there is abundance of data created from traditional functions. However, the bigger problem is accessibility of data, as much of it lies scattered across different departments (possibly due to regulatory requirements and legacy systems). This limits the quality of possible insights that can be generated. A lot of this data dispersion can be attributed to regulatory constraints around PII (personally identifiable information) data and geographic residency requirements. However, it is my view that organizational silos and legacy tech stacks are equally strong contributors to the above problem.

The other problem financial institutions struggle with in AI involves slow multi-year product development cycles, coupled with manual (non-digital) processes. For one to incorporate AI improvements, end-to-end digital processes that can be driven by software are just as important as rapid product development cycles with frequent deployments.

Q: Are there any banks, insurance, or other financial institutions that have been able to crack this challenge? Or are all financial institutions in the same bucket and still struggling?

Definitely, there is a class of newcomers that did not have many legacy challenges and have been successful in building new systems from the ground up that are skewed towards data. We can segregate them into two categories:

■ The Squares and Stripes of the world are ahead at implementing AI, as their compliance, fraud-detection systems are largely based on machine learning and AI, requiring minimal human intervention. In fact, data generation begins from the time a client signs up with the company and the company maintains a detailed track record of all client transactions, which facilitate detailed data analysis.

■ Within the incumbent class of financial institutions, those that have adopted cloud functionality more aggressively than others have, by definition, been better able to adopt AI-related technologies. This seems reasonable, as once you build cloud functionality, a lot of the data is being regularly captured and is available centrally – facilitating generation of insights. Moreover, there are also a lot of externally available software and open-source cloud libraries that facilitate development of AI capabilities in the cloud.

Generally, it has been noticed that single-country and single-business-line financial institutions (e.g., Capital One) have been better able to implement cloud and thus AI capabilities. There is also a lot of interesting work being done by multi-business and multi-country financial institutions, but they will simply take longer to leverage their cloud and AI efforts given their complex business structures.

Q: A lot of external analysis suggests that banks/the financial industry is the biggest spender on AI. Is this true, in your opinion? Or is it that the sheer volume of data availability in this industry justifies more AI spend?

Yes, banks and the financial industry tend to be the biggest spender on AI. This can be attributed to the following:

First, financial institutions and banks are among the biggest spenders on IT in general, and this is true in data/analytics/ML/AI applications vertical as well.

Second, AI comes naturally to the finance industry, as historically it has relied extensively on data and statistical modelling for fraud prevention, risk management, and credit underwriting. As a result, it would be natural for financial institutions to spend more on newer technologies that help better understand data.

Last, one would expect large tech giants, such as Apple or Google, to be significant spenders on AI, possibly even spending more than financial institutions. However, it must be noted that these companies have invested heavily in creating new hardware and software systems for AI, but they have seldom used off-the-shelf AI solutions from external vendors. Instead, they prefer building systems themselves based on their custom needs or by acquiring smaller firms. Hence, they would not show up in league tables as big spenders on third-party AI software, and this probably explains why banks show up as the biggest spenders.

AI-driven Applications in Banking

AI is increasingly seen as a competitive advantage in finance, with banks seeking to analyze structured/unstructured data, turning raw data into actionable intelligence to improve revenues, reduce losses and costs, or do all of the above. We believe most AI implementations in finance are currently focused in these areas:

■ **Improving customer experience** – AI applications are helping financial institutions increase customer engagement by providing data insights into user behavior and spending habits, enabling financial institutions to offer contextual, custom recommendations.

■ **AI-based fraud detection** – Banks are using AI to analyze client and employee behavior by extracting patterns from huge amounts of unorganized data, which can help identify potential fraud and mitigate risks. AI in cards also helps reduce false declines and increase accuracy of real-time approvals for genuine transactions.

■ **Meeting regulatory requirements, compliance** – AI technologies can help financial institutions monitor real-time data and meet regulatory requirements, as well as reduce risks associated with human error and misconduct.

■ **Making data-driven decisions faster** – AI can help firms increase human productivity by reducing the amount of time spent on manual/repetitive tasks, resulting in accelerated decision insights. For example, AI-driven credit-scoring methodologies and advisory services augmented with robo-advisors.

■ **Cost savings through automation** – AI can help banks streamline their front end by deploying machine learning/robotics to do routine functions and resolve client queries (such as chat-bots), thus helping free valuable human resources for more value-added customer services and improve cost efficiencies.
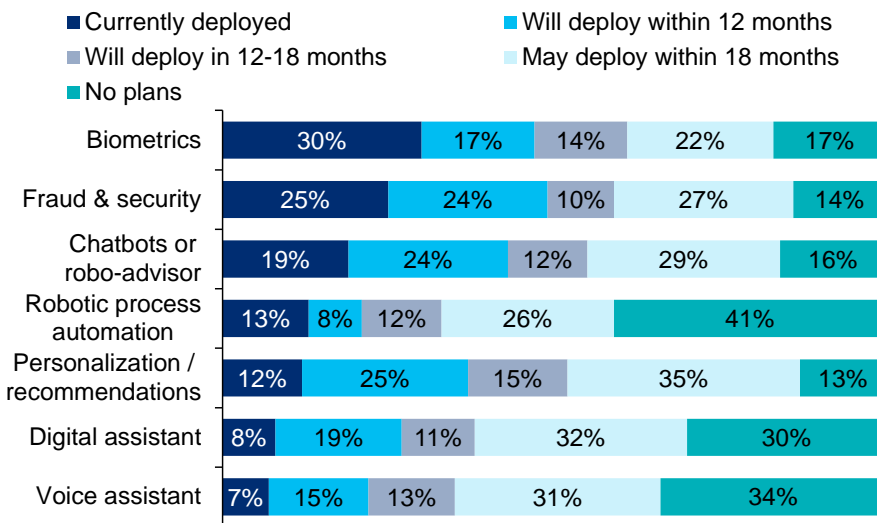
Figure 18. Artificial Intelligence to Banking

VALUE FROM AI TO BANKING

	Enhance efficiency	Scale non-linearly	Accelerate & Enhance decision insights
	Simplify; Automate; Efficiency; of existing operating models	*Meet demand growth without equivalent supply investments*	*Improve decision making; in real time, in complex areas*
Customer Engagement	• Simplify and automate user engagement *Robo-advisory is 80%+ more cost effective than traditional models*	• Augment and enhance human effort in interactions *Virtual agents can scale to handle 1.5-2MM+ customer queries daily*	• Increase speed & quality of insights to target & personalize *Recommender systems increase targeting returns by 2X+*
Operations	• Automate & standardize process flows *RPA reduces processing costs by 40-50%;*	• Augment capacity to address variable demand & complexity *Quicker ledger reconciliations can reduce capacity needs*	• Reduce time to predictions & information retrievals *ML can improve treasury liquidity forecasting effectiveness by 15%+*
Risk & Compliance	• Reduce costs by automating manual tracking & reviews *Automation of standard legal processing can reduce costs by 80%+*	• Track risks in real time, at scale; while improving effectiveness *AI use in cyber-security can improve detection by 3x, and reduce false positives*	• Reduce time to detection and mitigation *DL techniques can reduce time to fraud detection by 30%+*

Source: Citi Digital Strategy, Citi Research

■ **Potential use by regulators (robo-regulators)** – Financials regulators are also exploring the use of AI for better monitoring of financial institutions. For example, the Financial Conduct Authority (FCA) in the U.K. is looking at the possibility of making its handbook machine-readable and then fully machine-executable. This would mean that machines can interpret and implement the rules directly (CNBC). Similarly, the Security & Exchange Commission's (SEC's) Division of Economic and Risk Analysis (DERA) in the U.S. is also exploring use of big data/ML to extract actionable insights from massive datasets, helping examiners find cases of potential fraud / misconduct (SEC speech).

According to a Digital Banking Report study published last month by BI Intelligence, one in four U.S. bank executives surveyed stated that their organization used AI for fraud and security, and 30% used it for biometrics. Including plans for deployment during 2018, about half of U.S. banks in the survey planned to use AI for risk management and biometrics. Use of AI for chatbots/robo-advisory is also rising.

Figure 19. AI Solutions Planned/Deployed at Financial Institutions, U.S.

Legend:
- ■ Currently deployed
- ■ Will deploy within 12 months
- ■ Will deploy in 12-18 months
- ■ May deploy within 18 months
- ■ No plans

Category	Currently deployed	Will deploy within 12 months	Will deploy in 12-18 months	May deploy within 18 months	No plans
Biometrics	30%	17%	14%	22%	17%
Fraud & security	25%	24%	10%	27%	14%
Chatbots or robo-advisor	19%	24%	12%	29%	16%
Robotic process automation	13%	8%	12%	26%	41%
Personalization / recommendations	12%	25%	15%	35%	13%
Digital assistant	8%	19%	11%	32%	30%
Voice assistant	7%	15%	13%	31%	34%

Source: BI Intelligence report titled "AI in Banking & Payments," February 2018

Current implementations of AI have been able to detect real-time problems within processes, such as incorrect calculations or instances of fraud, and have been deployed by financial institutions to detect fraud and for natural language processing. However, true cognitive solutions in financial services that use machine learning to sift through unstructured data in order to predict problems before they happen and advanced use of robotic process automation aren't as developed yet.

Use Cases in Consumer Banking

AI implementation in consumer banking is an enabler of growth (via better targeted marketing) and efficiency improvement (higher volumes, lower risks). AI, particularly chatbots, is proving useful, with banks running pilots aimed at increasing automation and simplifying day-to-day transactions. AI is also finding use cases in real-time monitoring instances of fraud and cybersecurity.

Predictive analytics are being deployed in retail banking to study customer behavior and offer personalized products and investment advice. Several banks are embracing AI to target clients and offer personalized promotions. Many are piloting chatbot technologies or using voice biometrics to authenticate phone banking customers.

US Bancorp has enabled its customers to complete banking tasks, such as checking an account balance or making digital payments, by speaking a command to Amazon's voice-activated assistant, Alexa.

Figure 20. Artificial Intelligence Use Cases and Adoption in Consumer Banking

	AI USE-CASES	MARKET EXAMPLES	TYPICAL VALUE BENEFITS
Customer Engagement	• **Target & personalize customer offers** better, across channels	✓ DBS, Chase, RBS, BBVA, DB, Capital One	• 2-3x+ better response rate • 20-30%+ revenue uplift
	• **Chatbots/ Digital agents** for customer service & query support	✓ DBS, USAA, HSBC, BoA, CMB, Capital One	• Handle 1MM+ queries/ daily; • Improve resolution time by 80%
	• **Secure Digital Identity** with **facial, voice & behavioral biometrics** for smarter onboarding and servicing	✓ Barclays, Wells Fargo, HSBC, USAA, WestPac, CapitalOne	• Reduce fraud by 70-80% and verification costs by 50-70%.
	• **Automated spend and Investment advisory**	✓ USAA, Capital One, Bank of America, Betterment, Wealthfront	• Reduce costs by 80%+ • Increase clients/ advisor by 2X+
Operations	• **RPA for automating** ledger reconciliations, automating tech support, IT automation etc.	✓ WellsFargo, Chase, ICICI, Danske Bank, JP Morgan, Bank of America, DBS	• Lower operating costs by 40%+ • Reduction in reconciliation time by 60-90%
Risk & Compliance	• **Detect fraud better, particularly for payments in real time**	✓ Visa, Mastercard, Stripe, JP Morgan, Nordea Bank	• Reduce false positives in fraud by 60-80%
	• **Enhance Cybersecurity with ML techniques**	✓ CapitalOne, Barclays	• Reduce time for detection by 30%+

Source: Citi Digital Strategy, Citi Research

Interview with Active.Ai: Ravi Shankar

About Active.AI

Active.AI is a Singapore-based FinTech that is focused on using Artificial Intelligence (AI) to deliver conversational banking services. The company has built an advanced, proprietary conversational AI platform that connects consumers with their banks via micro conversation. Their AI platform can be deployed for financial institutions, insurance companies, and capital markets.

About Ravi Shankar

Ravi Shankar is the co-founder and CEO of Active.Ai. He was an investor and board member/ advisor at Emvantage Payments (Exit to Amazon) and MRL Posnet (Exit to Atos WorldLine) .He also co-founded Nevales Networks Pvt Ltd. in January 2010. Prior to that, he worked as Group Executive Vice President of Yes Bank. He was VP & Head of Non Branch Delivery channels of ABN AMRO Bank. He started his career in HDFC Bank.

Q: Tell us about the genesis of Active.Ai?

We started the company in early 2016. I did a trip to China in mid-2015, looking at how financial services were being delivered, and knew China was making huge strides in using AI and the latest technologies to enable financial services. It was fascinating to see how China got there. By the end of 2015, it was clear that the "mobile first" model for financial services, built from China, was going to be disruptive and take on the world.

Everything was changing: messaging became ubiquitous, unstructured mobile data use significantly increased. China made progress and used messaging platforms whereby people were getting connected to people and then businesses. WeChat set the stage in financial services by using messaging as a connected highway, first to people and then to institutions, and then became a financial services player. The pace of this execution was something never seen before.

We saw that a large majority of the incumbents would be caught on the wrong foot, as they didn't see this technology come in as they were dependent on third parties for their technology. Incumbents were exposed to a new competitor – mobile-first companies with lot of capital, bringing new technology and engaged consumers.

This was the gap we saw in the market and the genesis for Active.Ai.

Q: Why do you think China became so advanced? Why are these messaging platforms, such as Tenpay in China or WhatsApp in India, so powerful?

The average time mobile users spend on apps was increasing significantly since 2013. In the West, it was a lot about Facebook, or e-commerce, but the rails were different. Social and commerce didn't intersect. In China, by mid-2014, the shift was visible and different. Messaging just took off; it was very clear something very different was happening in China. In China, it was mobile messaging and a lot more commerce within messaging, and this was making money and adding an enormous number of users.

Surging mobile commerce forced Tencent and Alibaba into making early investments in AI – transport, big data, robots, and payments.

500 million+ monthly active users (MAUs) in messaging apps alone forced the investments into AI to handle the scale, engagement, and processing throughput not seen by Visa or MasterCard put together on a monthly basis. China thus leapfrogged the world on mobile commerce.

These platforms out of China are now global. They bring a mobile-first engagement stack to consumers. They also bring marketplaces from commerce to financial services. And most importantly, they have, in effect, unlimited capital. That's why they are powerful.

India lags China in terms of e-commerce and mobile payments. Like the rest of the emerging world, the Indian e-commerce market is very nascent; however, the 300 million+ monthly active users in WhatsApp are reflective of a social nation that likes unstructured communication, similar to China.

The big flip for India came about with the establishment of the India Stack. The ability to identify and authenticate a user and then use an application program interface (API) to pay one in the banking ecosystem provided a game changer, not only for banks but also for non-bank participants such as WhatsApp.

The WhatsApp beta for payments on the messaging platform has already gone viral and threatens to disrupt small value peer-to-peer (P2P) transfers. This is very similar to early experiences of WeChat and has similar potential for explosive growth.

Q: Talk us through the process of how banks saw technology in the 1990s to now, moving from outsourcing tech to tech becoming a USP now.

Technology at banks started as being outsourced and then moved to becoming more collaborative. The early focus for banks was automation to reduce costs and start handling scale. Online banking evolved quickly but only in small pockets of the world – fewer than 500 million people used online banking across the world until the mid-2000s.

By 2010, it became evident to banks that we were in a mobile-first world and that smart apps were key to customer engagement. Apps, however, despite their heavy marketing and promise, failed to engage users, except in a few first-world countries, where data speeds were good and people preferred remote banking.

The number of users was still similar to that for online banking. Some banks in-sourced their mobile development, while many banks just outsourced to multiple vendors. Most banks failed to understand the mobile banking needs of their customers and ended up having more than ten apps for various purposes on their stores.

By 2015, it slowly became evident to banks that Internet giants and FinTechs (heavily capitalized) could eat their lunch as they offered better mobile experiences. Governments globally opened up banking to non-banks to enable greater access and efficient delivery of services.

To compete better, banks had to respond. They had no choice but to make technology a key differentiator. They had to partner with innovators and build in-house tech teams around mobile and AI to respond to the new challengers. Thus, tech became the USP for banks. Banks globally have responded differently. Some have built a war chest to acquire technology talent. Others have set up venture arms to invest or acquire technology. Some banks set up technology incubators.

Q: Going from mobile first to AI first? What does it mean?

Mobile first was all about getting banks' services on the mobile phone, across the app ecosystem and text platforms largely. This has been one costly experiment, as banks waded into a rapidly evolving ecosystem with limited understanding of who will remain winners and how these platform technologies will evolve. Hence they invested in many applications to support a complex and evolving hardware and software industry. Customers changed phones frequently, and their preference for mobile ecosystems made it almost impossible for banks to focus on a single mobile technology. The return on investment (ROI) from the investments in making a bank mobile has been a sore point for most banks.

By 2015, it was evident that messaging was the new way on mobile and that app fatigue had set in. The shift from apps to messaging was happening at a great pace, and millennials were driving the change. Customers liked unstructured communication, and the bot framework provided an opportunity to engage over 2 billion monthly active users. This new channel for banking was exciting, but unlike apps, this required a new stack that banks didn't have – an AI platform. We believe that one in two banks are considering an investment into AI technologies to enable a better engagement platform with their customers by 2020.

How does AI help banks? First, in the messaging layer itself, AI can help banks better integrate in a conversational style via text or in voice (Alexa, Siri, etc.). Also, AI is helping integrate predictive services to make intelligent conversations with customers.

Banks are now working with multi-lingual chats that can, for example, start with a virtual assistant bot in English and end with Spanish. In countries such as India, where WhatsApp is the primary mobile app, customers converse in English and regional languages and exchange billions of messages a day. AI-based translation tools are being deployed to make the conversations understood by bots to respond to customers in a meaningful fashion with the right data.

Q: What does Active.AI do for banks, where, and with what products?

Active.Ai enables via its platform (cloud or on-premise) financial institutions to deliver their services over messaging or voice platforms to their customers. Banks deploy the platform in customer acquisition workflows, servicing, or even the transaction layer. The Active.Ai platform is omni-channel and is being deployed by over ten institutions in markets across Asia, Australia, and North America. The company aims to have a few tens of millions of users on its platform by 2018.

Financial Institutions are investing into the Active.Ai stack to

1. Reduce cost of service (as this will be fraction of other channel costs, such as call center or online banking).

2. Better engage (data from users' social, location, etc. along with other mobile parameters).

3. Compete better with other FinTechs and Internet majors.

Axis Bank and CIMB are using Active.Ai in Asia. Banks in other regions are also using or trialing the Active.Ai offering currently. Look out for several more public announcements during 2018 from banks that go "live" with Active.Ai.

Use Cases in Commercial Banking

While AI in consumer banking is gaining traction with the most common exploration of the technology in customer experience and sales, several banks are also eyeing AI success for streamlining operational processes in corporate banking. Some of the functions being explored include improving accounts receivables performance, maximizing company credit lines, and providing competitive trade finance offerings.

Banks are using AI tools and customer data to carry out detailed analyses on corporate transaction flows, payables, and receivables, which in turn help banks provide advice on the timing of bill payments, offer discounts for early payments, and provide investment advice. Recently, Wells Fargo and JP Morgan launched a new payment reconciliation solution with AI capabilities designed to help customers reduce days sales outstanding (DSO) and improve cash forecasting.

Figure 21. Artificial Intelligence Use Cases and Adoption in Treasury and Trade Solutions Banking

	AI USE-CASES	MARKET EXAMPLES	TYPICAL VALUE BENEFITS
Customer Engagement	• **Virtual digital assistants to help corporate clients** navigate through product detail / answer queries.	✓ HSBC, RBS	• Virtual agents can help reduce corporate calls by 70-90%
	• **AI based chat logs analytics** for better customer interactions.	✓ DBS, Bank of America, HDFC Bank	• 60%+ of queries resolved quicker through analysis of chat logs.
	• **AI based analytics** for liquidity optimization	✓ JP Morgan, Yes Bank, HSBC	• 10-15% reduction in liquidity buffer feasible through predictive optimizations
Operations	• **AI predictive analytics** of DPO /DSO estimation, to optimize Supplier Financing	✓ Wells Fargo, DBS, JP Morgan	• Improve financing forecast by 70-90%.
	• Automate **ledger reconciliations**	✓ JP Morgan, ICICI, Axis	• Lower operations costs by 40-60%.
	• Automate **payment reconciliation** for receivables	✓ Bank of America, Citi	
Risk & Compliance	• **Intelligent and automated contractual processing**	✓ JP Morgan	• Reduce legal costs by 80-90% through automation of standardized terms
	• Machine Learning **to predict exposure risk** for client investments	✓ CapitalOne, Goldman Sachs	• Predictive risk improves 20-30%

Source: Citi Digital Strategy, Citi Research

AI in trade financing is helping banks automatically transfer documents and feed data directly into issuance systems. For instance, HSBC has adopted robotic technologies to analyze documents, digitize, and extract relevant information before feeding it into its transaction processing system.

The other area gaining attention recently is automated contractual processing and machine learning to predict exposure risks. Notably, banks such as JP Morgan have invested in technologies (referred to as COIN) to automatically review loan contracts and financial deals, thus eliminating several man hours required by lawyers and loan officers. Goldman Sachs employs machine learning to signal an early warning for assets at potential risk.

Use Cases in Capital Markets Banking

AI-driven software for traders/wealth managers is helping financial institutions aggregate enormous amounts of data, from company earnings to news flows, regulatory commentary, and industry trends – all in real time. AI-powered applications also have great use cases in compliance and risk management (see the interview overleaf with the founder and CEO of Behavox, a people analytics company).

AI in capital markets is also being explored for news sentiment and volatility analytics. Online trading platforms, such as E*Trade Financial, have rolled out new adaptive portfolios, which offer passive investment management that automatically rebalances to accommodate for market changes. Other players, such as Wealthfront and Betterment, also offer similar products.

We started this chapter with Kensho, founded in 2013, which offers an AI-driven repository of data, powered by strong visualization capabilities that facilitate making predictions on stocks, bonds, and commodities. For wealth managers and traders, this means less time spent on data gathering and more time on actionable trading and marketing opportunities.

Figure 22. Artificial Intelligence Use-Cases and Adoption in Markets Banking

	AI USE-CASES	MARKET EXAMPLES	TYPICAL VALUE BENEFITS
Customer Engagement	• Virtual digital assistants for **assisted trading**	✓ Fidelity, E*Trade	
	• AI based analysis to enhance **customer market insights**	✓ JP Morgan, Goldman Sachs, Numerai, Walnut	• AI insights helps improve ROI by 10-20%
	• ML-based **high frequency / automated trading** platforms	✓ Credit Suisse, Goldman Sachs , DB, Citi	• Automated trading reduced 80-90% savings in FTEs
Operations	• **Automated trade ledger and market reconciliations**	✓ Goldman Sachs, JP Morgan	• RPA automation enables 60%+ reduction in trade reconciliation time
	• **Asset price relationship** tracking	✓ Goldman Sachs, RBS	• Reduced info retrieval cycle by 50-60%
	• **News sentiment analytics** for financial forecasting	✓ Deutsche Bank, JP Morgan	
	• Enhancing **research insights** with AI	✓ State Street	
Risk & Compliance	• ML graph **analytics techniques for market compliance & fraud analytics**	✓ Goldman Sachs, HSBC, JP Morgan, DB	
	• **Developing credit risk profiles** for wealth products	✓ UBS, Deutsche Bank	• Improved compliance by 70% and 5-10% better ROI for high risk profiles.

Source: Citi Digital Strategy Citi Research

Interview with Behavox: Erkin Adylov

About Behavox

Behavox is a people analytics company that analyzes employee data in a corporate environment. By using software and machine learning, Behavox aims to generate previously unidentifiable insights on (1) compliance and risk; (2) culture and conduct; (3) people performance; and (4) sales and profit.

About Erkin Adylov

Erkin Adylov is the founder and CEO of Behavox Ltd. Before, he worked as portfolio manager at GLG Partners, where he managed the GLG financials fund with about $2bn in assets under management. He also served as a research analyst at Goldman Sachs. Erkin has a master's degree from the London School of Economics. He is a British national and splits his time between London and New York.

Q: Tell us about an average day in the life of Behavox?

Nothing in the day of a high-growth tech company is average, but if you were to visit us for a day, you would witness (1) data science teams developing machine learning algorithms that are able to make sense of unstructured data, such as phone calls and trader chats; (2) back-end engineering teams working on Hadoop, Spark, and other technologies that enable our Platform to process increasingly large data sets faster than any data lake on the market; and (3) regulatory experts busy working on the quarterly magazine that we publish. Behavox systems installed in client environments are handling 3.5 million phone calls and more than 26 million emails, chats, and messages per day.

Q: What problem is Behavox solving?

Compliance and risk are among the most important business requirements for any financial institution. But there are major, long-standing problems that have squeezed compliance departments:

■ **Dispersed communication channels** – Compliance teams tend to struggle with at least 20-30 different communication channels used by market participants that require regular monitoring, everything from voice calls and WhatsApp messages to Bloomberg and Slack chats. Behavox helps consolidate, index, and analyze all of these communication channels for easy monitoring, in real time, with one simple interface. In addition to communications data, Behavox Platform also analyzes and links structured data, such as trades, to communications data. No more impenetrable silos of data that are not connected.

■ **Inefficient legacy systems** – At present, the legacy systems mean compliance teams search for keywords within employee content without adequate filtering. This means that for a big global bank, the keyword search could generate about 30-40 million content points – most of which are not very useful. Behavox's machine-learning algorithms are integrated into search logic to dramatically reduce irrelevant/unhelpful results.

For example, at one client, regulators were looking for transactions related to The Cheesecake Factory. Running a simple keyword search on a legacy system for the word "cake" generated nearly 15,000 references, with most referring to cake in the context of food rather than a business. In actual practice, using Behavox with the help of AI / machine learning, the relevant content was immediately narrowed down to just about 50-60 items.

Q: From the banks' perspective, what is the ROI for using Behavox?

If we look at it from the banks' perspective, I think there are essentially three benefits that they can gain from working with Behavox: (1) replace legacy technology and lower IT costs, as the cost of Behavox can be nearly 5x cheaper than that of a legacy system; (2) avoid regulatory wrath and penalties by improving regulatory compliance; and (3) add new capabilities for data insights that the bank did not have before, thus allowing banks to upskill people.

Q: How hard do you think it is to replicate what Behavox is doing?

Behavox has a lot of intellectual property on the tech side, which is hard to replicate. It took the company three years to build the core software, and I expect it would take the same amount of time for any new entrant in the market. Additionally, Behavox also has intellectual property on the business side – for instance, in any compliance project, Behavox helps provide clients with the insights to first understand what they need to be looking for and then provide a detailed solution on how to go about searching for that in a well-structured and timely manner.

Q: How do you hire the right people? Where are they from?

We are currently hiring in regions that suit our client base, which at this moment is mainly London, Singapore, and New York. However, we look for recruits all around the world to increase the likelihood of finding top talent. To meet our headcount growth targets, we also opened Behavox University, which is responsible for onboarding and continuous education for our staff.

Q: How does software delivery work?

We need "bare metal" hardware that is given by the client at the start – this usually tends to be a virtual machine that is basically the equivalent of a physical computer but in the client's data center. Behavox does not store or process any client data, so we rely on our clients' providing hardware where we install our software. Behavox software requires some project management time – but much of this is done by the Behavox implementation team. We recently completed an implementation with a large U.S. client in record time of two months.

Q: How often do you run updates?

Behavox operates in the enterprise technology market, which is typically slow moving with a lot of software that is hated by the users. We want to shake up this status quo by offering updates of our software frequently. Currently, we release updates every four weeks, but in the near future, we will be moving to continuous rollouts. We expect this to cause a revolution in enterprise software, because bugs will be discovered and eliminated in hours, and new features will be available to our clients as soon as they are production ready. Behavox wants to bring what people love in consumer technology or the SaaS world to the world of enterprise software.

Q: Who are the major competitors for Behavox?

Behavox's competitive advantage is that we provide three value propositions: (1) data lake for all of a client's data; (2) machine learning and AI-enabled application; and (3) deep subject matter expertise in financial markets. Most other companies only work with one or two of these elements, not all three. Many of our competitors look at national security as well as financial risks. But understanding financial regulations and compliance could not be more different; it has more shades of grey.

AI Enables FTE Reduction, Optimizes Distribution

We are past "peak banker," especially in developed markets. Increased use of automation and AI-driven systems is likely to help banks improve cost efficiencies by employing fewer workers as repetitive human tasks are replaced by machines that can understand human behavior and make decisions.

As far back as 2015, Antony Jenkins, former Barclays CEO, noted that "the number of branches and people employed in the financial services sector may decline by as much as 50% over the next 10 years, and even in a less harsh scenario I predict they will decline by at least 20%."

In 2017, John Cryan, Deutsche Bank CEO, told a Frankfurt conference: In our bank we have people doing work like robots. Tomorrow we will have robots behaving like people. It doesn't matter if we as a bank will participate in these changes or not, it is going to happen."

Similarly, at a Singapore conference in 2017, Vikram Pandit, former Citigroup CEO, noted that "everything that happens with artificial intelligence, robotics, and natural language — all of that is going to make processes easier …It's going to change the back office."

Mr. Pandit mentioned that development in technology could see some 30% of banking jobs disappearing in the next five years, but he also expected new jobs to be created with "banking world going from large financial institutions to one that's a little bit more decentralized" (Bloomberg, September 2017).

EU banks have cut employee numbers by around 15% since the 2008 Great Financial Crisis. The crisis hit countries such as Greece, Ireland, Spain as well as digitally focused markets such as the Netherlands and Denmark, which have seen the most employee reduction, ranging from 20% to 40%. U.S. banks are also behind European peers when it comes to employee reduction, possibly as a result of better growth and less profitability pressure.

Figure 23. Change in Full-Time Employees 2016 vs. 2009
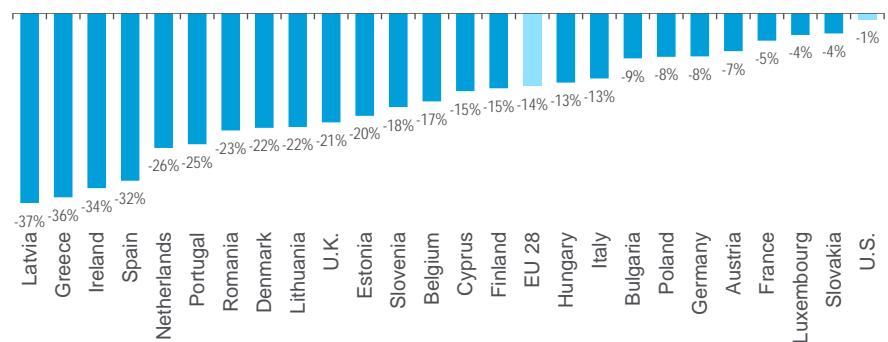
Source: ECB, U.S. Bureau of Labor Statistics, Citi Research

The pace of staff reductions so far has been gradual (~2% per year or ~10-14% from peak levels pre-crisis). As we noted in our previous GPS report, we expect banks to experience another 30% reduction in staff between 2015 and 2025, shifting from the recent 2%-per-year decline to 3% per year, mainly from retail banking automation. From peak staffing levels pre-crisis, this would result in a ~40-50% decline.

Figure 24. At the Tipping Point of Full-Time Employee Reduction (million)
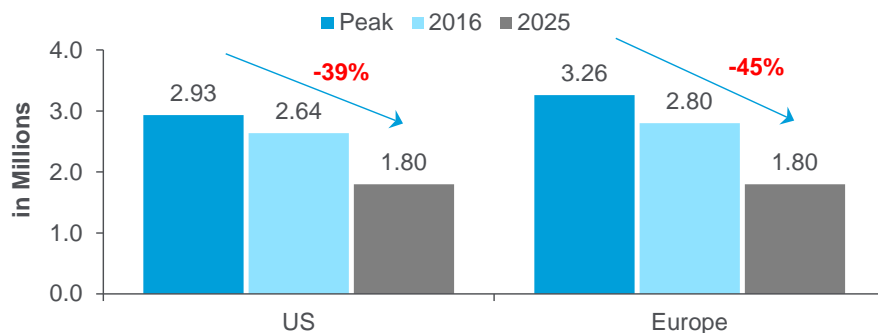
Source: ECB, U.S. Bureau of Labor Statistics, Citi Research estimates

We believe wide adoption of AI and automation will have a profound impact on banks' distribution and servicing channels. As discussed in our earlier GPS report (link), banks in developed markets are expected to cut their number of branches by another 30-50% from the level in 2014.

The Nordic banks have exceeded our expectations, with branch density down nearly 25% in just two years. The euro area developments appears to be in line with our estimates (-2% in 2014-16), whereas the U.S. banks are lagging our expectations, with branch density still holding at 2014 levels.

Figure 25. Commercial Bank Branches per 100k Adults (2016 vs. 2009)
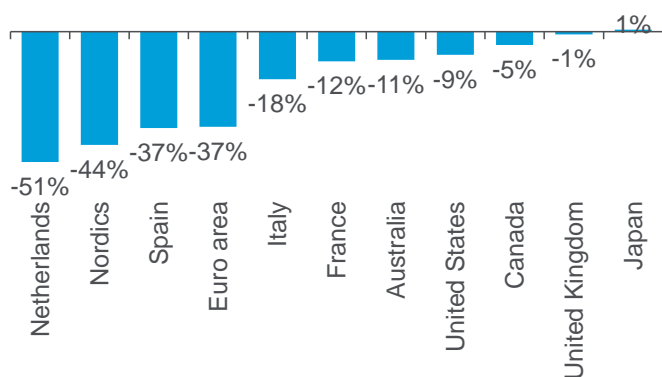
Note: Latest data for U.S. only available until 2013
Source: IMF, World Bank, Citi Research

Figure 26. Commercial Bank Branches per 100k Adults by Region
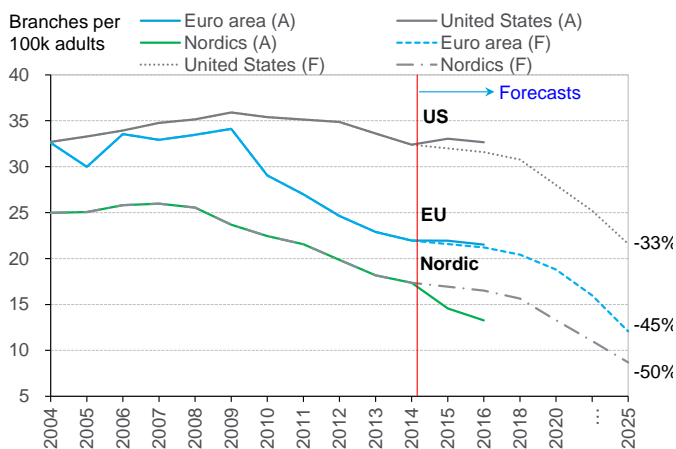
Note: F stands for Forecast, A stands for Actual
Source: World Bank, Citi Research

Chapter B: BigTech or the ANT-ification of Finance

Finance is being re-imagined and re-created in emerging markets (EM) by FinTech and BigTech players with the proliferation of mobile platforms, a growing middle class, and favorable government policies. New entrants have made a mark in the consumer payments and finance space in Asia, especially in China and increasingly in India. In this chapter, we take a closer look at how BigTech, rather than FinTech, poses a competitive threat and a collaborative opportunity for incumbent banks.

"10x" improvements are more likely in new markets that can "leapfrog" established technology – e.g., go mobile first/only, skipping the landline phase in telecom. In China, e-commerce giant Alibaba has amassed the world's largest money market fund and issued nearly $100 billion of loans in five years, whereas in India, mobile wallets provider Paytm has nearly 280 million registered users with an average transaction value of INR500 ($7.50) per day. In developed markets, B2C FinTech plays have not reached the scale of their Asian peers with a few exceptions, most notably PayPal.

Traditional banking is being challenged not by small FinTech startups but rather by established tech giants (particularly in emerging markets) leveraging their strong customer bases, vast user data pools, agile technology pl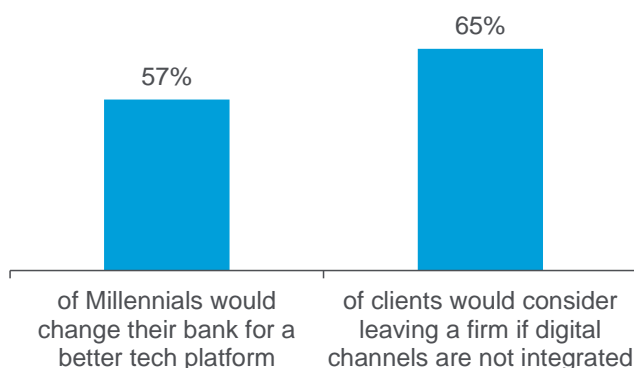atforms, and deep funding pockets. BigTech giants are eroding the boundaries between industries as they seek to be all things to all people. While payments and transaction services are often the first area of disruption by BigTech, the end objective is creation of an integrated financial ecosystem as part of a holistic customer engagement strategy.

But do clients want to do banking with BigTech? According to a survey by Deloitte in "Millennials and Wealth Management," nearly 57% of U.S. millennials cited that they would change their bank for a better tech platform, while 65% would consider leaving a firm if digital channels are not integrated (Capgemini World Wealth Report). But banks are still trusted, even if not loved. U.S. retail banking clients still trust their primary bank more than BigTech on money matters. But the survey data would probably look different for U.S. millennials and for EM-based clients.

Figure 27. Importance of Digital Leadership in Choice of Bank

57% of Millennials would change their bank for a better tech platform

65% of clients would consider leaving a firm if digital channels are not integrated

Source: Deloitte, Capgemini

Figure 28. Which Company Would You Trust Most with Your Money?

More Trust

Primary bank	1.7
Banks in general	3.3
PayPal	4.0
Amazon	4.3
Apple	5.1
Google	5.4
Microsoft	5.5
Facebook	7.4
Snapchat	8.3

Less Trust
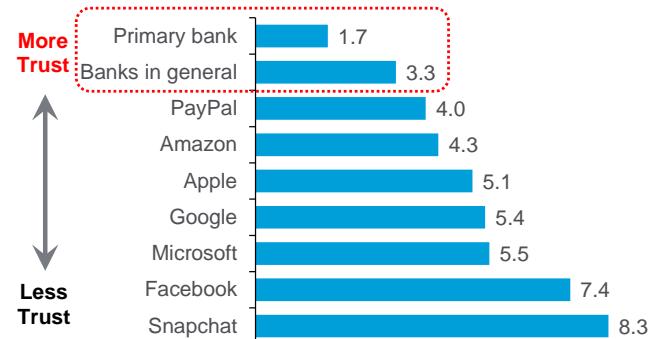
Note: Rankings on a scale of 1 to 9, with 1 indicating highest trust.
Source: Bain Research Now Customer Loyalty in Retail Banking Survey, 2017 (link) (Used with permission from Bain & Company. Note Bain & Company, Inc. is not affiliated with Citi Equity Research, and the information, advice or recommendations contained in this report have not been reviewed or endorsed by Bain & Company.)

Chinese BigTech and Financial Services

The presence of Chinese Internet giants Baidu, Alibaba, Tencent, and JD.com (BATJ) in finance is striking if we consider that (1) China's largest e-commerce platform also runs China's largest mutual fund (Yu'e Bao by Ant Financial), and (2) the Chinese social messaging app facilitates large volumes of money transfers / payments (WeChat by Tencent).

BATJ have made rapid progress in Internet finance, backed by agile tech platforms and a high degree of service integration (leveraging their ecosystem to offer scenario-based services). Notably, each one of them differed in their initial roots – Alibaba and JD.com started off with an e-commerce platform, Tencent expanded its social media messaging platform, while Baidu built on its online advertising business model as a search engine.

Over the years, these Chinese BigTech firms have established a comprehensive multi-licensed financial ecosystem, including a payments interface, wealth management products, consumer finance, and insurance products, among others. Figure 29 compares their primary financial services offered.

Figure 29. BATJ — Internet Finance Product Offerings

	Baidu	Alibaba	Tencent	JD.com
Internet payment	Baidu Wallet (2014)	Alipay (2004)	Tenpay (2005) Weixin pay (2014) WeChat / QQ Wallet (2014)	JD Payment (2012) JD Wallet (2012)
Internet wealth management	Baidu Finance (2013) Bai Fa (2013)	Yuebao, Taobao licai (2013) Zhaocaibao, Yu'ebao (2014) Ant Fortune (2015)	Licaitong (2014)	JD XiaoJinKu (2014) XiaoBai Finance (2014)
Internet insurance	Bai An Insurance (2015)	Zhongan (2013)	Zhongan (2013)	JD Insurance (2014)
Online lending	Baidu loan (2013)	E Dairong with CCB (2007) Ali micro loan (2010) Jie Bei (2015)	Tenpay microloan (2013) QQ loan (2015)	JingBaoBei (2013) JingXiaoDai (2013)
Consumer financing	Umoney (2014)	Tmall instalment (2014) Ant check later (2014)	Weilidai (2015)	JD BaiTiao (2014)
Crowdfunding	Baidu Baizhong (2014)	iZhongchou (2013, renamed from Taoxinyuan in 2014)	QQ Gongyi (2014)	JD Crowdfunding (2014)
Digital-only Bank	Baixin Bank (2015)	MYbank (2015)	WeBank (2015)	—
Credit scoring	—	Sesame Credit (2015)	Tencent Xinyong (2015)	Xiaobai Xinyong (2015)

Source: Citi Research

We believe BATJ enjoys considerable competitive advantages that help position them favorably when competing with incumbent banks, including (1) a large and captive user base; (2) low online acquisition cost; (3) big data customer insights (helps product pricing and risk management); and (4) Internet banking licenses.

Additionally, Baidu, Alibaba, and Tencent (BAT) have also invested in new online banks that do not need physical branches and have fewer overheads. It is expected that the technological advantage of BAT provides them with a unique advantage to leverage technologies such as big data and cloud computing, which can help tailor user experiences and improve credit assessment procedures.

Figure 30. Comparison of Online-only Banks Setup by Internet Giants

	Baixin Bank	MYbank	WeBank
Shareholding	CITIC Bank (70%) Baidu (30%)	Alibaba (30%) Fosun (25%) Wanxiang (18%) Jinrunzichan (16%) Others (11%)	Tencent (30%) Baiyeyuan (20%) Others (30%) Liye (20%)
Launch date	Nov. 2015	Jan. 2015	Jun. 2015
Overview	A unique tie-up of a search engine giant with traditional bank.	Positioned as the bank "not for the rich, but for the little guys". The pure online bank offers smaller loans than regular banks by leveraging its cloud-based model, and does not accept applications of over RMB5mn.	Sells financial products for other institutions and grants small loans to consumers
Loan offerings	Small personal loans	Focused on offering 3 kinds of loans which indirectly tie in with Alibaba's core business: (i) for people in rural areas (ii) for Internet start-ups (iii) for Tmall and Taobao sellers	Small personal loans and auto loans

Source: Citi Research

[A] Ant Financial Builds an Empire of Services

Ant Financial is one of the largest FinTechs in the world. Its strategic vision is based on (1) leveraging the power of the Internet and big data; (2) empowering financial institutions to create an ecosystem; (3) serving both SME and individual customers; and (4) providing inclusive financial services.

Ant Financial's competitive advantages include a large user base; an incubator for vital, innovative financial products; and a world-class financial cloud technology platform. In addition, it is a pioneer in the DT Era, employing data to drive innovation.

Figure 31. Ant Financial Ecosystem
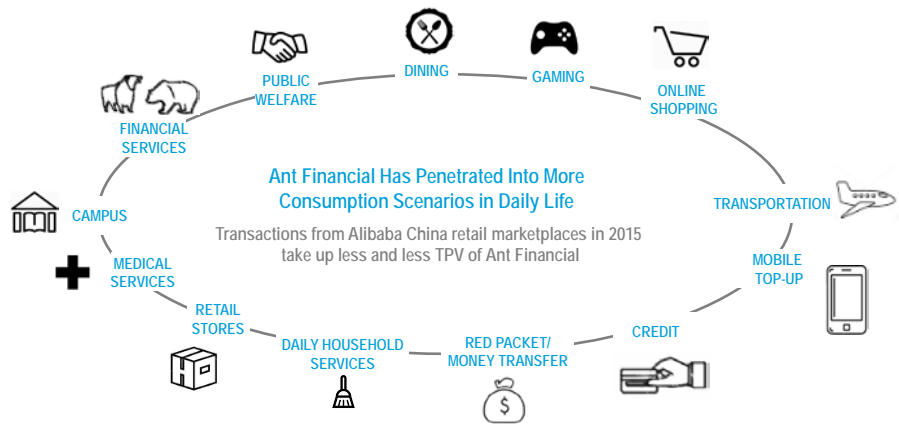
Source: Citi Research

■ **Driving Platform Effects with comprehensive products**

   – Sesame Credit – launched January 2015, in 11 months to >100m cumulative users

   – Yu'e Bao – launched June 2013, in 20 months to >100m cumulative users;

   – Insurance – launched November 2010, in 31 months to >100m cumulative users

■ **Yu'e Bao: convenient cash management service** – This money market fund provides convenient cash management service for users and provides a foundation for other wealth management services. Yu'e Bao is the largest in the world, with assets of ~RMB1.5 trillion (~$230bn) and a cumulative user base of about 330 million, which translates to an average c.RMB4,500 ($710) per user. Yu'e Bao's real advantage is its strong technology edge, which enables high-frequency usage owing to great user experience and ever-expanding user scenarios. The platform also benefits from Big Data, which helps in liquidity risk management, such as analysis of future redemption ratios.

■ **Zhao Cai Bao: P2P lending platform** – Started in 2014, the platform lets small businesses and individual borrowers directly raise loans from investors provided that a financial institution has guaranteed the loan and made sure money will be paid back (each loan is divided across a maximum of 200 investors). Average loan sizes are ~RMB70,000 ($11k), with durations of 3-12 months and annualized interest rates of 3-5%.

■ **Hua Bei (Ant Check later)** – Launched in December 2014, Hua Bei is an online consumer loan product offered to Alipay users for purchase of goods or services approved by Ant Financial (usually at Taobao or Tmall). The maximum lending amount is up to Rmb30k ($4,750), with an interest-free period of 50 days, and average loan size is ~RMB3,000 ($475) per borrower. Huabei has achieved good synergy with Ali's e-commerce platforms by effectively promoting one's consumption. As of the first half of 2017, the outstanding loan balance of Hua Bei reached Rmb160 billion ($25bn). Meanwhile, the big data derived from the transactions via Hua Bei also allows Ant Financial to provide more customized financial services to its customers.

■ **Jie Bei** – Jie Bei is an online cash loan product launched by Ant Financial in 2015. The loan applications are made on the Alipay platform, with loans being directly transferred to the borrower's Alipay account. The credit line ranges from Rmb1k to Rmb50k (~$150-$8k), with typical loan duration of up to 12 months, depending on the borrowers' Sesame Credit Score, and average loan size is c.RMB700 ($110) per borrower. As of mid-2017, the outstanding loan balance of Jie Bei had reached ~Rmb100 billion ($16bn). However, Ant Financial suspended the Jie Bei service for certain users in early 2018 as a result of regulatory tightening on cash loan products and imposed a leverage cap for online micro credit companies (MCCs) by including all loans financed via off-balance sheet ABS (leverage of Ant Financial's MCC subsidiaries – i.e., the lending entities for Huabei and Jiabei – reached ~70x as of 1H17, compared to the regulatory cap of 2.3x).

■ **MYbank** – Launched in January 2015, MYbank offers three kinds of loans that tie in with Alibaba's core businesses: (1) for people in rural areas; (2) for Internet start-ups, and (3) for Tmall/Taobao sellers. MYbank strictly operates small/mid-sized ticket loans and does not accept any loan application over RMB5 million. The bank offers no physical branches and operates entirely on a cloud

computing platform using Big Data to compute loan amounts and terms, thus saving significantly on operational costs. Loan application processes are quick (usually lasting just three minutes), following which, if approved, the loan amounts are wired to the individual's bank account. As of June 2017, the bank funded loans of RMB115 billion in value, with an average loan size of ~RMB17,000 (~$2,700).

Figure 32. Plans to Evolve into a Global FinTech Company

PAYMENTS	WEALTH MANAGEMENT	FINANCING		INSURANCE		CREDIT REFERENCE	
ALIPAY	ANT FORTUNE	ANT CHECK LATER ANT MICRO LOANS				SESAME CREDIT	
520mn Annual Active Users(1)	330mn Cumulative Users (1)	17% YoY AUM per active user	100mn Annual Active Users (1)	73% use Ant Credit Pay 6+ times in 1 yr.	392mn Annual Active Users (1)	43% YoY premium growth per user	257mn Activated Users (1)	95% YoY growth
PayPal 2 203mn active users	Charles Schwab 3 10.2mn active users	China Merchants Banks 3 46mn cards in circulations		Ping An 3 131mn active users		FICO Score U.S. Credit Accounts (3) ~250mn	

(1) During the 12 months ended March 31, 2017, or by the end of March 31, 2017
(2) During the 12 months ended March 31, 2017; Source: Form 10-Q
(3) As of fiscal year ended December 31, 2016
Source: Annual Reports, IR websites, Company Reports, Citi Research
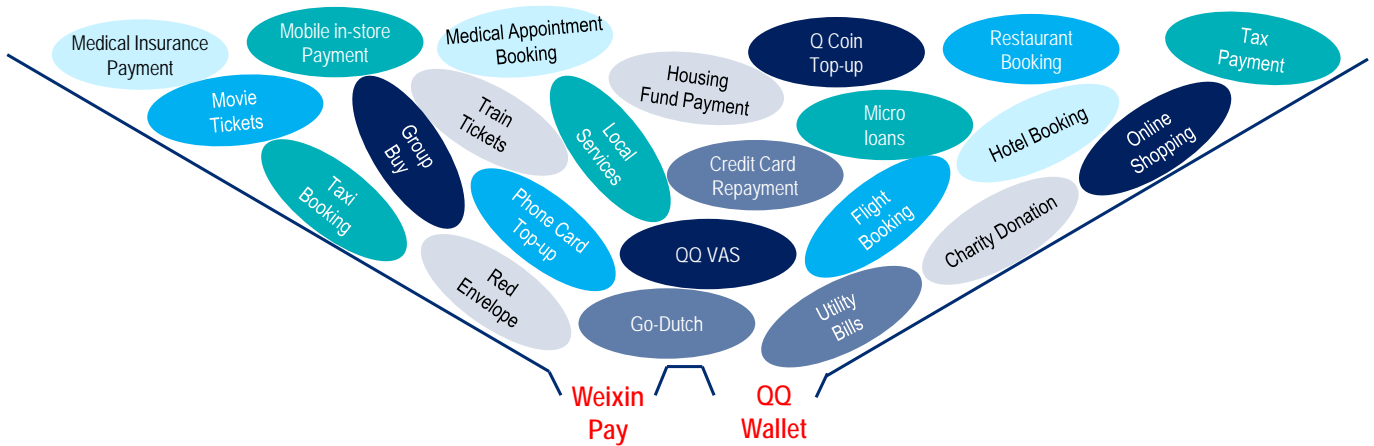
Ant Financial's growth strategy can briefly be summarized as follows: (1) capture urbanization trends, serve rural areas, drive financial inclusion; (2) collaborate with local partners through technology transfer, make financial services more accessible; (3) generate dynamic data from the business, in turn feeding the business ecosystem. The aim is to serve 2 billion customers globally in ten years.

[B] Tencent's WeChat Is China's App for Everything

Weixin (WeChat) Pay – Tencent owns and operates Tenpay, which allows users to transfer money through WeChat, a social messaging app. With 980 million monthly active user accounts as of September 2017 (+16% YoY), Tencent's Weixin mobile messaging app has become a powerful multi-function platform, including for integrating third-party services, including payments and financial services. Weixin Pay and QQ Wallet are consumer-facing mobile payment solutions that expand use cases for social (red envelop gifting and money transfers), Online to Offline (O2O) services, and online finance. Based on a Tencent survey, about 70% of respondents spend more than RMB100 ($15) per month in payments and transfers, with the most popular function being digital red envelope money (85% of respondents), followed by payments (58%) and money transfer to contacts (57%). WeChat credit card (payment processed via scanning QR code) was used by 20% of respondents, and 14% used Weixin Pay to pay off credit cards.

WeBank – In 2015, Tencent launched WeBank, China's first online-only bank, based in Shenzhen. WeBank is essentially a "connector" of individuals and small enterprises to banks and financial institutions. Key services include offering investment products, such as money market funds, and granting loans to small and medium-sized companies, farmers, and individuals. In May 2015, WeBank launched its first loan product, Weilidai, providing microcredit to users amounts up to RMB200k ($30k) without the need for guarantee or collateral, at a daily interest rate of 0.05% (approximately 20% annually). WeBank promotes its services on WeChat and QQ, its dominant social media apps. As of June 2017, WeBank extended total loans of RMB200 billion ($30bn) in value with an average loan size of RMB8,000 ($1,250).

Figure 33. Weixin Pay and QQ Wallet

Source: Company Reports, Citi Research

Figure 34. Tencent Ecosystem

Hardware Manufacture
• WeChat hardware

Agriculture
• Agriculture customization
• Authentic verification system

Business promotion
• Smart mall
• WeChat credit card

Financial Service
• WeChat Payment
• WeChat Bank

E-commerce
• JD.com
• Weidian
• Cross-border shops

Startups
• Open platform
• Co-working space

AI
• Smart device
• AI software

Communication Service
• WeChat life
• Government service

Transportation
• Didi Dache
• Ticket service

WECHAT: Industry improvement, Innovation service, E-commerce / financial industry, Community service

Source: Company Reports, Citi Research

Figure 35. WeChat Stats and Trends

Daily Logged in Users:
902,000,000
Daily Logged in Users (Sep-17)
17% YoY Growth

WeChat Usage Time:
90 mins.
50% of users use WeChat for at least 90 minutes a day

Red Packets Sent Daily:
2,350,000,000

Lunar New Year's Eve | Valentine's Day | Women's Day | 520 Day | Qixi Festival | Mid-Autumn Festival | Typical Day

Monthly Avg. Spent on Red Packets Per Person
¥370 Youth Users | ¥580 Typical Users | ¥380 Senior Users

Source: Company Reports, Citi Research

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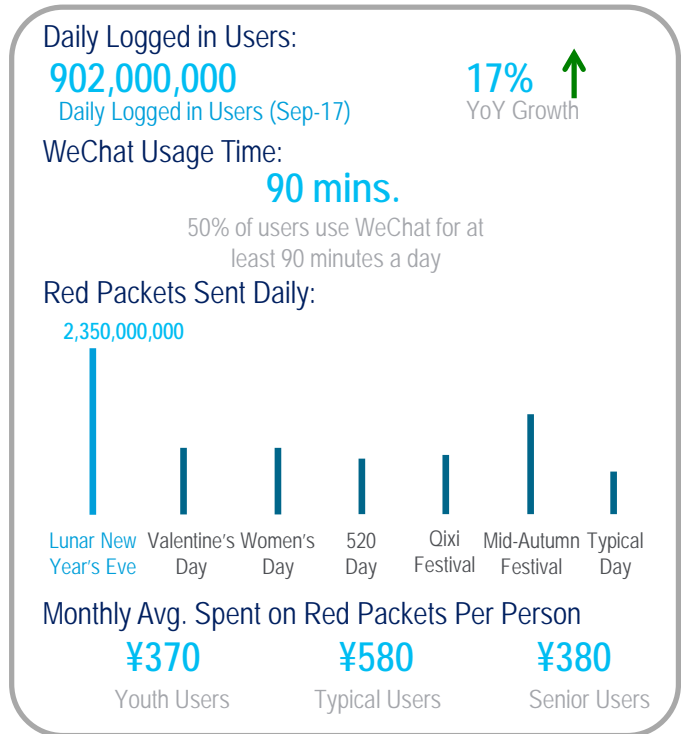
Interview with Kapronasia: Zennon Kapron

About Kapronasia

Kapronasia, founded in 2007, is a Shanghai-based research and consulting firm primarily focused on the financial services industry in Asia. Kapronasia helps financial institutions, technology vendors, consultancies, and private equity firms understand the impact of business technology and regulatory issues on banking, payments, insurance, and the capital markets.

About Zennon Kapron

Zennon Kapron is the founder and director of Kapronasia, with more than 20 years' experience in the finance and technology sectors. Before Kapronasia, Zennon was the Global Banking Industry Manager for Intel, based out of Shanghai, China, and prior to Intel, he worked for Citi for a number of years in the U.S. and Europe, culminating as his role as CIO for Citigroup Portugal. He holds a Bachelor's of Science in Computer Science from Syracuse University and an MBA from INSEAD. Zennon is also the author of *Chomping at the Bitcoin: The History and Future of Bitcoin in China* published by Penguin.

Q: If you had to mention one BigTech company that has already expanded into financial services, or will likely do so in the future, which one would you most expect to have the biggest disruptive impact on its domestic financial sector?

We are seeing the future today. The way that China's tech giants have not only taken over their respective niches but have captured the everyday habits across a number of products and services is unmatched.

What will be interesting is how they leverage technology for the next wave of innovation. We are already seeing them experiment with AR/VR, AI, and Blockchain; that, coupled with an incredible amount of user data, should enable business models that it would be difficult to imagine today.

Q: Why did BigTech became active in financial services in China (see ANT Financial or WeChat Pay), while by contrast, the GAFAs have been less active in the U.S./Europe in financial services? Is it to do with Chinese vs. U.S. business models, differences in regulation, stage in the economic/financial dev cycle?

FinTech in China really started with the launch of Alipay in 2004. Alipay was initially designed to be a solution to the problem of trust in e-commerce. Previously, most e-commerce transactions were conducted in cash, which presented several risks. The buyer may not pay. The seller might try to defraud the buyer.

Gradually, the use of Alipay grew to other online sites and models and now is used for offline transactions through QR codes that have become immensely popular today. Both online and offline, there was a tremendous amount of friction previously. Cash slowed e-commerce uptake, and a typical point of sale (POS) transaction was anything but instant.

The inefficiencies of the existing processes were the first driver, but this happened in the context of government and regulators that recognized the potential benefits of competition from China's BigTech, not just for the financial industry but the economy as a whole. To foster this growth, they adopted a "wait and see" approach to FinTech, which allowed the tech giants to grow.

It is only in the past few years that we have seen the governments "ring-fence" what the tech companies are able to do in the FinTech space.

Q: The BigTech players that have expanded into financial services in China and in other markets usually have an e-commerce or social media / messaging core business. Does the original business on which these platform companies are built matter for their success in financial services?

In the beginning of China's FinTech journey, products did one thing and did it well. Initially, WeChat was used for chat, and Alipay was used for payments. What we have seen more recently is these companies moving from being one-trick ponies to "lifestyle platforms" providing payments and chat, as well as taxi booking, train and plane tickets, insurance, wealth management, and a myriad of other products.

Although they have moved into multiple different business areas, those core businesses, e-commerce for Ant Financial and social for Tencent's WeChat, are still critical and drive a significant amount of traffic that feeds the other products and services. When you make a purchase on Taobao, Ant Financial might offer you credit. When you're chatting with a friend on WeChat, you might also share travel plans and buy a plane ticket.

Q: Social media appears to be a good base to build a C2C payment offering and then expand into other client segments, as with WeChat Pay, or to build a brand neo-bank, as with Kakao Bank. Is social / messaging a superior base to expand into finance versus e-commerce?

The consumer platforms that we have seen be successful globally so far certainly have some "sticky" element that entices users to it in the first place, whether that be chat or e-commerce.

Indeed, many of the platforms that have started out in payments, such as Venmo or PayPal, have struggled to expand outside of that niche. They may not need to, as there is significant revenue just in the payment space, but certainly with the Chinese tech giants, we have seen the benefit of having a multi-product approach.

Q: India is about to have its "WhatsApp moment" in finance as we move from the current beta testing phase to a full launch. How large will WhatsApp become in Indian payments and how quickly? Will it build other financial services on top of payments? And will it do this in other countries?

What happened with WeChat in China was largely because Tencent understood how individuals were using the app and how they might want to in the future. As is the case with many products that achieve significant adoption, understanding customer preferences and behaviors is key, and India is no exception.

Although it is clear that Indians are open to paying with their phone and chatting on their phone, will they want to do both together? If we look at other markets, such as the U.S. and Australia, there is an app for each function, and they are very separate. We will find out very shortly if that's the same for India.

China and India on Different FinTech Paths

China is the world's leader in FinTech, with the biggest market for digital payments and dominant online lending platforms. We believe its rise as a FinTech behemoth can be attributed to (1) growth of e-commerce and digital adoption; (2) the boom in middle-class consumption; (3) underserved retail banking clients; (4) a favorable regulatory environment, particularly in the early stages of innovation; and (5) an increasing culture of entrepreneurship and availability of venture capital funding.

Indian FinTech Today = China of 2013? 2006? India isn't far off either, with innovation and technology leading a radical change in traditional financial services supported by the sheer market size potential with 1.3 billion people. Arguably, India's FinTech environment today is where China was in 2013 on mobile-related metrics and 2006 on GDP/capita levels.

But while China and India may both arguably have considerable opportunity for FinTech growth, we believe there are significant differences in aspects such as infrastructure, economic, and regulatory framework that determine how both countries approach FinTech innovation. These factors include the following:

■ **Cash dependence** – According to data disclosed by Visa, India, Russia, and Indonesia lead among the most cash-dependent major economies. China, with ~40% cash/check dependence, is among the least cash dependent of the major EMs. In India, the equivalent number is ~90%. A major part of the difference is due to differences in the supporting infrastructure.

Figure 36. Percent of Transactions Done in Cash and Check (Cash Penetration by Market)
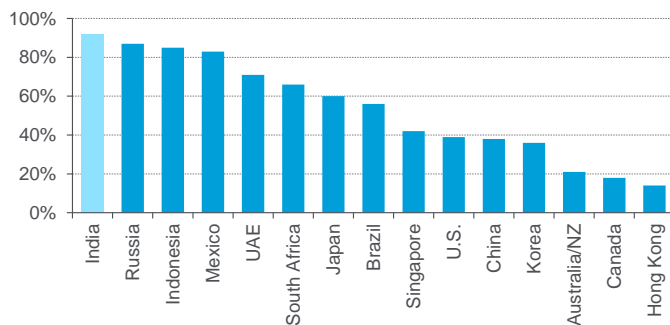
Source: Visa Investor Day, Citi Research

Figure 37. Mobile Cellular Subscriptions (per 100 people)
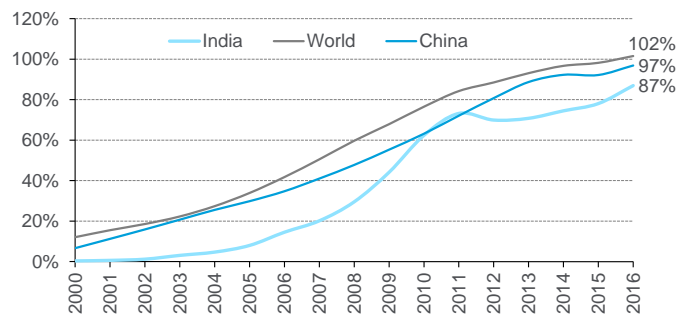
Source: World Bank, Citi Research

■ **Mobile penetration** – While mobile phone penetration for both China and India grew rapidly post 1998, the growth rate in China was initially significantly ahead of India. While India has closed much of the gap on mobile subscriptions, China is still well ahead for smartphone usage – 70% versus 25%. And China's 3G/4G network penetration is almost ubiquitous, unlike India's.

■ **Internet penetration** – The ability to access the Internet is another major factor that drives the adoption of non-cash usage techniques in different markets. Markets with higher Internet penetration tend to have lower cash dependence. India, with almost 25% Internet penetration (versus China's 50%), lags on this metric.

■ **E-commerce** – In addition to the differences on the payments side, significant differences remain between India and China in e-commerce market size. While The Chinese e-commerce market was Rmb 5.2 trillion in 2016 ($757bn); the e-commerce market in India is relatively very small at ~$16 billion (Nasscom expects it to reach $34bn by 2020).

- **GDP/capita** – There is a substantial difference between the two economies on income levels, with China almost 5x ahead on a nominal basis. While China is at just above $8,000 GDP/capita and has grown fast over the last decade, India is sub-$2,000. Clearly, the rapid rise in GDP/capita to middle-income status is a major driver on consumption and finance trends in China versus India.

Indian FinTech Today = Global Laboratory. India is, of course, in many ways not China in 2006 or China in 2013 but its own unique model. For example, India has the public building blocks of an open digital architecture (i.e., UPI, India Stack), and new entrants can build on these.
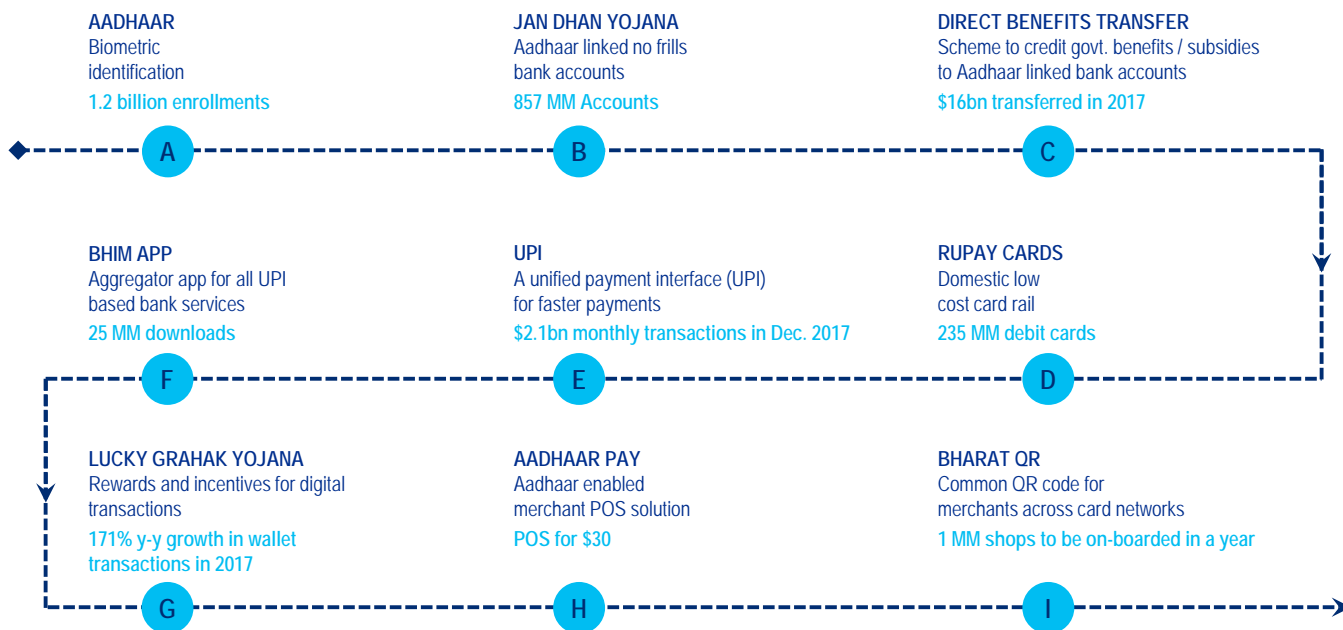
Transformation drivers include officially supported infrastructure developments, such as the "JAM" initiatives, policy measures to reduce cash usage ("demonetization") and private sector activity, including from local players and international companies in the tech, Internet, and finance sectors.

Digital initiatives in India tend to be top-down driven by government initiatives, following an open model whereby several players develop different systems to meet customer needs. India's coming FinTech revolution is based on rewiring its old financial system with cutting-edge biometric identification and real-time consumer payments.

While the JAM (Jan Dhan, Aadhaar, and Mobile) system is the backbone of India's digital framework, the latest developments in terms of the Unified Payments Interface (UPI) platform, government-backed Bharat Interface for Money (BHIM) App, Aadhaar Pay, and Bharat QR are top-of-the-line cutting-edge technologies that use the JAM framework for digital transactions.

Today, Aadhaar is not just a proof of identity, but an important document used for various purposes, including availing government services and opening new bank accounts/insurance products.

Figure 38. India's Digital Framework

AADHAAR
Biometric
identification
1.2 billion enrollments

JAN DHAN YOJANA
Aadhaar linked no frills
bank accounts
857 MM Accounts

DIRECT BENEFITS TRANSFER
Scheme to credit govt. benefits / subsidies
to Aadhaar linked bank accounts
$16bn transferred in 2017

BHIM APP
Aggregator app for all UPI
based bank services
25 MM downloads

UPI
A unified payment interface (UPI)
for faster payments
$2.1bn monthly transactions in Dec. 2017

RUPAY CARDS
Domestic low
cost card rail
235 MM debit cards

LUCKY GRAHAK YOJANA
Rewards and incentives for digital
transactions
171% y-y growth in wallet
transactions in 2017

AADHAAR PAY
Aadhaar enabled
merchant POS solution
POS for $30

BHARAT QR
Common QR code for
merchants across card networks
1 MM shops to be on-boarded in a year

Source: Citi, Imperial College London

India on the Frontline of Digital Finance

Initially supported by government-led initiatives to promote financial inclusion and mobile payments, India's nascent but rapidly growing digital (including finance/payments) scene is now getting large infusions of capital from global players with deep pockets, including players of American, Chinese, and Japanese origin.

India is becoming a battleground – and arguably testing ground – for the global tech giants' expansion into finance. Some of the GAFAs (Google, Apple, Facebook, and Amazon) efforts in payments and finance in India may lead to similar initiatives in other countries, such as the rollout of WhatsApp in payments.

The finance industry in India may be on the cusp of its own "WhatsApp moment." WhatsApp (Facebook) has been in beta testing for its UPI-based payment service in India, with over a million clients, and it should be rolled out more broadly soon.

A payments feature embedded within WhatsApp could provide yet another boost for digital payments in India especially because the payment interface is likely to be integrated directly into the chat app, making the experience seamless. Given the ubiquity of WhatsApp in India (>250mn users), WhatsApp could provide a major competitive challenge to current leaders, such as Paytm (~280mn users).

WhatsApp also recently launched its business app in India, allowing small corporates to set up a different account with smart messaging tools. The new app is expected to make it easier for companies to connect with customers as well as more convenient for users to chat with businesses that matter to them.

Figure 39. Approximate Number of Users for Prominent Mobile-Wallet Providers in India
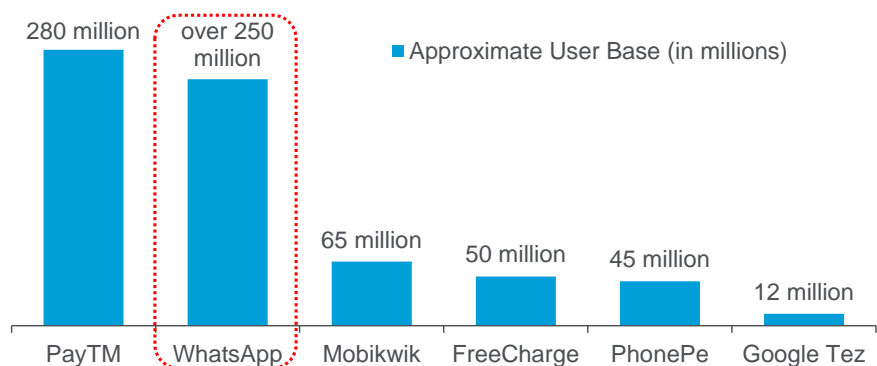
Source: Company Websites, Bloomberg, Business Standard, Economic Times, Entrack, Citi Research Estimates

India's Transformation Towards Digital

India's banking and payment channels are evolving with a push toward digital. This includes transactions via the UPI platform, credit / debit cards, National Electronic Funds Transfer (NEFT), Immediate Payment Services (IMPS), and others. Electronic payment transaction volumes have increased sharply (+59% year over year in 2017), highlighting increased reliance on formal payment channels as a means for daily transactions. Furthermore, there has been an increase in share of non-paper transactions (as a percent of formal banking transactions) from ~60% in April 2013 to ~93% in December 2017. The two most popular digital modes of payments – PPI (m-wallets) and UPI – represent approximately 20% and 10%, respectively, of all transaction volumes via banking channels supported by increased proliferation of m-wallets.

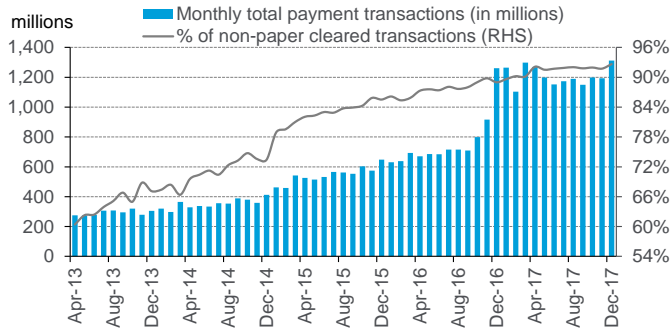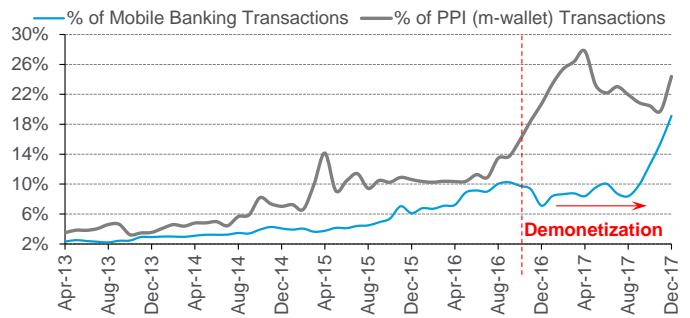Figure 40. India Payment Transactions, 2013-17 (by Volume)

Figure 41. Percent of Payment Transactions (by Volume) Done Through Mobile Banking or m-Wallets

Source: RBI, Citi Research; Note: [1] Total transactions for this exercise EXCLUDE usage of debit / credit cards at ATMs; [2] Mobile banking transactions are undertaking banking transactions using mobile phones by customers that involve credit / debit to their accounts and include accessing bank accounts for non-monetary transactions like balance enquiries; [3] mobile banking data from July 2017 include only individual payments and exclude corporate payments, which were being included earlier.

Google's m-wallet (Tez) Sees Early Success

Google's m-wallet, Tez, launched in September 2017, has had some early success in India's crowded payments market, gaining 12mn active users and >140mn transactions as of December 2017 (ET). Of course, Google is at an early stage of its India payments expansion and is still only a fraction of the size of market leaders, such as Paytm. However, Google's enormous user base and connected ecosystem and India's broader push towards digital post November 2016 "demonetization" make this an interesting development to watch, with implications not just for India but also markets globally.

Google Tez is a UPI-based m-wallet app, enabling users to link their mobile phone numbers with their bank account to pay for goods in physical stores / online and facilitate P2P transfers. Its unique features include (1) a special "Cash Mode" that allows users to pay nearby Tez users without exchanging personal information (audio QR); (2) Google's partnership with third-party payment sites to facilitate quick payments aside from regular bank transfers using UPI; (3) added business support to allow merchants to start their own Tez channels with tailor-made offers / custom actions; and (4) payments interface embedded in a chat-like window.

Google Tez had taken ~53% share in the UPI transaction market in October 2017, rising to 73% in November. As of December 2017, Google Tez had 12 million active users and about 500k merchants and processed over 140 million transactions (ET).

Figure 42. Monthly UPI Payments Transaction Volume Mix (Nov. 2017 vs. 3M Prior)
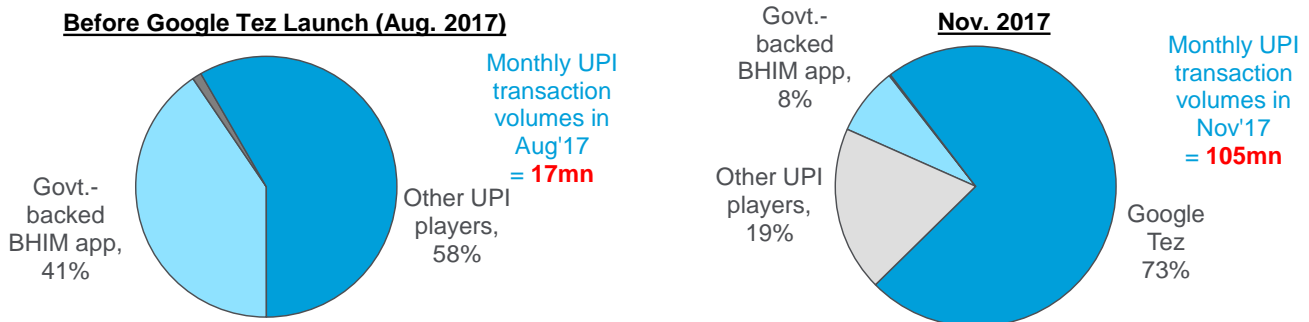
Source: NPCI, Citi Research Estimates; UPI = Unified Payment Interface

Google's entry into payments also has fired up the UPI platform, with retail transactions quadrupling between September and December 2017. Total UPI transactions in December 2017 totaled 146 million by volume (~10% of retail payments) and INR132 billion ($2bn) by value. Notably, attractive cashback/incentives offered by Google Tez (INR 51/- for new sign-up and INR 51/- for each new referral, coupled with other offers) and UPI rollout by m-wallets such as Paytm (November 2017) may also have contributed to UPI growth.

Figure 43. Retail Payment Transactions on UPI Platform – by Volume
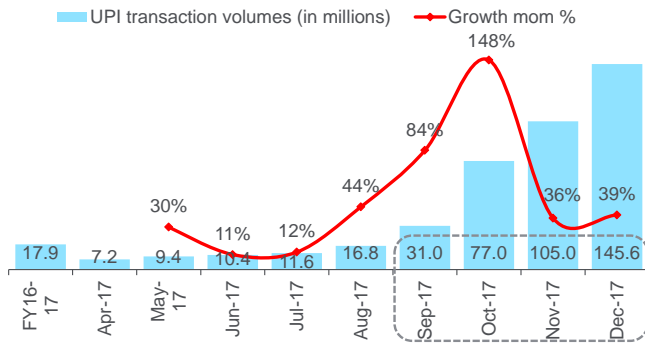
Source: NPCI, Citi Research

Figure 44. Retail Payment Transactions on UPI Platform – by Value
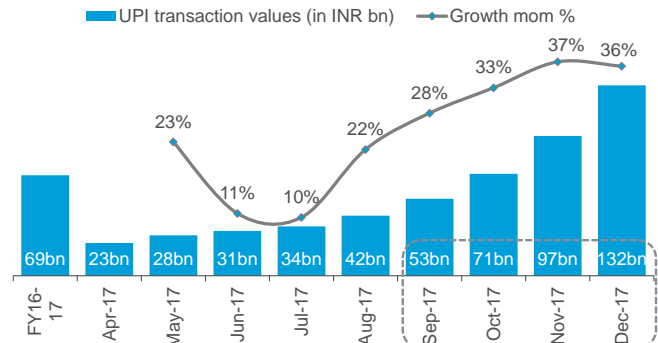
Source: NPCI, Citi Research

Google Tez offers two notable features that differentiate it from rivals: (1) an audio QR technology that powers Google's 'Cash Mode' feature; and (2) a chat feature embedded within the digital payment platform (currently still under pilot) that will improve overall experience and help it take on rivals such as WhatsApp.

Google's 'Cash Mode' feature, is a proprietary technology that enables the app to automatically pair with nearby senders/recipients using ultrasonic sound, without exchanging sensitive personal information – thus enabling instant payment from one bank account to another. Audio QR works on almost every smartphone and the only things needed are a smartphone (to download the app) with a speaker and microphone. To make a payment with Audio QR, two users can bring their phones near each other, hit pay or request payment, enter the amount / description, select the form of payment and then proceed to pay by entering their UPI PINs.

Figure 45. Illustrative Example Using Google's Audio QR Technology
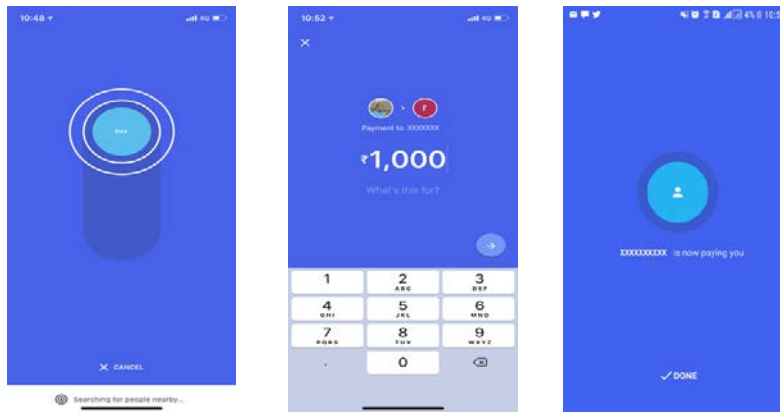
Source: Google Audio QR

Other tech giants such as Amazon are also seen strengthening their FinTech footprint in India. Amazon launched its semi-closed e-wallet in India in July 2017 that is capable of holding money and powering payments on other partnered sites. The company is also in talks with regulators and partner banks to join the UPI payments ecosystem (ET). This is part of Amazon's broader global digital transformation strategy to expand into financial services by leveraging its marketplace capabilities.

Globally, Amazon has deepened its involvement in finance by offering short-term loans to small and micro businesses that sell on its marketplace. Since the launch of Amazon Lending in 2011, the company has surpassed $3 billion in loans to June 2017. In the 12 months ending June 2017, Amazon has lent more than $1 billion to over 20,000 small businesses across the U.S., the U.K. and Japan with typical loan sizes range from $1,000 to $750k. Amazon is also in early talks with big U.S. banks like JPMorgan Chase and Capital One to create a checking account type product targeted at young users without a bank account (Bloomberg).

Amazon's global payments vehicle (Amazon Pay) allows users to pay both Amazon and non-Amazon merchants online and has seen strong user growth. Nearly 30% of Amazon payments are for sellers who do not sell on Amazon and they grew almost110% in 2016-17, closing the year with 33 million customers who paid for shopping on non-Amazon retailers. In fact, Amazon also provides logistics to such retailers.

Amazon's global expansion is intensifying with a series of big acquisitions in AI / data and cloud computing as well as core technology acquisitions in recent years such as GoPago's mobile payment tech and the payments company TextPayMe.

Figure 46. Amazon Global M&A

Source: Venture Scanner, CB Insights

In India, Amazon has been looking to expand its footprint in the financial technology space with investments in: (1) **Bank Bazaar** (set up in 2008), a financial services online marketplace, providing customers with rate quotes on loans, mutual funds and insurance products; (2) **Capital Float** (set up in 2013), an online SME lending platform in India that offers short-term inventory purchase / cash flow loans; (3) **QwikCilver Solutions** (set up in 2007), a leading provider of gift cards, stored value solutions and loyalty points to businesses, in order to enable them to offer more engaging options to their end-customers; (4) **Emvantage Payments** (set up in 2012) offers an online payment gateway platform that is compatible with credit/debit cards and net banking. Additionally, Amazon is set up as a licensed payment service provider in India and is looking to provide instant lending at the point of sale through bank accounts.

New RBI Directive Could Threaten Digital Payments

Recent regulatory changes requiring all digital wallet operators to complete full Know Your Customer (KYC) norms by February 2018 risk threatening the digital payments momentum in India. Admittedly stricter KYC norms are a positive, as they pave the way for greater interoperability between prepaid payment instruments, bank accounts and cards in a phased manner; but we think wallet players are likely to face two key challenges: (1) the costs associated with completing KYC formalities (including identification details and biometrics) would pose a significant financial burden, especially for wallet providers with large user bases; and (2) the potential loss of users who fail to comply with KYC norms and are required to be barred from wallet services starting March 2018.

Interview with Citi's Global Digital Strategy Team: Aditya Menon

About Aditya Menon

Aditya Menon is a co-founding member of Citi's Global Digital Strategy Team and leads the team's digital capabilities initiatives. Prior to joining Citi, he was a three-time entrepreneur, twice in the transaction banking space (in payments and trade-finance) and once in the mobile payments space with Obopay. He helped to start a bank as the first CIO for Yes Bank in India, and served as group CIO for mPhasis, prior to its acquisition by EDS / HP.

Q: Why did BigTech become active in financial services in China (see ANT Financial or WeChat Pay) while by contrast the GAFAs have been less active in the U.S. or Europe in financial services?

Two years ago, in my opinion, payments were the end-game for most players; but this is not the case any longer. Instead, the end-game has now evolved to the creation of a broad financial system. Notably, Alipay cites that they do not expect to make money from payments – but rather see it as an enabler for other financial services; and we believe this is the case for most other players too.

In fact China has already proven this and this is also slowly becoming true for India if we look at Paytm's monetization policy – which has gradually transitioned from mobile payments to e-commerce, gold, flight tickets, and the latest in investments – replicating Ant's model in China to find adjacent value pools.

Regulations are one area that often limits BigTech's ability to enter into banking domain, particularly around lending. Where regulations are tight, players can still get into lending via partners. In China Alibaba has gone all in into the finance world. Notably, a few entrepreneurs such as Jack Ma have been able to drive the agenda and build the financial ecosystem.

Macro-economic and socio-economic factors in the country they operate in are also important. In Western countries, one of the other concerns for FinTech or BigTech getting into financial services is the fear of getting regulated by multiple regulators, as the case in the U.S. and Europe. Even in India, while the wallet players have had a relatively free run, from March 2018, KYC regulations have been tightened.

Q: BigTech players that have expanded into financial services in China and in other markets usually have an e-commerce or social media/messaging core business. Does the original business on which these platform companies are built matter for their success in financial services? How important is social?

The user momentum tends to be more with messaging platforms, given the amount of time individuals spend on them. Regardless of whether consumers are in Asia Pacific or EMEA, they spend on average 2 to 2.5 hours on social media and chat, which in turn drives advertising. Therefore, it is a logical step for digital giants in social media and chat to expand into the adjacent value pool of payments.

Of course, one needs to convert the momentum of the social media platforms into payments which will be then loop back to social media again and that will be a stepping stone to advertising clicks (i.e. revenue stream). So I believe it is about creating ecosystems and payments add an extra sticky element to that.

While Alipay/ANT led the way into payments in China, WeChat Pay is neck and neck with Alipay and is also spreading its wings internationally – a space that Alipay has tended to dominate. Alipay owned over 80% of the mobile payments market till 2013. However, WeChat Pay, which grew very rapidly from the social media / chat space, now commands ~40% of the Chinese market.

Notably, while Alipay has higher transaction amounts, WeChat Pay has almost double the number of active users. WeChat Pay achieved this by doubling down on two key areas – social payments and offline retail in China.

The explosive growth of Kakao Bank, Korea's second Internet-only bank, was also impressive last year, raking in 2 million banking clients in 2 weeks of its launch.

I think, in order to be successful, one needs to connect payments, social media and advertising. For social media players, they have already set up and monetized an ad network; as a result, they only need to add the payments piece to it and that brings attribution enabling them to extract higher fees from the advertisers.

In India we see Paytm doing exactly this by expanding into e-commerce and chat; whereas WhatsApp, which was slow to start, is now launching payments in India (its single largest market globally). Google too is not left out and is now adding chat to its very successful Tez wallet in India.

Globally, Facebook is at its early stages of expanding into payments and they have launched Mobile Payments services in the U.S., the U.K. and plan to roll out to other countries using Messenger. Facebook has also sought an Indian patent for electronic payments through its Messenger app and already owns a similar patent in China.

Q: E-commerce appears to be a good base to build a B2C payment and financial services offering. Amazon has eaten up many other industries in the U.S. and elsewhere. Will finance be next for Amazon-ification? And if so, will it be in the U.S. or in an EM such as India?

I think there are two parts to answering this question – Firstly, if you are a platform business and have enough consumers/merchants, it gives you a certain degree of freedom, which other businesses may not have, to explore new areas. Jeff Bezos, Amazon's CEO, looks for areas that have a problem worth solving and then applies Amazon's platform agility to go tackle it.

However, I do not believe that Amazon would want to be in the financial services business as a principal and its recent moves such as that of looking to partner with JPM on retail bank account opening in the U.S. would be a good example.

Secondly, I think there will be a bigger industry shift between now and 2025 that will see the coming of $60 trillion into direct distribution with direct selling for B2B and B2C through marketplaces. Alibaba and Amazon are placed well for this seismic shift in the business landscape that extends across every sector of industry.

We have already seen Amazon's intentions in the online-to-offline play with Whole-Foods, acquisition of drug distribution licenses in several U.S. states, launching its own global logistics play to rival DHL/Fedex and also a foray into insurance.

Q: India is about to have its "WhatsApp moment" in finance as we move from the current beta testing phase to a full launch. How large will WhatsApp become in Indian payments and how quickly? Will they build other financial services on top of payments? And will they do this in other countries?

WhatsApp has nearly over 200 million customers in India and this is the largest market globally for WhatsApp, based on app downloads. Their strategy for now is to connect businesses to customers. WhatsApp has concluded its beta testing for payments in India and is planning to roll it out soon – this works by leveraging UPI for universal payments both in-store and on-line.

I think WhatsApp has a good opportunity as they are the only ones with adequate scale to compete with Paytm and they also have the relevant engagement in the social media space to be a formidable competitor. Arguably, WhatsApp does not have enough advertising customers for now, but they do have them on Facebook which can be monetized.

In fact in my opinion, WhatsApp has better ingredients than Paytm for now, as it will be almost impossible for Paytm to penetrate social media/chat. Paytm has tried to build its own chat feed to add-on social, but it hasn't kicked-off well so far.

Q: How material is the recent Reserve Bank of India (RBI) tightening of KYC standards for electronic payments and wallet companies in India?

A recent challenge for WhatsApp and others like Paytm has been the RBI's move to necessitate KYC for all wallet users, which in my opinion could be a significant challenge for both incumbents and new entrants. As long as the wallet players remain meta-wallets that use others wallets, they can avoid this (e.g., Google Tez, WhatsApp).

KYC is a real problem as it is estimated that many e-wallet users (as many as eight out of every ten) failed to fulfill the KYC formalities and several digital wallet providers were forced to bar users from adding or receiving money in their wallets starting March 2018.

It is estimated that the cost to execute RBI's new KYC guidelines could be well over $100 million for the firms in total (wallet companies, payment banks etc.). My estimate is that KYC will cost Rs50-75 per client. There will be a short term drop in e-wallet volumes. Amazon Pay has already shown a 30% drop-off in the wallet's customer volumes. I think March 2018 is going to look like the "demonization for wallets".

However, to sum up, I think there will be several key changes over the next one year and WhatsApp payments will be used by many users – for context almost 240 million Indian consumers actively use WhatsApp messaging now. I also see three new well-positioned players emerging in the Indian payment landscape – Amazon, Flipkart-Walmart combined, and lastly, Facebook-WhatsApp combined.

GAFAs at the Gate with PSD2; But Do Bank Clients Care?

While BigTech is active in China and increasingly in India in finance, a changing regulatory landscape in European retail banking with the introduction of Payment Services Directive (PSD2) in 2018 may open the doors for tech giants to disrupt banking in the medium term.

PSD2 is an European Union directive that aims to enhance competition and innovation across the European banking/payments space by forcing banks to share certain types of customer data – with the customer's consent – with third parties and also enables third parties to initiate payments from a customer's bank account to another party's (i.e., merchant's) bank account, thus bypassing the more traditional credit and debit rails.

PSD2 and its Open Banking UK version went live in January 2018 and we believe could end up being a big deal as they drive a shift for banks to a shared ecosystem, moving us away from the current closed environment, breaking banks' monopoly over client data and primary relationships. The new world may be one where banks work closely with third parties, including tech companies and other non-banks.

Big retail banks such as Lloyds and ING believe they could be winners from Open Banking and have rolled out new PSD2-ready platforms. Similarly, not surprisingly, U.K. challenger banks are also optimistic on open banking, citing it as an opportunity to capture new customers.

In the medium term, the biggest change in retail banking may be the acceleration of BigTech entering finance as a client interface. In a recent survey by Finextra and CA Technologies, banks saw the GAFAs (Google, Amazon, Facebook, Apple) as the biggest threat to business post-PSD2, followed by other established banks at #2; FinTechs were the least worry.

Figure 47. Business Threat Post PSD2
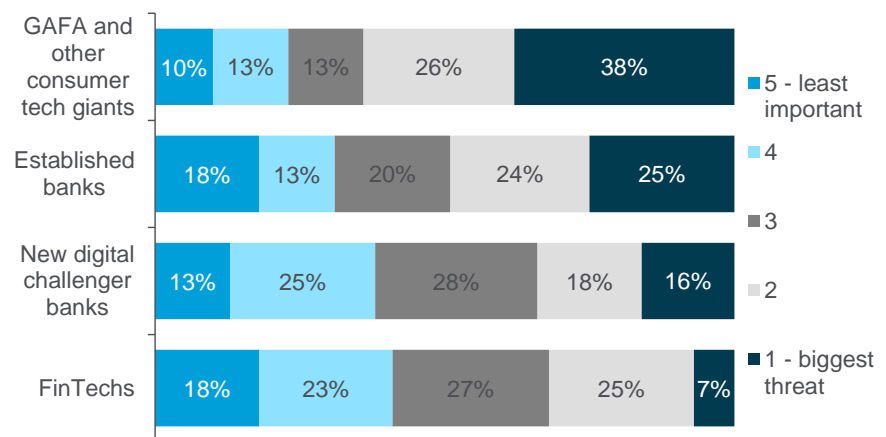
But an interesting question, especially for the near term, is whether bank customers really care? We believe banks' advantages of incumbency and retail client inertia remain a valuable asset. A survey of U.K. current account holders by 'Which?' in August-September 2017 found that over 90% of the public weren't aware of 'open banking' despite its discussion among experts and the media. Furthermore nearly half stated that they were fairly or very unlikely to share their financial data.

What is PSD2?

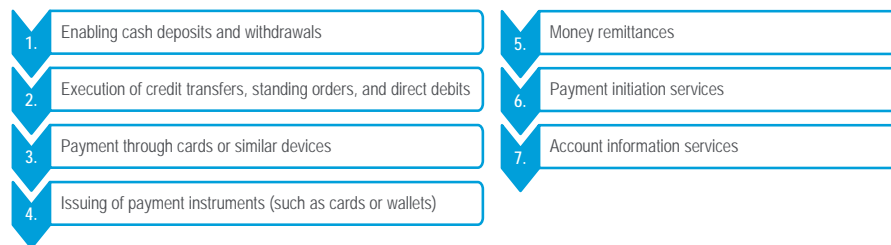PSD2 at its core brings two fundamental changes that apply to banks operating in the EU.

First, banks, with the customer's consent, must share certain types of customer information (at very least account balance and possibly more, including transaction history) with third parties. This is known as the "access to account" (XS2A) rule. Prior to PSD2, EU banks were not required to share customer data with third parties. In PSD2 parlance, third parties that access such information are termed "Account Information Service Providers" (AISPs).

Secondly, PSD2 enables, again with the customer's consent, third parties to initiate payments directly from a customer's bank on the customer's behalf to other parties' (i.e. merchants') bank accounts. In PSD2 parlance, third parties which initiate such payments are termed "Payment Initiation Service Providers" (PISPs).

To both access customer account information and initiate payments, not only must these third parties obtain the consent of customers, they must also be certified by the regulator as authorized third-party providers (TPPs)

Figure 48. Payment Services Covered by PSD2

PSD2 covers a number of payment services, including

1. Enabling cash deposits and withdrawals
2. Execution of credit transfers, standing orders, and direct debits
3. Payment through cards or similar devices
4. Issuing of payment instruments (such as cards or wallets)
5. Money remittances
6. Payment initiation services
7. Account information services

Source: European Banking Federation, European Commission, Citi Research

The New Banking Model under PSD2

Under PSD2 we can surmise that the "access to account" rule increases the risk that European banks may be disintermediated from their retail customers as third parties take over the relationships that banks currently have with their customers.

Consider a not uncommon situation where a customer has a financial product (savings/fixed deposit) with one bank and another financial product (mortgage, credit card) from another bank. In the pre-PSD2 era, both banks would have a direct relationship with the customer.

In a post-PSD2 world, it is possible that either or both banks could lose their direct relationship with the customer as that relationship instead would be managed by the account information service provider (AISP), the PSD2 term for third parties with access to customer account information. The customer might still use each bank's financial products, but the customer's primary relationship would be with the AISP, and the AISP – not customer – would interface with banks on the customer's behalf.
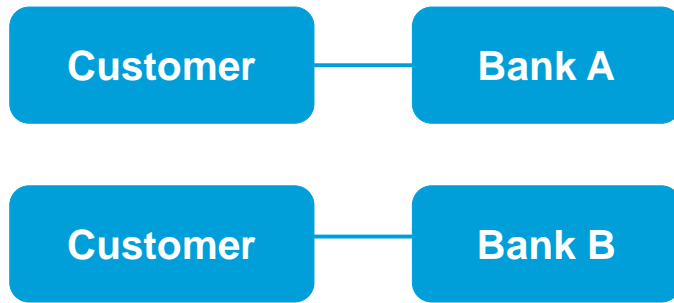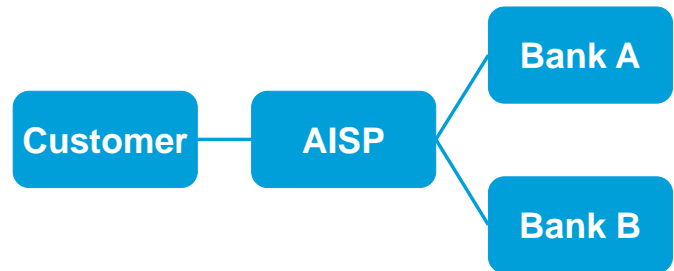
Figure 49. Customer-Bank Relationship Today

Customer	—	Bank A
Customer	—	Bank B

Figure 50. Possible Customer-Bank Relationship in Post-PSD2 World

Customer — AISP — Bank A / Bank B

*AISP stands for account information service provider. In PSD2 parlance, an AISP is a third party authorized to access some types of information that a bank has about its customers. Note: Bank A or Bank B can also choose to become an AISP.
Source: Citi Research

Every interaction a bank has with a customer is an opportunity to learn about the customer and potentially cross-sell to him or her. The more products a customer has with the same bank, the less likely the customer is to leave. In the scenario described above, not only would the banks lose the opportunity to cross-sell to their clients, but also they risk being viewed as commodities by consumers and forced to compete largely if not exclusively on price. Any value created by having a relationship with a customer would accrue to the Account Information Service Provider (AISP).
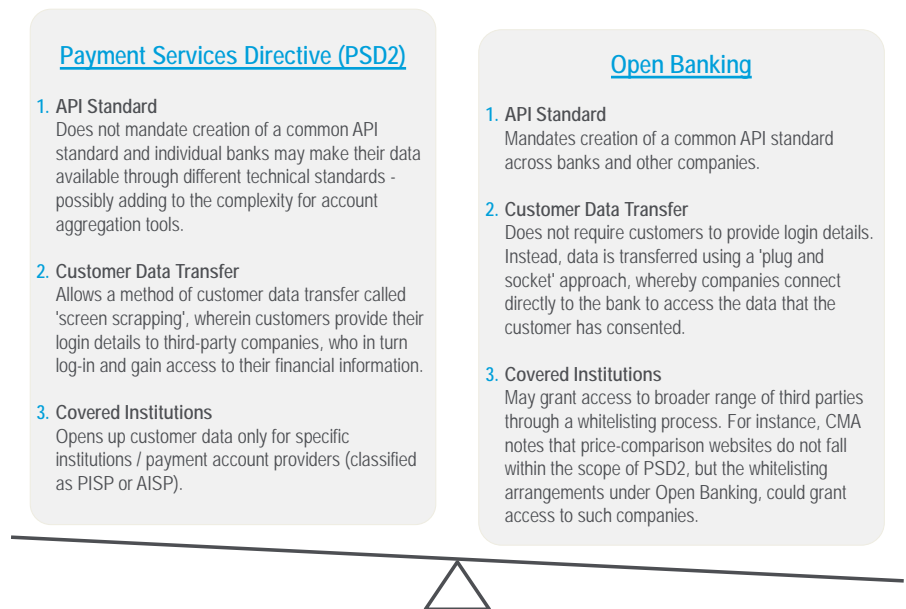
U.K.'s Open Banking Standard

Similar to the PSD2 directive applicable across the EU, the U.K.'s Competition and Markets Authority (CMA) has created its own ruleset called 'Open Banking' to provide extra safeguards for transfer of customer data. This will help standardize APIs that banks and other institutions use to make payments, access information.

Open Banking rules aim to create a level playing field between different payment service providers as well as boost transparency, innovation and competition in the market. Open Banking regulations (in force since January 13, 2018) require the nine largest banks in the U.K. to make their data open to third parties. However as of December 2017, banks like HSBC, Barclays, RBS, Santander and Bank of Ireland have been granted an extension by the U.K.'s CMA ranging from a month to a year.

Initially, Open Banking makes it easier for consumers to compare details of current accounts/banking services, as well as provides information about ATM and branches. However, in time, Open Banking technology and standards will be able to develop new online / mobile applications, allowing customers to share banking information securely with other banks and regulated companies. While the requirements from the U.K's CMA coincide with the EU legislation in many areas, with PSD2 providing a legal framework within which the CMA requirements will have to operate, Figure 51 highlights some prominent differences.

Figure 51. European Union PSD2 vs. U.K. Open Banking Regulations

Payment Services Directive (PSD2)

1. **API Standard**
   Does not mandate creation of a common API standard and individual banks may make their data available through different technical standards - possibly adding to the complexity for account aggregation tools.

2. **Customer Data Transfer**
   Allows a method of customer data transfer called 'screen scrapping', wherein customers provide their login details to third-party companies, who in turn log-in and gain access to their financial information.

3. **Covered Institutions**
   Opens up customer data only for specific institutions / payment account providers (classified as PISP or AISP).

Open Banking

1. **API Standard**
   Mandates creation of a common API standard across banks and other companies.

2. **Customer Data Transfer**
   Does not require customers to provide login details. Instead, data is transferred using a 'plug and socket' approach, whereby companies connect directly to the bank to access the data that the customer has consented.

3. **Covered Institutions**
   May grant access to broader range of third parties through a whitelisting process. For instance, CMA notes that price-comparison websites do not fall within the scope of PSD2, but the whitelisting arrangements under Open Banking, could grant access to such companies.

Source: European Commission, UK Open Banking Implementation Entity, UK CMA, Citi Research

Impact of PSD 2/Open Banking on Banks – Risk of Disintermediation?

While PSD2 has the potential to bring revolutionary change, the new model also means that banks will no longer be competing only against banks, but instead against everyone offering financial services. Theoretically, PSD2 could put further pressure on banks' margins and result in higher deposit volatility, lowering banks' sources of funding and lending capabilities.

We believe PSD2 is more likely to cause evolutionary change, at least over next two to three years. Over a longer time horizon, however, the effects of PSD2 are likely to be felt more broadly and deeply.

In the near-term, we expect disintermediation to be constrained by: (1) the regulators' "principles level" approach to PSD2 which will likely yield a flurry of technical standards and new products in the early stages of PSD2 before market forces ultimately consolidate a fragmented space; (2) slow consumer adoption; and (3) a handful of obstacles in the payments space. Ultimately, we believe that banks face considerably more disintermediation risk than do payments companies because the latter, in our view, are better suited to adapt to a post-PSD2 world.

Figure 52. PSD2 – Summary of Potential Positive and Negatives

Entity	Potential Positives	Potential Negatives
Bank	■ Ability to become an AISP or PISP ■ Can offer third-party products or use information obtained via AISPs	■ Elevated implementation and ongoing IT/compliance spend ■ Breaks monopoly on certain types of customer data ■ Threat of retail customer and payments disintermediation
Merchant	■ Increased payment choice ■ Potentially decreased transaction cost (longer-term)	■ Increased complexity (initially)
Network / Digital Platform	■ SCA exemptions for contactless payment / transaction risk analysis should provide an early advantage ■ Need for secure payment information transmission can support additional services such as tokenization ■ Can develop or supplement new use cases, diversify by becoming AISPs or PISPs	■ Could modify the payments value chain, transaction economics (longer-term) ■ Possible shift in share as "account-to-account" transactions increase (longer-term) ■ Competition from FinTech start-ups
Acquirer / Processor	■ Benefit from regulatory complexity (help merchants and FIs to adapt) ■ Can develop or supplement use cases or function as a AISP / PISP ■ Accelerated displacement of cash payments	■ Could modify the payments value chain, transaction economics (longer-term) ■ Possible shift in share as "account-to-account" transactions increase (longer-term) ■ Competition from FinTech start-ups
Bank IT provider	■ May capture implementation and ongoing IT/compliance spend	■ Bank IT spend could be affected if a specific client(s) is impacted negatively due to PSD2

Source: Citi Research

New Product / Service Priorities for Banks under PSD2? But Are Consumers Ready?

A survey of 200 respondents from 89 banks across 14 European countries, conducted by Finextra and CA Technologies published in the report "PSD2: A Strategic Game Changer With Long Term Impact", concludes that most banks are prioritizing payment initiation services and account aggregation services.

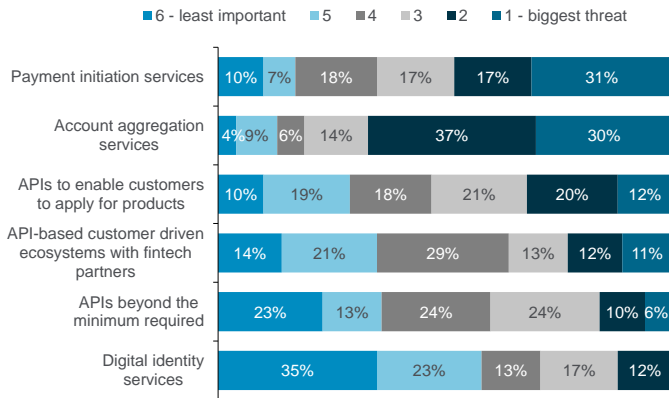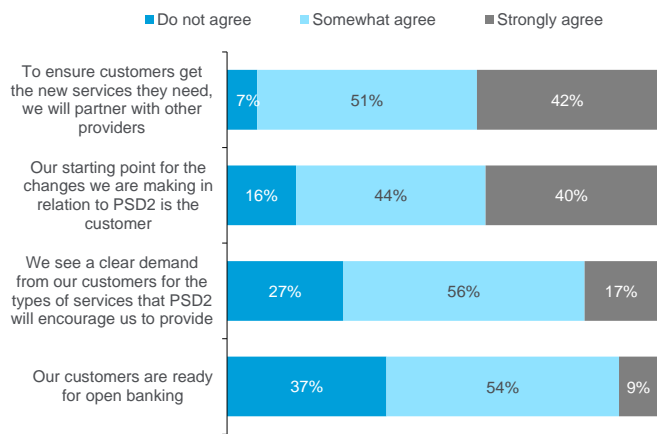Figure 53. New Products/Services Banks are Prioritizing Under PSD2

Figure 54. Consumer Readiness

based on survey of 200 respondents from 89 banks published in: "PSD2: A Strategic Game Changer With Long Term Impact"
Source: Finextra, CA Technologies (both charts)

The same survey also highlights bank respondents' views on potential changes under PSD2 with most banks indicating an understanding that they may need to partner on an ongoing basis in order to be successful in a PSD2 world. Interestingly, they also cite that a large majority of banks do not see a clear demand from customers for the type of services that PSD2 will enable banks to offer and believe customers may not be ready for open banking yet.

Chapter C: Core Banking, Cloud and Challengers

Banks invested in the first mainframe computers as far back as the 1950-60s. Over 50 years and a myriad of computing innovations later, the majority of the incumbent banks still use legacy systems that are mainframe based, often running outdated COBOL language. Admittedly, while replacing these core banking systems has proved to be a costly and time-consuming affair as can be testified by the Australian banks, which have led the way, the status quo is not an option.

We are of the opinion that core infrastructure overhauls will only gain importance over next few years as legacy bank IT systems have arguably reached the point of redundancy as complex integration of outdated systems is becoming too costly. Factors likely to drive greater IT investments include: (1) New and improved tech, such as cloud adoption, present more options to bank CEOs; (2) Greater focus on data quality, accessibility, standardization, and utilization; (3) Rising customer expectations, which could accelerate with open banking initiatives; (4) A major cyber breach; and (5) Even greater investor focus on cost savings.

IT expenses as a percentage of revenues are notably higher in the Banking industry than any other (~9%) and almost 2-3x those of other major industries. Our bottom-up analysis indicates that approximately. 15-25% of banks' annual costs are allocated to IT.

Figure 55. Median IT Expense as % of Business Entity Revenue (2016)
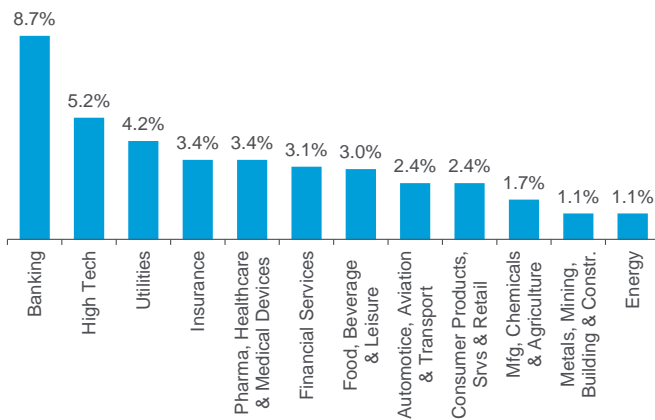
Total IT expenditure includes operating expenditure and IT capital expenditure
Source: Citi Research, CEB, CEB IT Budget Benchmark, Arlington VA, 2016, p.6

Figure 56. Nearly 15-25% of Banks' Annual Budget Allocated to IT, 2016
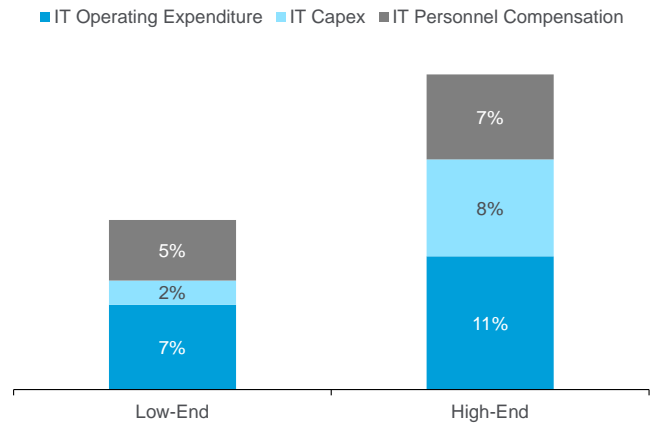
*Based primarily on banks in the EU, U.S., and Australia
Source: Citi Research

Australian banks are the biggest spenders on tech and communication amongst the developed market banks, with non-staff costs at c.11% of their total expenses, followed by Europe and the U.S. Interestingly, Australian banks have also increased their IT spend as a percent of total costs since 2010, as have the Americans, unlike European banks that have been on a starvation diet during a period of rolling crises and now face a period of potential catch-up spending.

Figure 57. Europe, U.S. and Australia Banks Tech & Communication Opex as % of Total Opex (change in ppts since 2009)
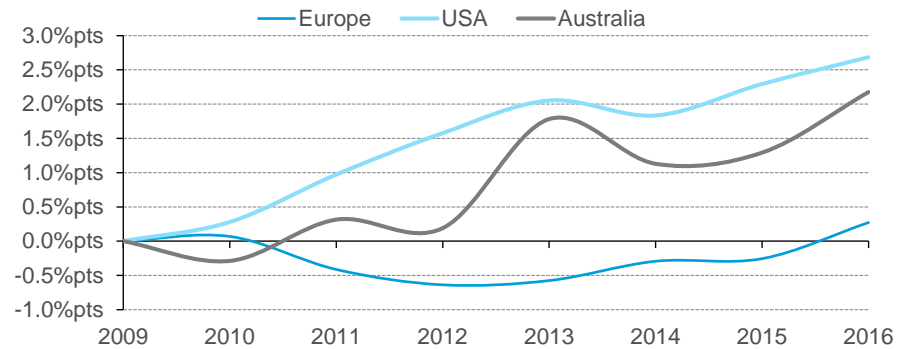
Source: SNL Data, Citi Research; # Bottom-up analysis based on company disclosure where available consistently

In this chapter, we assess some of the pain points banks struggle with related to their IT infrastructure and why many incumbent banks are still reluctant to overhaul core banking systems due to high initial investment, high execution risk, and long payback periods. We also look at how investing in the Cloud can provide real benefits of efficiency, agility and flexibility that can help banks address legacy IT.

IT system transformations are difficult, time-consuming and expensive. We believe most incumbent banks are still in the early innings of a digital transformation and are likely focusing to upgrade select IT components where the ROI is most compelling. In contrast, the neo and challenger banks with their agile platforms and speed to market are simplifying the financial world, by creating customer centric experiences to services and transforming the way banking is viewed by end-users.

Challenge of Legacy Core Banking Systems

Legacy core banking systems were developed by product – Legacy core banking systems were typically purchased from vendors e.g., banks would buy an IBM mainframe (such as an IBM zSeries), and that mainframe had one purpose, which was to support a single application, such as the Hogan deposit system that ran all of the necessary features to process deposit transactions. These are often referred to as monolithic applications. So, in one purchase, banks had a complete solution for their deposit activities, which could do one task very well and quickly.

– **Which created vertical silos…** – Since the core banking systems were developed by product, the large banks could have 20+ different core banking systems, all of which were written in different generations of software over the years. This created vertical silos whose fundamentally incompatible systems made sharing data difficult.

– **And a complex web that wasn't interoperable** – Given the nature of how bank IT evolved, applications were designed and deployed first, so they weren't designed with integration in mind. Instead, banks had to make customized fixes to override the lack of interoperability as they responded to business line head requests for a particular type of functionality. Over time, this resulted in a complex web as banks attempted to get silo'd mainframes to "talk" to each other. In some cases, thousands of applications need to be maintained, creating considerable complexity.

Figure 58. Bank IT Architecture Consists of Intricately Interwoven Applications

Source: Avoka – Rabobank mapped out its IT infrastructure with Lego and string

Legacy core banking systems are stable and reliable, but are slow. Despite being complex, this IT architecture has 'worked' for banks historically. The systems have proven to be very stable, reliable and able to withstand sizeable workloads. As time has passed, banks have hacked into their systems and been able to deliver the necessary functionality upgrades. But these legacy systems have obvious challenges that are increasingly an issue today:

- **Not nimble** – While modifications can be made, the problem is that it is not easy, and as demands on the systems accelerate, it may be difficult for banks to keep up. Take the example of when deposit systems were needed to handle the opening of checking accounts via a mobile phone. In all likelihood, it took a lot of time to be able to go through the code and tie in this new application to the legacy core deposit system. This may explain differences between banks' capabilities. Another example was in November 2017 when the U.S. banking industry developed new real time payment rails that will be used initially for B2B payments. So far, we believe seven banks have built out the functionality to deliver real time payments via a payments hub even though the underlying core systems remain written to a batch environment.

- **Tend to be brittle** – Staying with the deposit example, many of these decades-old applications were written in COBOL, which is an older computer language, and were not written for the pace of change in today's era. These monolithic applications perform many functions and consist of massive chunks of intricate code, which make them difficult to modify and connecting them is not an easy task. Consequently, a lot of hours can be spent going through the lines of code to make even a minor change. Since everything is co-dependent, this results in the need for tests and retests. Any changes to functionality can be done, but it can take a very long time to implement even minor tweaks.

- **Which leads to issues around speed to market** – The IT architecture would continue to 'work' for banks if business demands remain unchanged; however, that is not the case. Demands on the IT infrastructure are increasing as customer expectations as to what banks should be able to deliver increases, and making changes to core banking applications is very difficult.

    – **As complexity begets more complexity** – Banks running 30+ years old core banking systems or numerous bespoke applications are often connected via customized APIs. These legacy APIs make changing applications more difficult since they are customized to specific functions, and are one more factor that developers need to consider, and can result in more layers of middleware to keep these systems 'working.'

Banks Face Multiple Pain Points

We see the banking industry facing multiple pain points – this applies to banks across regions and size and includes aspects such as emerging competition, evolving customer expectations, cost of legacy systems, regulatory burdens and low rates. With the exception of low interest rates – which may or may not increase in future – we believe these pain points will only grow more severe with the passage of time.

Figure 59. Banks Face Multiple Pain Points
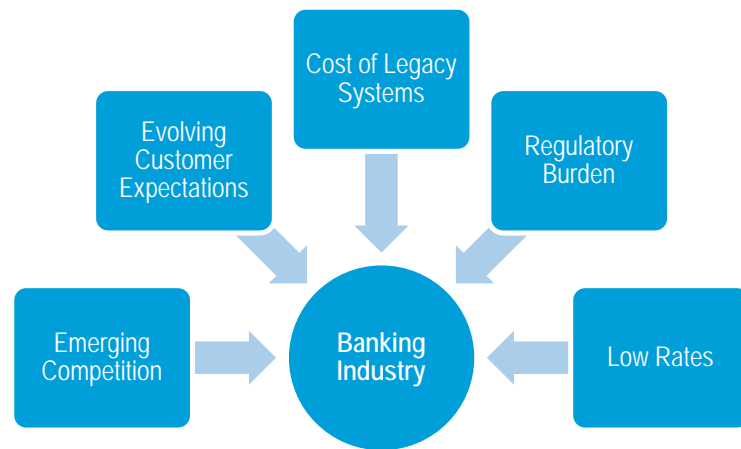
Source: Citi Research

It would be a mistake to view each of these pain points in isolation. Instead, we think they are very much interconnected. Although the time frame over which it happens is subject to debate, we believe these pain points will ultimately compel more banks with legacy core banking systems to address the deficiencies and limitations associated with those systems so that they can more effectively compete and augment profitability.

Interestingly, in its 2017 survey of bank executives, Temenos and Accenture found that these executives cited diminished profitability as their top challenge. As legacy banks face this challenge – and the aforementioned pain points which are causing it – there are deeper and more profound questions to be asked: what will be the role of a bank going forward?
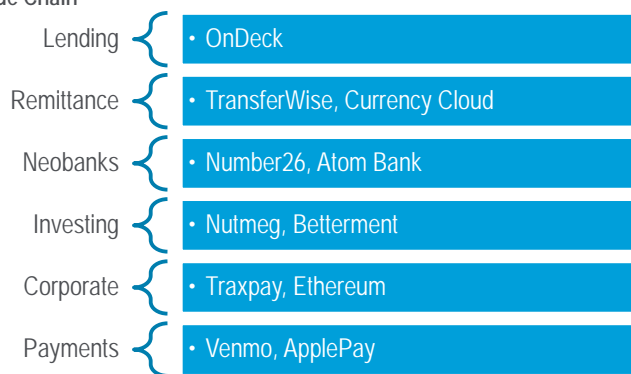
Will a bank merely wait for its customers to come transact with it? Or will a bank act more broadly as a financial enabler for its customers? That is, will a bank find ways to interact and pro-actively help its customers at multiple points in the customers' lives where financial transactions take place? It appears that banks are increasingly opting for the latter view, and that in turn will affect how they choose to deal with these pain points.

[1] Emerging Competition – We believe banks face increasing competition from players ranging from Neobanks to companies which have traditionally not focused on financial services but are doing so today. These players tend to be more technologically adept, offer a superior customer experience than traditional banks and are attacking multiple points along the traditional banking value chain.

Due to their superior technology, these new players are able to service clients at 40%-70% lower cost than that for an incumbent bank. However, the biggest hurdles for these new players are typically the initial launch and customer acquisition costs.

Figure 61 illustrates product pricing offered by disruptors in Europe and the U.S., clearly showing pricing pressures for traditional incumbent banks, especially for financial services such as remittances, investment and saving products.

Figure 60. Examples of Companies Attacking the Traditional Banking Value Chain

Lending	• OnDeck
Remittance	• TransferWise, Currency Cloud
Neobanks	• Number26, Atom Bank
Investing	• Nutmeg, Betterment
Corporate	• Traxpay, Ethereum
Payments	• Venmo, ApplePay

Source: Citi Research

Figure 61. Product Price Offered by "Disruptor" as % of Traditional Banking Incumbent Pricing

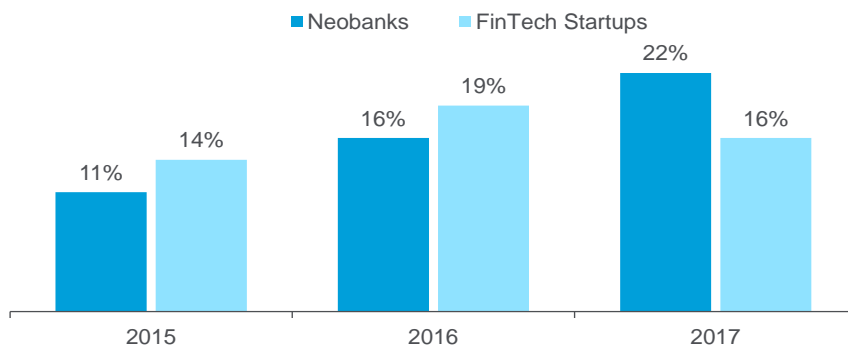|	
Remittances	18%
Investing	40%
Savings	50%
Personal Loans	67%
Checking	85%
SME Loans	92%
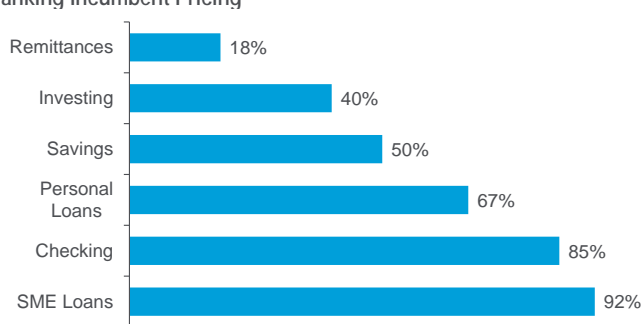
Disruptor pricing for savings has been adjusted to reflect a higher rate environment
Source: Citi Research, Citi GDS Analysis, McKinsey

Interestingly, according to a survey by Temenos and Accenture, bank management teams see Neobanks – and not FinTech startups – as the greatest competitive threat facing their organization. "Peak FinTech" appears to have been in 2016 when almost a fifth of bankers surveyed highlighted FinTechs as their biggest threat.

Neobanks are unencumbered by legacy core banking technology and use more modern platforms. By contrast, banks possess copious amounts of data about their customers, but with legacy systems often have this information stored in silos by business unit – making it difficult if not impossible to share this data across business units. Neobanks have banking licenses and are often launched by existing players (see for example Bank Leumi/Pepper in Israel or ING/Yolt in the U.K.).

Figure 62. Which of the Following Are the Biggest Competitive Threats to Your Bank?

Legend: Neobanks, FinTech Startups

	2015	2016	2017
Neobanks	11%	16%	22%
FinTech Startups	14%	19%	16%

Source: Temenos & Accenture 2017 Banking Survey; Citi Research

As we discussed in the previous section on PSD2 implications, bank executives are most concerned about BigTech Consumer firms exploiting access to clients in the U.K./Europe in the future (see Figure 47). Many Neobanks face the same challenge as the original FinTechs: can they get scale and customers before the incumbents can get innovation, or run out of funding?

However, if we are lukewarm on the prospects of many standalone Neobanks, if we were to combine a Neobank's banking license, banking relevant software and product knowledge with BigTech's brand and client reach, we might have the 'killer app' to threaten incumbent banks.

[2] Evolving Customer Expectations – Based on their experience with companies in other industries, bank customers' expectations are evolving fast. They expect 24/7 availability, real-time capabilities, personalized offerings and an overall low-friction user experience.

When legacy banking systems were created, the world was a very different place. The local bank branch was typically a customer's only channel and most processes were product-focused rather than customer-focused. In addition, processes such as account opening, credit approval, etc. could take days or even weeks to complete.

In contrast, consumers today – again, based on their interactions with companies in other industries – have become accustomed to rapid and low-friction processes (onboarding, ease of completing a transaction, etc.). In addition, consumers increasingly expect products / service tailored to their individual needs and wants.

It is worth noting that evolving consumer preferences are a paramount theme driving much of the development in the broader FinTech universe. Legacy bank systems often prevent a bank from meeting these customer expectations because of their inability to convert data into a global, real-time view of the customer's needs.

As AI is used more and more, accessible and structured data is key for analytics which in turn can help banks better understand their customers. Please refer to our earlier chapter on AI for a more detailed discussion on AI use cases in finance and also challenges and limitations faced by incumbent banks.

[3] Cost of Legacy Systems – Legacy systems have become costly to maintain both in terms of explicit maintenance costs and implicit opportunity costs.

According to CEB, IT expenses as a percentage of revenues are higher in the Banking industry than in any other, at ~9%. Bottom-up analysis reinforces this: we estimate banks' IT expenditure amounts to ~10-20% of total costs. Furthermore if IT personnel compensation is included, both internal and external, then the IT spend as a percentage of total costs increases to ~15-25%.

In the near term, we expect IT expenditure to remain a cost headwind, rather than a cost opportunity. In particular, we see banks' IT spend as a percentage of total budget increasing up to 10% in the coming years as legacy core banking systems, which are up to 30-40 years old, come under review.

To add to the IT costs, in many cases banks are running multiple legacy systems which are decades old. All else being equal, multiple systems require more IT staff. Also, the age of these systems requires knowledge of outdated computer languages which is in short supply. In the U.S., for example, over 40% of banking systems are built on COBOL. Many of the people with expertise in these languages are retired or are approaching retirement age, meaning the manpower required to service these applications is in short supply and expensive.

Figure 63. Age Distribution of COBOL Programmers

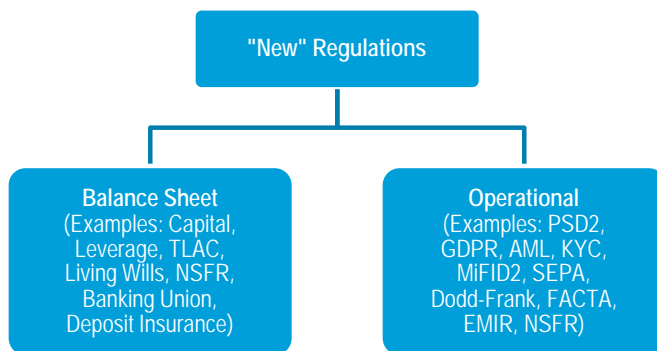| Age	Percentage
Over 60	4.30%
55-60	14.50%
45-55	41.70%
35-45	28.00%
Under 35	11.50%
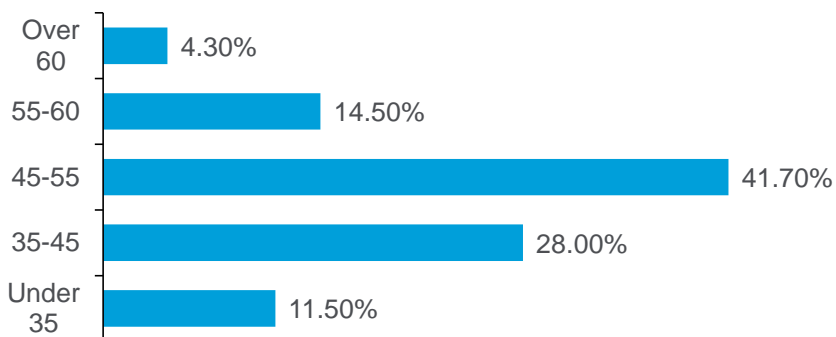
Source: Reuters, international COBOL Survey Report, Citi Research

Software written in COBOL does not lend itself to being easily changed, and as such considerable effort must be invested to make even relatively minor changes. The complexity of legacy systems hinders banks from releasing and updating new products to the market.

Legacy core banking systems typically run on mainframes, and each mainframe or group of mainframes was tasked with supporting a single banking application. IT infrastructure, which is mainframe based, is inefficient as it makes growth and scalability expensive. It also slows down new product launches.

[4] Regulatory Burden – Since the global financial crisis in 2008, the regulatory burden on banks has grown tremendously. Banks are expected to comply with and incur the substantial costs of complying with more stringent balance sheet and operational regulations. We believe, some of the burdens, particularly those dealing with customer data, are made heavier by sub-optimal IT infrastructure.

Figure 64. Examples of Regulations Adopted Since the Global Financial Crisis

```
                    "New" Regulations

        Balance Sheet                    Operational
        (Examples: Capital,              (Examples: PSD2,
        Leverage, TLAC,                  GDPR, AML, KYC,
        Living Wills, NSFR,              MiFID2, SEPA,
        Banking Union,                   Dodd-Frank, FACTA,
        Deposit Insurance)               EMIR, NSFR)
```

Source: Citi Research

Regulators are also increasingly focusing on data quality and utilization. For example, in order to ensure better compliance with KYC and AML rules, regulators in multiple jurisdictions have pushed banks to "clean up" their customer data. This is not at all an easy task for banks that have legacy core banking systems. Data in these systems tends to be silo'd and not set up for traceability.

Across Europe, we believe the regulatory focus on data will become more intense when GDPR takes effect in May 2018. The General Data Protection Regulation (GDPR) is based on the notion that individuals have a "fundamental human right" to

own and use their personal data as they see fit. It potentially imposes severe financial penalties, up to four times global annual turnover on organizations which misuse personal data.

These new regulations are not merely a cost and operational burden on banks: in some cases, they also increase the risk of disintermediation. For example, in Europe, Payment Services Directive 2 (PSD2) requires banks to share customer data, with the customer's consent, with third parties. And it also allows third parties to initiate payments from a customer's bank account to a merchant's bank account.

As such, PSD2 increases the chance that a third party could insert itself between banks and their customers by offering those customers a better user experience and superior product than the banks offer. PSD2 also offer banks with modern architecture the opportunity to exploit PSD2.

In the end, we think the question for banks arises as to whether or not it is more cost efficient to comply with these and future regulations with a more advanced core banking system. It also raises questions as to how these and future regulations change the nature of competition in the banking industry, and whether or not these regulations place banks with legacy systems at a competitive disadvantage.

Do Banks Need To Update Core Systems?

Both the technology and structure of major developed market banks has changed dramatically since core IT systems were put in place in the 1970s/80s. While most of the IT development has been focused on customer interfacing channels, an estimated two-thirds of a major bank's cost base is not seen or touched by the customer. A myriad of systems have been developed to speed up processes and handle large volumes of accounts, but core IT banking systems remain the same.

A bank's core banking system is essentially the back-end system used for deposit, loan and credit processing capabilities. This is used for daily banking transactions, such as making and servicing loans, opening deposit accounts, processing cash deposits and withdrawals and interfacing with general ledger systems to reconcile transactions and post updates to customers' accounts and other financial records.

According to a survey by Temenos to identify where banks' investment priorities reside, Core Banking systems were cited as the main focus area as it is a key driver of long-term cost efficiencies and is often a pre-requisite to maximizing the benefit of investment in other areas. Investments in Digital Channels were listed as a second priority, before a decline to Analytics, CRM & Regulatory investment. Meanwhile, Service, Payments & Virtualization bring up the rear.

Figure 65. IT Spending Priorities, 2014-2016
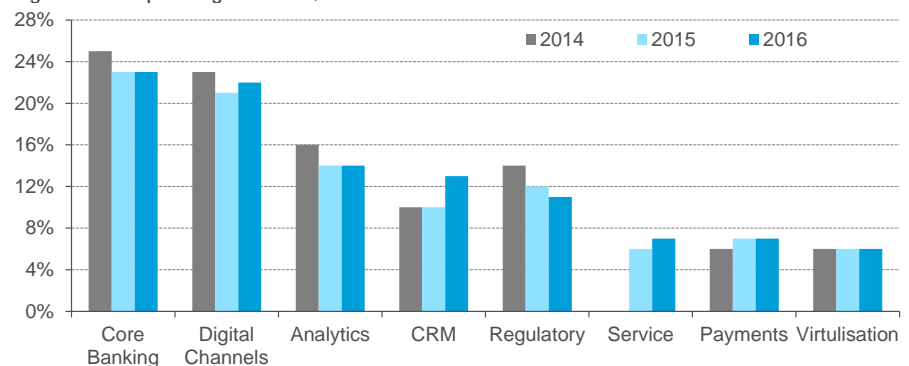
Source: Capgemini, Temenos

When these legacy IT systems were created the banking world was a very different place: (1) Customers had a single contact point with the bank at their local branch; (2) The key processes were "product", rather than customer focused, with payments dominated by a multi-day check clearing system; (3) Many key functions which are now conducted centrally, like credit assessment, were conducted locally with significant discretion given to officers; (4) IT architecture was mainframe based, complete with processors, memory and operating systems, making business growth and scalability prohibitively expensive. While, the proliferation of servers in the 1980s/90s assisted, it often meant that banks ended up with large inventories of underutilized hardware, with thousands of servers using a fraction of their capacity.

In today's digital world: (1) The customer demands multiple interfaces with the bank with various levels of human assistance, while many branch operational roles have been centralized and branches closed as part of large cost-cutting drives; (2) Customer expectation is for a rapid on-boarding process, quick credit decisions, and (close to) real-time payments, else the bank risks being disintermediated by new neo-bank and FinTech start-ups; (3) Many business processes remain the same with large amounts of manual processes which could theoretically be eliminated and re-engineered in this digital world, while cloud adoption has the potential to significantly reduce capex required for the purchase of hardware and software.

Legacy bank IT systems have arguably reached the point of redundancy, as the convoluted integration of outdated systems has become too costly and unwieldy to persist with. Consequently bank managements have started to 'bite the bullet' and address IT systems as an enabler to driving sustainable cost savings.

However the path to achieving these productivity initiatives usually requires a costly, multi-year investment. Once underway management is typically committed to the resultant project and investment spend, regardless of any changes in the broader operating environment, or advances in technology that happen in the meantime (albeit upgrades can be negotiated with third-party IT vendors).

Updating core banking systems can result in various upfront charges for new hardware, system integration, new training and new license fees. In addition a new core banking system can lead to recurring maintenance charges, albeit a bank would typically look to more than offset this by retiring legacy systems and by streamlining back-office support and processing functions.

As the initial investment in a new core banking system is high, the payback period can stretch into multiple years. According to Capgemini analysis (see 'Core Banking Transformation: Measuring The Value'), the payback period for Core Banking projects can range from 2.5-5.5 years with an average period of ~4.5 years.

Figure 66. Payback Period For Core Banking Transformation
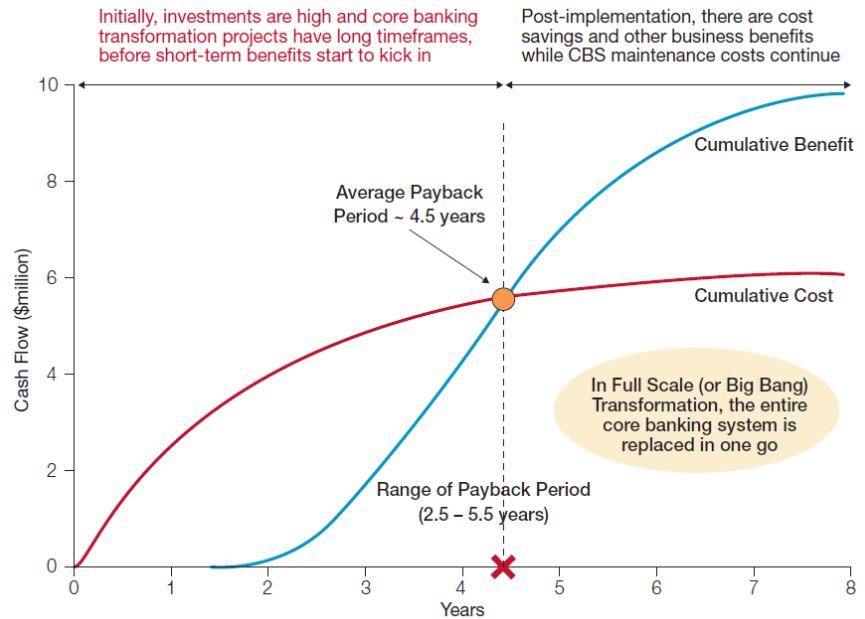
Note: The plot comprises 29 banks belonging to Tier 1 (>US$500m), Tier 2 (US$100-500mn, Tier 3 (US$5-100m), and Tier 4 (<US$5m) category, with a majority of banks belonging to Tier 3 and Tier 4 category.
Source: Capgemini Analysis, 2013; Core Banking Systems Cost Benchmark, IBS Intelligence, 2012

So systems upgrades are complex, costly and take time. But on the positive side, new systems enhance the customer experience, via reduced on-boarding and approval times, better straight-through-processing, and more agile capabilities to launch new customer offerings, thus helping to potentially drive superior revenues or lower cost to serve per customer. And crucially, they help secure incumbents' competitive moats beyond just inertia and client laziness.

IT Change: Incumbents, Neobanks and Vendors' Views

We find many incumbent banks are still reluctant to overhaul core banking systems, due to high initial investment, high execution risk, and long payback periods. To be sure, there is an argument to be made for banks not transforming their core banking systems but rather building new front-end and middleware solutions on top of their legacy core systems. (We do not think there is a credible argument for banks not adopting a digital strategy nor do we know of any major banks making that argument.) The argument against core transformation is that not only is it expensive and time-consuming, but that there is considerable execution risk.

[A] The Incumbent Banks' View

The Australian banks were among the first to upgrade their core systems and have had a mixed experience as these projects often exceeded initial cost and timeline estimates and the actual benefits fell short of forecasts. We would note that these banks were among the first large banks to launch core transformation programs – announced in 2008, a decade ago – and since then both software vendors and third-party implementers have built a reservoir of experience which should reduce execution risk today.

We look at the experience of two of the first-movers below.

Commonwealth Bank of Australia (CBA) announced a replacement of its core IT system in 2008, and initially estimated the cost of the replacement would only be A$580 million (~$450m) over four years. The end result was A$1.3 billion ($1bn) over five years. By adopting the new SAP system, CBA did create a scalable platform, with some competitive advantages, such as real time processing, a superior customer experience, reductions in branch staff errors, and better speed to market with new products.

On the flip-side these benefits do not appear to have translated into significant market share gains. Furthermore, there are some areas that haven't been as successful. The mortgage loan book has not been migrated over to the new system due to cost and complexity; Australian mortgages are customized products that don't naturally fit. Annual IT costs have also failed to meaningfully decline following the completion of the project, albeit this is complicated by extra regulatory spend.

National Australia Bank (NAB) attempted a similar core IT system replacement with Oracle, rather than SAP. This project was hampered by serious issues with both the vendor system and the NAB IT infrastructure supporting the system. NAB ended up delaying the migration of existing customer files to the new system due to cost and complexity. New customers are entered into the new Oracle system, while existing customers remain on the existing 40-year old system and will need to be run off. The costs of this IT project are also expected to be multiples of the original estimates and the timeframe has moved from a 5 year project to a 15 year project.

NAB now targets an additional A$1.5 billion of investment spend over 2018-20. This is focused on: (1) customer journeys at scale; (2) enhanced technology resilience (e.g., cyber security, AML, regulatory requirements); (3) product & tech simplification; (4) digital capabilities, ecosystems; (5) automation, straight through processing; (6) SME digital investments; and (7) pricing analytics.

Figure 67. Australian Banks – Tech & Communications Operating Expenditure Per Year Continues To Rise As % Of Total Expense
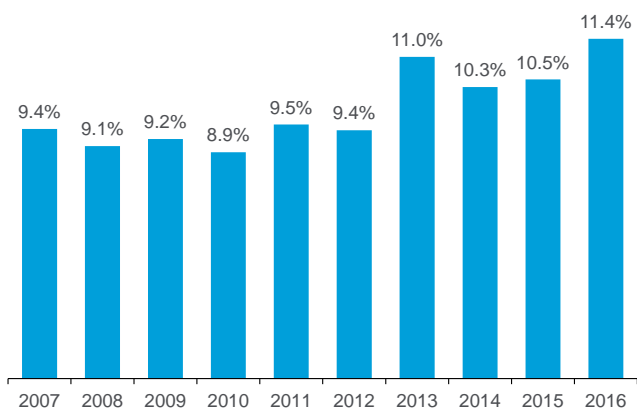
Source: SNL, Citi Research. Note: Different banks allocate tech spend differently, hence why we show an aggregate measure of operating expenditure. This measure excludes depreciation & amortization (see second chart for capex spend) and also excludes internal IT employee compensation (but will capture third-party contracts).

Figure 68. Australian Banks – Additional Capitalized Software Balances As % Of Total Expense (And Capex Net of Amortization)
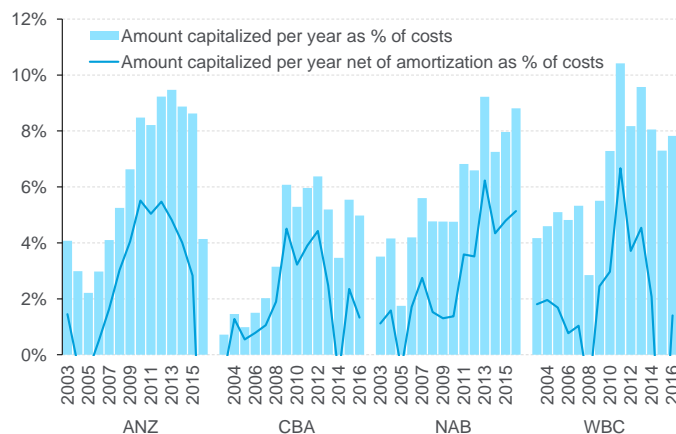
Source: Company Reports. Note: ANZ 2016 number was impacted by an accelerated amortization charge of $556m, relating to previously capitalized software balances

Transforming without a core system replacement. DBS, the largest bank in Singapore, has successfully transformed itself without replacing its legacy core system but rather by reducing its dependence on it. DBS launched its technology transformation back in 2009 and in 2014 accelerated that transformation in the face of growing digital competition.

While DBS called its transformation "digital to the core" – it would not simply apply "digital lipstick" to the front-end systems – the bank decided not to replace its legacy core banking system. Instead, DBS decided to reduce its dependence on it by moving functions to microservers and designing systems and processes which would migrate to the cloud.

Following this transformation, DBS says that its digital customers have a cost-to-income ratio of 34% versus traditional customers at 55%, and that digital customers generate a return on equity (ROE) of 27% versus an ROE of 19% for traditional customers.

Our take on DBS is that (1) it demonstrates the benefits for a bank that fundamentally transforms itself into a digital bank, (2) a bank that does so must reduce its dependence on its legacy core banking system even if it does not replace it but (3) that this approach is likely only an option for the very largest banks with scale and substantial resources whereas (4) banks lacking that size are likely better off using a third-party vendor to re-platform.

European Banks and Legacy Systems. In contrast to their Australian peers, the European banks are only now starting to review their legacy core banking systems. Two of the most prominent examples are Nordea and Bank of Ireland, which have announced agreements with Temenos to develop and deploy new systems over 2015-21 and 2016-21 respectively.

■ **Nordea's** program is expected to cost €1.1 billion ($1.35bn) in total (split 70% capex, 30% opex), a 30-35% average annual increase in the banks' IT budget. This would be equivalent to ~4-5% of annual Group costs. Nordea expects development spend and capitalization to peak in 2017, while IT-related intangible assets are expected to peak in 2020 (at ~€2.5bn) and depreciation & amortization in 2021.

Figure 69. The Nordea Program - Plan and Milestone Delivery
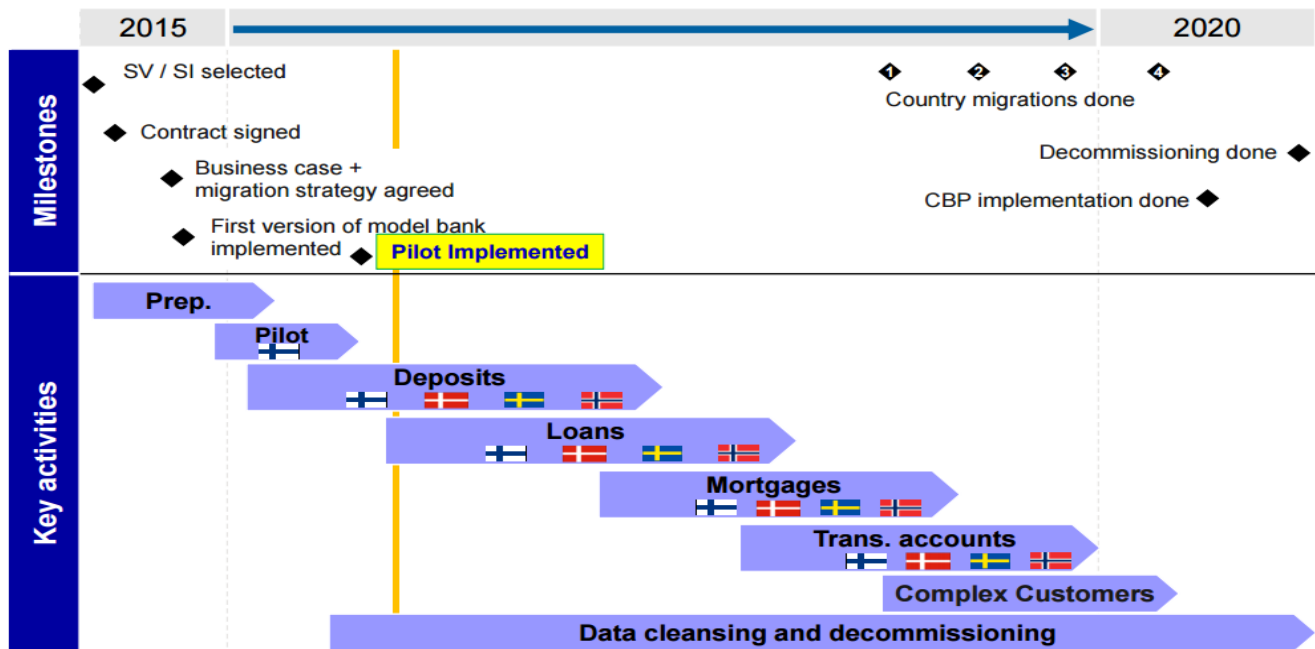
Source: Nordea Company Presentation

- **Bank of Ireland** expects to invest €0.9 billion ($1.1bn) in total (mainly capex), or ~€0.2 billion per year, equivalent to a 50% increase in the annual IT budget, or ~10% of Group costs. The capex will hit CET1 capital ratios on day one (even though it will only be amortized via the P&L over time), so this will be a 35-45 basis point impact per year.

Figure 70. Bank of Ireland – Core Banking Platforms Investment Program
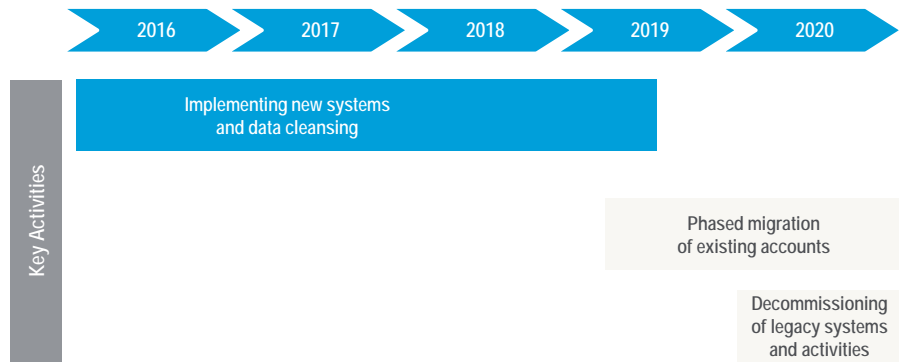
Source: Bank of Ireland Company Presentation

These two banks are however still in the minority. Many European banks that we speak to still stress that it does not make commercial sense to overhaul existing core banking systems.

While most banks are talking about "digital transformation", we've found banks are often only focused on the front-end. While this may enhance the functionality for the customer, many of the changes are just cosmetic. This does not necessarily address back-end infrastructure issues that matter in the long-run.

The common push-back we received from the incumbent banks was as follows:

- **Execution risk.** These projects can be multi-year projects, with sizeable risk of cost and time over-run, and long payback periods. This high execution risk means that the immediate cost & revenue benefits need to be more tangible.

- **Rationalization required before replacement is even considered.** Many European banks still operate with multiple core banking systems, especially if they operate on a cross-border basis and/or across multiple products. From a cost perspective the 'low hanging fruit' is first and foremost from rationalizing the number of systems that the bank operates with. This can then also significantly reduce the execution risk of migrating to a new system at a later date.

- **Existing core banking systems can be highly bespoke.** Systems may be old, but they are still functional and have been adapted over time to suit a bank's needs and product offering. It would be extremely difficult to replicate this with an 'off-the-shelf' vendor offering. The risk is then that ongoing running costs would actually rise, rather than fall, due to an inability to migrate legacy products. This tends to be particularly true for checking accounts, due to their long duration, and mortgages, where each country tends to have its own product nuances.

- **Big banks are complicated.** Other large banks argue that their existing core banking systems are highly bespoke and difficult to replicate. Our view is that while this may be true, it applies much more so to the very largest global banks. As such, we think these banks are unlikely to rely on outside vendors for core banking transformations but may use them for smaller projects.

■ **Lack of flexibility.** Linked to the above, it was highlighted that vendor solutions can potentially reduce future flexibility. While some IT vendors are software agnostic this is not always the case. Furthermore, any third-party core banking system will need to be able to integrate with, and support, a range of internal and third-party applications (APIs), which is not always feasible.

■ **Cloud is still in its infancy.** While the cost save opportunity from cloud adoption could potentially be sizeable in the long-term, the technology is still in its infancy. Cloud-based banking platforms still don't have the capability to run a lot of products and processing capabilities that banks require and customization of cloud solutions can take a prolonged time. Where banks have disclosed interest in cloud adoption, it has typically been via a hybrid solution.

Regulation. Regulators are still issuing guidelines on cloud computing – see the next chapter – including on data storage location. KYC/AML risks can also potentially rise if a bank chooses to shift to real-time payments infrastructure.

■ **Timeframe required to complete a core banking overhaul project is long.** And management teams fear that by the time the project is complete, technology will have moved on and that their "new" systems will already be outdated. While this is a risk, we believe not transforming core operations is arguably a greater risk. As time elapses, consumers – particularly millennials – are unlikely to tolerate a poor consumer experience, and will move to a bank that offers a superior customer experience – particularly if switching is easy.

[B] The Neobanks' View

Services offered by Neobanks and FinTech companies can appeal to a wide range of customers, due to their ease of use, functionality, and agile operating models. This can enable quicker on-boarding, authentication, servicing, payments, end-to-end lending and product development for customers.

In recent history we have seen a couple of instances of explosive new user acquisition by FinTech companies: (1) Paytm (India's digital wallet) saw a spike in users from almost 150 million to >200 million in the months post demonetization (Nov-Dec. 2016); and (2) Tenpay, China's one-stop payment service provider, took control of over a third of 3rd party mobile payments in a short span, following a spike in "WeChat Red Envelopes" around Chinese New Year. However both cases involved Internet companies initially adding payment facilities, especially P2P, rather than offering full banking services.

The fastest growing recent Neo-bank example is the Korean mobile-only bank, Kakao Bank, which garnered attention by enrolling 2 million customers (5% of Korea's adults) within two weeks of its launch in July 2017. For context, K-Bank (Korea's first Internet bank by age) attracted 0.55 million users over 4 months and DBS' digibank (in India) has reached 1.6 million users since its launch in August 2016 (and DBS digibank launched in Indonesia in August 2017). What set Kakao Bank apart? Kakao's large social media and KakaoTalk user base (42m MAU Korea), easy access/online-only authentication and lower loan rate/fees.

Figure 71. Korean Internet-only Banks – Aggregate Number of New User Accounts
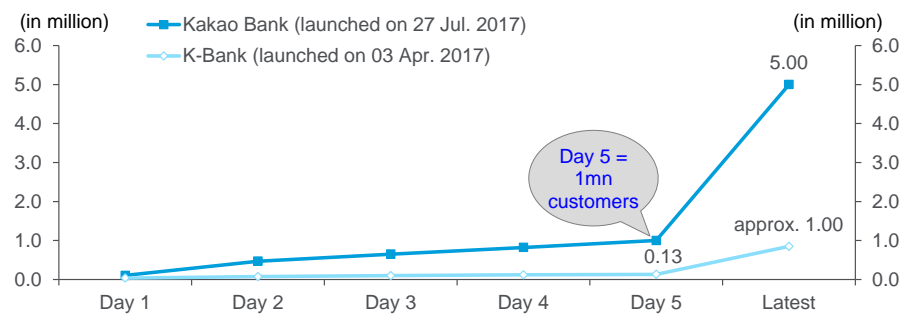
Source: Press Reports (Business News Daily Korea), Citi Research

Internet banks are not new; they've been around since the late 1990's with early Internet banks like Skandiabanken in Norway and Collector Bank in Sweden, but they have been gaining increasing prominence in the last 2-3 years with rising technology penetration and changing customer mindsets. In Asia, some of the biggest Internet banks are in China (WeBank, MYbank), followed by Japan (Rakuten Bank, Japan Net Bank); and Korea (K-Bank, Kakao Bank).

In Europe Internet or Neobanks have generally seen slower customer acquisition, as the incumbent banking markets are already well penetrated and relatively sophisticated. Regulation has typically also been more stringent. This has meant that new digital bank entrants have often been developed by the incumbents themselves.

They have had greater success in regions where smartphone (tech) penetration is high and customers prefer to interface via digital channels, such as Scandinavia, Netherlands or the U.K. In contrast in certain European countries, like Italy, there is still high demand for branch-based banking and banks need to be careful of not running too far ahead of their client base.

Examples of incumbent-led evolution include ING Di-Ba, in which ING has owned a 100% stake in since 2003. This now has 8.8m customers, including 1.7m customer accounts. ING has since rolled out similar models in Austria, France, Italy and Spain, albeit it has supplemented these with a handful of branches, especially in Italy and Spain, due to different customer dynamics.

Hello Bank, by BNP Paribas, was founded in 2013 and now has >2.5 million customers across 5 countries (~1.5m of which are in Germany). Another more recent example is Bank Leumi and its digital bank "Pepper", which is supported by Temenos. In each case these are 'new' banks and existing customers / products from the parent have not been migrated across.

In the U.K. CYBG launched "B", its new digital banking offering, in June 2016, and has since taken on over 100,000 customers, albeit approximately half of these were existing CYBG customers. While "B" bank appears to be real-time to the customer, it still runs off legacy core banking system, with reconciliation once a day.

There are also a handful of start-up banks: Starling, Atom and Monzo all have banking licenses, while Revolut and Loot are based on pre-paid cards which sit behind a 3rd party banking license. Starling and Monzo Bank run on in-house developed technology, while Atom, Tandem, and others run on vendor solutions.

Figure 72. Profile of Key Global Internet-only (Digital) Banks

Bank Name	Country	Key Stakeholder	Established
Skandiabanken	Norway	Skandia	1994
Collector Bank	Sweden	Fastighets AB Balder	1999
Rakuten Bank	Japan	Rakuten	2000
Japan Net Bank	Japan	SMBC	2000
Sony Bank	Japan	SONY	2001
SBI Sumishin Net Bank	Japan	SBI, SMTB	2007
Jibun Bank	Japan	MUFG, KDDI	2008
Daiwa Net Bank	Japan	Daiwa Sec	2011
Hello Bank	Belgium, Germany, France, Italy, Austria	BNP Paribas	2013
Compte nickel	France	BNP Paribas	2014
Go Bank	USA	Green Dot Corp	2014
Revolut	United Kingdom	Startup Founders	2015
WeBank	China	Tencent	2015
Baixin Bank	China	CITIC Bank, Baidu	2015
MYbank	China	Alibaba	2015
DBS digibank India	India	DBS Group	2016
Imagin Bank	Spain	CaixaBank	2016
Atom Bank	United Kingdom	BBVA	2016
Monzo Bank	United Kingdom	Startup Founders	2017
Starling	United Kingdom	Startup Founders	2017
Kakao Bank	Korea	Korea Investment Hldg.	2017
K-Bank	Korea	Woori Bank, Danal	2017

Source: Company Reports, Citi Research
Note: ING DiBa evolved from the mergers of BSV, ADD, GiroTel and Entrium

The Neobanks argue they can take market share from the incumbent banks due to the superior customer experience that they provide. The cost of servicing can also be c40-70% lower than a mainstream bank as functions are often highly automated. Instead, the biggest hurdles to overcome are usually customer acquisition costs.

Even if the market share shifts are small, we believe the risk of revenue attrition is likely to force the incumbent banks to invest more into IT. To some extent this can be achieved via bolt-on front-end applications, or by creating their own neo-bank, but this tends to assist only with customer retention / growth. Without overhauling legacy core banking systems it is difficult for incumbent banks to match the lower servicing cost per customer that the Neobanks enjoy.

The financial crisis and subsequent tightening of IT budgets drove pricing pressure among vendors. This, combined with new technology offerings, resulted in global vendor consolidation in recent years. However IT budgets are rebounding — globally we see 5% all-sector IT budget growth. And vendors are seeing an improvement in sentiment among financial services clients, including European banks.

Banking clients offer some of the most attractive growth prospects, with Gartner forecasting an 8% compound annual growth rate in spend on banking software over 2016-20, of which core banking is the single largest component (it typically encompasses nearly half of a bank's total IT investment).

At Temenos' 2017 Capital Markets Day it highlighted that third-party spend on banking software totals $9 billion today (based on licenses and maintenance), or only ~23% of the $39 billion total. This is expected to rise to $12 billion in the medium-term, based on an 8% compound annual growth rate (CAGR).

Interestingly, Temenos expects the biggest increase to come from Payments (+11% CAGR), Fund Admin (+10%) and Channels (+8%). By contrast, incremental spend on third-party Core Banking software is expected to be only a +5% CAGR. This is

partly because core banking is likely to be kept in-house: it accounts for almost 40% of total software spend, but less than a quarter of third-party software spend.

In our experience, IT vendors typically argue that banks' core mainframe systems, which are still predominantly COBOL based, now have limited external support, with the odd exceptions, such as Cobol Cowboys, MicroFocus, etc. As banks' existing IT employees retire there is therefore a risk that these systems could eventually become largely unsupported.

Historically any new system would be built in parallel to existing systems and there would then be a single transition at the end. While this may have made commercial sense for smaller banks, it typically led to high execution risk for large banks. The process has since become far more modulized, often broken down into much smaller steps, either region-by-region, or application-by-application.

Vendors argue that this 'progressive renovation' has helped to reduce execution risk and can also greatly shorten the initial payback period. This is important as banks typically build an IRR business case for updating their systems based on cost take-out alone, with any revenue or customer benefit usually viewed as option value.

Figure 73. Banks' Third-Party Spend On Banking Software ($bn)
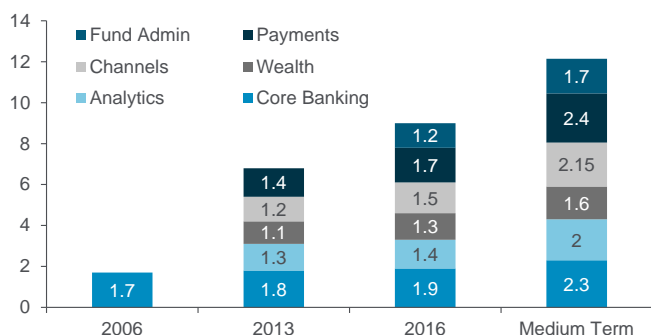
Source: Temenos, Gartner, IDC, Celenet, Ovum, Oliver Wyman

Figure 74. Temenos Core Banking Market Share By Value Of Deals
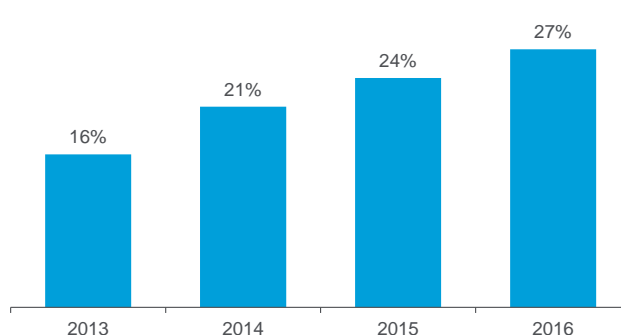
Source: Company Reports, based on IBS league tables and Temenos estimates

Case Study: Leveris Banking Core

Leveris is a FinTech company headquartered in Dublin, offering a fully-stack platform which means it is a standalone, fully integrated suite of front-end, middleware and back-end services and applications. Its range of products include: (1) Banking Core- a comprehensive suite of fully integrated, back-end, middleware and front-end services and applications; (2) Payments Hub – a payments solution pre-integrated with core platform; (3) Data Science – a real-time operational control, MI & deep insights platform; (4) Operational Excellence – delivers lower operational risk, operating costs and increased revenues; and (5) Channel & Interfaces – Suite of digital channels supported by the enterprise integration layer

Leveris Banking Core: The firm has developed a fully integrated, front-to-back office core banking platform which was built using open standard formats, APIs and protocols. This platform is targeted for traditional banks, new market entrants and also consumer brands looking to enter the banking / lending space. It delivers this in 4 ways, (1) Integration: offers an extremely broad range of system integration; (2) Cloud or On-premise: the Core Banking system can be deployed on-premise as well as in cloud; (3) Modular Platform: allows for progressive innovation build / migration strategies which help reduce risks / time to market; and (4) Continuous upgrades: deals with upgrades, maintenance, platform compliance, server, storage.

Figure 75. Banks' Challenges and Leveris Banking Core Solutions

	Problems	Solutions
Scalability	Banking systems can't keep up with the exponential growth in volumes brought about by the digitization of banking, and soon the Internet of Things	The Leveris platform is a flexible, adaptable, and scalable technology stack that leverages data to scale to your needs and grows with you.
Complexity	A typical traditional bank runs more than 600 inter-connected software applications which increase risk and complexity	The Leveris Banking platform delivers all retail products from the same platform; no more complex spaghetti junction systems.
Cost	Years of software upgrades and middleware solutions mean banks can spend up to €1bn a year just to maintain the system.	A transparent pay-as-you-grow pricing model ensures costs are closely aligned to desired business outcomes.
Speed to Market	Traditional banks running on legacy systems can take over one year to launch new products and services.	Launch financial products that share no issues with any legacy IT infrastructure in weeks not months or years.
Data	Silo'd data and complex systems make it nearly impossible for banks to use data in any meaningful way.	Access detailed, real-time customer data through state-of-the-art data warehousing to understand your customers better.
User Experiences	Banking customers have come to expect great services at their fingertips. Unfortunately, banks cannot deliver.	Improve customer relationships across all channels and throughout the customer life cycle. Leveris allows you to create beautifully designed front-end applications.

Source: Leveris, Citi

Journey to the Cloud

We find it amazing how little of tech spend is available for new development and functionality. Two-thirds or more of banks' IT budgets are spent on maintenance. And even the 'change-the-bank' tech spend is often for compliance or regulatory driven change. Thus, the amount spent on real change or innovation is a small fraction of usually large IT budgets. One area of potential real change is the journey to adopting Cloud computing in ever larger parts of the banking ecosystem.

Cloud and more modern architecture offer solutions to legacy IT issues — a promise of efficiency, agility and speed to market. The move to the cloud provides the cost and efficiency play, while the reworking of legacy applications provides the benefit of agility, nimbleness and speed-to-market with product development.

With workloads shifting to the cloud, there should be cost savings. Expense saves will come as the scalability and elasticity create a more efficient environment. Hence, reduced requirements for physical equipment and a physical footprint – allowing banks to reduce server counts and shrink and/or eliminate data centers. Furthermore, public cloud usage could have additional labor cost savings as the infrastructure or software would be managed externally.

While cost savings are one important side-effect of cloud technology, we believe this is not really the key unique selling point. The leveraging of the cloud allows for flexibility and nimbleness. To the extent banks can enhance their speed to market with applications, this is a major benefit particularly relative to the ineffectiveness of legacy IT to deliver changes with speed.

Being innovative and responsive to customer demands (e.g., make updates to an app with no downtime) could be a key differentiator over time. In addition, we see significant benefits from getting data analytics and AI right, particularly for an industry that underwrites risk.

Cloud Ecosystem – The Vision for Hardware, Applications and Data

Often we hear the phrase that "the cloud is just someone else's computer" as if to imply that this evolution in tech is no big deal. While it's true that the use of public cloud uses "someone else's computer;" this is not true of private clouds, yet banks are still building them out. So it's not as simple as the idea of a computer.

In fact, we think of the cloud as a service, not a computer. It's this 'service' and set of capabilities, in addition to the entire ecosystem that comes with the cloud, which is transformational. When we refer to ecosystem, we are referring to the cloud (infrastructure), applications (software) and data. Benefits across all three of these facets are what can be truly transformational to the banking industry.

■ **Modernized hardware allows for increased speed and efficiency of resource allocation and cost savings** – The ability to virtualize all IT hardware (servers, compute and network) is now available, which means less need for physical equipment than with a legacy IT stack. This leads to cost saves (less physical presence), but also allows for on-demand provisioning of virtual machines.

For example, in a legacy environment, if a business line needed more resources, it would take upwards of 3-4 months to request servers, have the physical equipment delivered and racked into a data center. With cloud, a process measured in months can now be done in minutes. As more resources are demanded, a virtual machine can be spun up in minutes.

■ **Modernized applications built with micro-services provide flexible and agile products** – As back-end infrastructure is moving onto the cloud, applications are also being re-engineered to fully utilize cloud native features. Monolithic applications are now giving way to modular applications built from scalable micro-services.

The application design is becoming more manageable and resilient across the franchise with designs using Lego®-like micro-services connected through standardized APIs. With more flexible designs, we expect the cost of application maintenance to come down.

In addition, the ability to change quickly, innovate easily and compete is a strategic necessity. The ability to update applications with speed will likely become strategically important in areas like retail banking, payments, etc.

– We expect banks to 'pick their spots' and be methodical about which applications make sense to be re-engineered for the cloud. Workloads that appear to be better suited on a cloud environment (and likely among those to move first) include those that use high compute power (risk modelling, Monte Carlo) and those with spikey demand (trading, payments, mobile apps). Separately, banks can modernize and/or add new capabilities with SaaS applications although can take c.18 months to implement into legacy systems vs. one-third the time if micro-services were used.

■ **Enhancing data by decluttering and standardizing data usage** – Data is at the core of banks' ability to provide reliable and secure banking services. We see banks investing in data quality clean-up to better leverage and unlock the information. There is the need for data quality, accessibility, and standardization—which best comes from upgrading and realigning banks' core infrastructure.

The data clean-up initiatives are crucial in order for machine learning algorithms to extract meaningful insight. Setting an end-to-end data strategy can provide a more seamless client-centric experience, as well as enable more powerful analytics and AI tools.

With better data, there should be better integrated applications that allow customers to manage all accounts (debit, credit mortgage, trading, etc.) opened with the banks from one gateway point. Better quality data will enhance efficiencies of chatbots and robotic process automation (RPA) tools while moving closer to real-time B2B and P2P payments.

■ There are three levels of cloud computing: IaaS, PaaS and SaaS. IaaS is the most basic cloud service for raw hardware resources such as storage, computing, security or network capacity. PaaS includes infrastructure elements such as database, middleware, messaging, security, development tools and a presentation layer that are used to develop custom applications. SaaS is a cloud-based resource that is delivered as a complete software application to the end-user.

Figure 76. The Computing Stack for Public Cloud Offerings (Note 1)
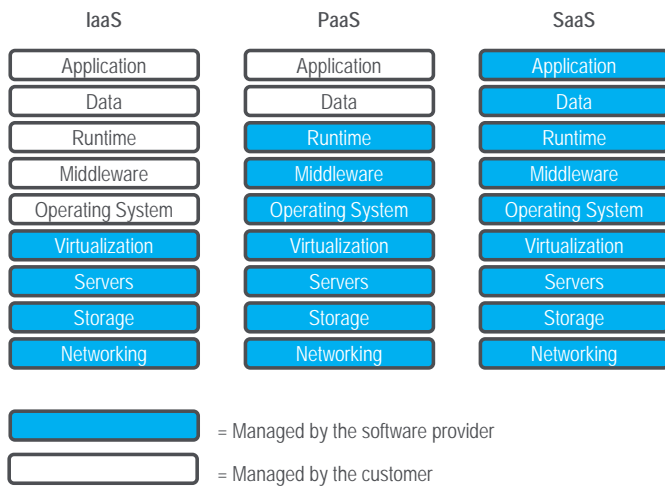
Source: Citi Research;   # Keep in mind that the 'blue; bars are outsourced to public cloud providers. A private cloud (akin to IaaS or PaaS) would have both 'blue bars' and 'white bars' both managed in-house, although 'blue bars' would be abstracted away.

Figure 77. Common Workload Paths to Cloud from On-Premises
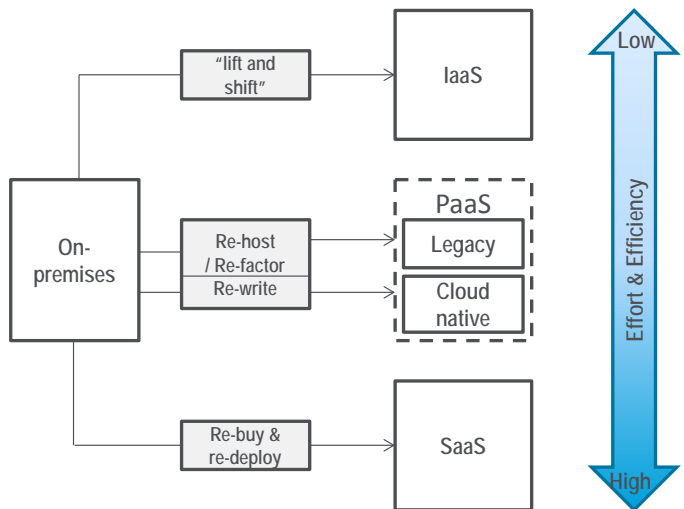
Source: Citi Research

Benefits to Modernizing Infrastructure – Cloud Can Lead to Cost Saves, Flexibility and Better Resource Allocation

A simple way to think of hardware infrastructure is the data centers' facilities full of server 'computer' stacks, network and cables for communication and all the supporting software that makes hardware run. Simply put, cloud makes all of this virtual. The IT infrastructure is accessible via the Internet.

In the past, applications or programs would run on software downloaded to a physical computer or server; now the same kind of applications can be accessed through the Internet. Consequently, cloud increases efficiency, and allows flexibility and automatic software updates.

Cloud helps to cut the high cost of hardware. It also helps eliminate some of the maintenance costs. Less maintenance and less physical equipment improve the opportunity cost of maintaining the infrastructure as well as the real dollar cost of maintaining the physical equipment and server farms.

Cloud allows a user to scale up the cloud capacity by drawing on remote servers. And conversely, provides the ability to scale down. This provides a level of flexibility in calling for resources, which is a real advantage in that it can accommodate fluctuating business demands on tech with speed.

Cloud technology enables banks to get applications to market quickly without worrying about underlying infrastructure costs or maintenance. For example, Capital One moved its mobile servicing platform to the public cloud (AWS). They were able to tune/test and find/fix small pre-existing performance flaws in their applications. Using AWS removed the constraints that would have prevented them from developing their ideal application.

There Are Many Different Ways to Move Applications to the Cloud…

One term we hear very often is "re-platforming," but we have found it to be used as an umbrella term to cover different strategies of moving legacy applications to the cloud. In this scenario, they would ideally be redesigned as micro-services in order to be considered cloud-native (able to leverage the on-demand elasticity of the cloud).

Choosing how to update applications is typically a trade-off between time/effort and application efficiency. While we have noticed that banks tend to modernize their infrastructure and apps in tandem, re-writing apps to the cloud is not prerequisite to streamlining systems.

■ **Ideally, applications would be re-written to be cloud-native, though it's a lot of work…** – Apps that are being re-written typically taking longer to move to cloud because the amount of effort and work increases. To upgrade or re-write or re-engineer a legacy application to leverage cloud capabilities like on-demand elasticity, banks first need to map out their application architecture, then restructure the app; extracting the logic from the legacy app as a base for the new application, and coding it as more modular, scalable micro-services.

– *But rewriting provides great benefits* – Applications re-written in micro-services are simpler to modify and result in much faster innovation, scalability, and flexibility, further improving hardware efficiency. The enables faster time to market with deployment and updates.

– *Micro-services are much more adept at leveraging the strengths of the cloud*, like its on-demand scalability; this is why we refer to IT "nirvana" as a cloud environment with applications built with micro-services. Rewriting applications also provides banks a chance to simplify their systems.

- **Re-factoring is a partial re-write, and therefore results in only part of the benefits** – Re-factoring involves breaking down an app into smaller pieces and can involve re-engineering some parts to be cloud-native. These applications typically only benefit from the marginally better scalability and flexibility, improving hardware efficiency but not to the extent that re-written apps would. We have heard this referred to as "lift-tinker-and-shift."

- **The easiest option is to re-host** – Re-hosting, otherwise known as the "lift and shift," simply migrates an old application to a new environment (cloud) and little is done to re-factor or rewrite the application. The app logic is not changed and only the minimum modifications are made to ensure that it can run.

  - *…but yields fewer benefits* – A "lift-and-shift" results in "your-mess-for-less" – the bank would benefit from a more efficient cloud infrastructure, but would miss out on any flexibility and efficiency benefits of embracing a cloud-native architecture, and these re-hosted applications are essentially unchanged and would inherit the issues related to legacy architecture.

- **Or banks can re-buy 3rd party solutions, but they tend to be less customizable** – In some cases, banks may choose to re-buy a third-party solution or referred to as SaaS (software-as-a-service). Though often thought of as "plug-and-play," they can take up to 1-2 years to integrate with the rest of the bank. Based on the size, scale and complexity of their needs, it's not always feasible for banks to use third party products without material customization. Furthermore, banks are tied to the vendor's release schedule or vulnerable vendor lock-in; whereas a bank's own application can be updated by its own developers.

Some Application Workloads Are Easier to Move to Cloud than Others

Banks often refer to moving workloads to the cloud. These workloads encompass the components needed to run an application, including the application itself, relevant data, and then compute, network, and storage resources needed to execute the application. However, some workloads are more difficult to move than others, and we expect banks will be selective with which workloads move to the cloud based on an evaluation of the benefits and risks.

Certain workloads can be more easily moved to the cloud. For example, lower-value workloads that benefit from the cloud's on-demand elasticity, like newer front-end engagement apps (e.g., mobile) or testing & development are typically the first to move to the cloud. In comparison, banks may be risk-averse about moving high value core banking systems which are harder to move because of long lifecycles and mission criticality.

The types of workloads on the cloud can be another barometer for cloud-progress. For example, Capital One has noted that it was the first U.S. bank to use the public cloud and it plans to migrate many core business and customer applications to AWS over the next five years. However, this would be only one data point. A bank with a lower percentage of workloads on the cloud may be spending more time and effort re-writing the application to fully leverage cloud characteristics.

Figure 78. Lower Value Apps Like Engagement and Testing and Development are Likely to be Among the First Workloads to Migrate to the Cloud

Workload	Description	Inhibitors	Value
Enterprise app	Mission critical business apps	Must be re-written or re-bought/deployed to get most cloud advantage. Mission criticality drives risk aversion	High
LOB, dept app	Non-mission critical business apps	Must be re-written or re-bought/deployed to get most cloud advantage.	Medium
Engagement app	Customer-facing applications; social, mobile, IoT, customer community	Few inhibitors, most are "new on new" so little legacy to deal with	Medium
File server, back-up, DR	Storage-centric applications	Data gravity of users and primary instance being on-prem can introduce latency	Low
Messaging, collab, productivity	Email, collaboration, enterprise messaging, software PBX/voice	Compliance and unique requirements that can only be supported in IaaS	Medium
Web	Web content hosting and serving, web-tier of enterprise and LOB apps	For web tier of on-prem app, can have architectural complexity	Low
Test, dev	Copies of primary workloads and developer tools	Cloud may not be supported in on-prem tools implementation and there may be compliance issues	Low
Security, sys mgmt., DNS	Authentication, proxy server, firewall, ITOM, ITSM	Tends to follow the workloads it secures/manages	Medium

Source: Citi Research

And Core Banking Applications Are the Hardest to Address

While legacy core banking applications have many limitations including complexity, inflexibility and inefficiency, banks are generally wary of large scale core banking replacements or upgrades. Addressing the root problem of modernizing core systems is a daunting and expensive task. Changes such as these could touch every inch of an organization.

Rather, there are things that can be done to tinker around the edges that can have more immediate functionality results. For example, banks can modernize their channels (e.g., digital) and update the user interface layer so there is increased functionality for customers. We see different strategies to address legacy applications amongst our banks—which we discuss below:

■ Banks can choose to update portions of their core banking solutions – Given the cost and complexity of significant overhauls, banks may opt to 'assemble' and 'endure'. By 'assembling,' we are referring to modernizing specific products or processes to gain enhanced functionality. The 'endure' piece refers to the portion of the IT stack that will go unchanged for the foreseeable future.

Decisions can be made on an application-by-application basis – Banks can buy 'off-the-shelf' solutions (SaaS or otherwise) to enhance specific functions. 'Off-the shelf' core banking solutions offer a very standard solution. To the extent that a bank wants or needs to customize, this adds to complexity.

It appears that configuration of a SaaS solution such as nCino may take upward of ~18 months. So while some solutions are considered 'plug and play,' it's worth noting that in some cases it might not be that simple.

■ …or choose to build and/or replace with new solutions – Banks may choose to 'build' or "buy" specific components on a new platform and extract them out of the legacy system. This hollowing out of legacy core banking applications is a riskier proposition in terms of complexity, length of time and cost.

That said, it arguably may have a long-term benefit to the organization as the applications are modernized and customized for the bank's needs. For example, JPM noted in its recent shareholder letter that "most of our digital solutions will continue to be built in-house due to competitive and strategic importance" with the company opting to build applications itself.

■ In terms of cloud investments, we see various strategies – Strategies include building private cloud, leveraging public cloud providers or a combination of the two (hybrid cloud strategy). If we were to make broad generalizations, we would say that we tend to see the most progress on private cloud build-outs more among the larger banks. For the large banks, persistent workloads can be cheaper on a private cloud setting, although we think this math and ROI decisioning changes by bank size.

■ Both core banking systems and application work are being done – While core banking systems are not directly related to cloud, per se, the more modern the systems (loans, deposits, mortgage, etc.), the easier to hook into more modern technology. We are seeing some banks doing core systems work as a means to remain modern— and better position for cloud technology, big data, AI, etc.

We see signs of some banks re-hosting applications onto the cloud. Re-hosting allows for some cost save benefits. Other banks are looking to re-engineer applications to harness the benefits of the cloud (elasticity and scalability). Applications re-engineered into micro-services are more nimble and flexible – and allow for innovation and updates to adapt to changing customer demands.

For the larger banks, re-engineering applications might be the longer-term strategy as some applications are likely so customized that off-the-shelf solutions do not necessarily work for their complex needs.

■ Banks are focusing on consolidation of data silos and integration of data between different applications – Data quality clean-up (governance, common source and re-architecting databases) can help banks be more agile and flexible to adjust along with the technology landscape. This process is labor intensive and manual. We find that banks that have done work on application re-platforming and retooling with APIs are likely to show more meaningful progress towards integrated data.

Interview with Ping An: Jonathan Larsen

About Jonathan Larsen

Jonathan Larsen is the Chief Innovation Officer of Ping An Insurance Group. He is also the Chairman and CEO of the Ping An Global Voyager Fund. Previously, he was the Global Head of Retail Banking at Citigroup and also Head of Consumer Banking in Asia. Mr. Larsen has over 30 years of financial industry experience.

Q: Tell us about the Voyager Fund's first investment: 10X Futures Technology.

10X Future Technologies was set up by Antony Jenkins (ex-Barclays CEO) in 2016. Legacy platforms relying on mainframe systems and many layers of surrounding technology are holding the banking industry back — they are hugely expensive and stifle innovation. Antony and the 10X team have created a new model based on contemporary cloud-based technology and an architecture centered on the customer. Consistent with contemporary SaaS-based models, business users are able to define and create products and processes without relying on technology resources. The platform includes sophisticated, real-time, recursive analytics tools suited to today's digital customer engagement models. Importantly, all data at rest and in transit is encrypted. 10X announced in late 2017 that it had raised nearly £34 million in funding from Ping An Group and Oliver Wyman, amongst others, to support its expansion.

Q: What is the problem with legacy systems?

The cost of creating new products using 10X Technology is a fraction of the cost that banks would pay with their legacy platforms. 10X is offering software to replace the core banking system, the multiple additional product processors operated by many banks, the many customer databases found in most banking architectures as well as middleware platforms, with a single modular but integrated solution. It also replaces the front-end mobile/Internet platforms if need be.

10X is just one example of large scale change likely in legacy platforms at financial institutions.

Q: Does 10X Futures Technologies already have clients?

10X's first client, Virgin Money, signed a major contract in November 2016 to build the technology backbone for Virgin Money's new digital bank. This is part of a broader plan to increase Virgin Money's appeal in the consumer and SME markets through the creation of a data-driven, customer-centric digital offering. The new digital bank will enable Virgin Money to unify its data platforms and offer customers a Universal Account that can be personalized to create a unique proposition tailored to individual needs.

Q: What are some of the other interesting projects you have seen abroad in your travels with the Voyager Fund?

90% of our focus is Global ex-China. We find a lot of innovation in the U.S., Europe and Israel and to a lesser extent in Asia. Silicon Valley/San Francisco, London, Continental Europe (especially Germany) and Israel present a lot of opportunities in the FinTech and digital health segments.

Singapore is still emerging as a FinTech hub, it is going to take time. They now have some 400 FinTech-related companies. That is good, but it will take time to build depth. A lot of Asia cross-border investments today are market access plays rather than core innovation plays.

Given the breadth of Ping An's businesses, we cover a very broad range of business sectors and technologies. So far, we've seen a lot of interesting investment opportunities in the B2B space, more so than the B2C challenger sector. But there are opportunities in both the B2B and B2C segments today.

Q: Most financial institutions are happy being reactive. What drives this mindset — is it the costs and that the return on investment is not that big or is it the culture?

Contemporary technology offers enormous opportunities to reduce friction, lower the cost of delivery and to improve customer experience. It is remarkable how slow much of the financial industry has been in taking advantage of these opportunities. Legacy gridlock is certainly one reason. Caution engendered by the post global crisis regulatory environment is likely another. While every major institution has some level of "agile" digital development and many are investing, as are we, in new generation financial enterprises, in very few cases has this penetrated to the core of the business. In the short term it would seem that the market often rewards cost optimization and return of capital over innovation and investment in future revenues.

All of this needs to change. The pace of innovation and the collective effect of the FinTech revolution are accelerating. Some institutions take comfort from the rise of B2B service providers, believing that FinTech represents an enabler for traditional players rather than a competitive threat. A different take is that the "B2B" FinTech sector actually represents the virtualization of the infrastructure of the financial industry and represents a massive lowering of entry barriers for new kinds of financial service providers and the embedding of financial services into a wide range of ecosystems not controlled by the financial industry.

I think we will see an increasing divergence between banks and other financial providers who embrace this new world at a fundamental level and those who are content to become commodity providers of regulated services with lower and lower margins and legacy costs. For the latter the future will be grim.

Q: What sets Ping An apart from other financial institutions?

It starts with being a founder-led company — a consistent customer-centered vision, a comfort with fundamental change as a way of doing business, and the embracing of technology as the core of what we do. Ping An has no mainframe computers and no legacy platforms. The firm invests $1 billion a year in R&D including extensive AI capabilities in areas ranging from facial recognition, voice print recognition, and many business-specific applications in insurance, banking, consumer credit, personal wealth management. These factors form a uniquely powerful combination with Ping An's massive scale, with over 150 million financial customers and 430 million digital users across the group.

It is important to create conditions where experimentation can be done on a significant scale. Ping An has a willingness to create new models and is not afraid of change. There are few if any financial institutions in the world capable of repeatedly creating new businesses such as Lufax, Good Doctor or One Connect. Ping An has these and many more at various stages of incubation and development.

Ping An tries to create a constant sense of crisis. Managers are encouraged to constantly re-think how existing activities can be better performed and how technology can be applied to customer problems in new ways.

Chapter D: Digital Assets

Cryptocurrencies have created a market buzz in recent months, with 2017 arguably the year of cryptocurrencies in popular culture. Prices of bitcoins increased 14x in 2017, Ethereum 100x and Ripple 350x (albeit the latter two started from a lower base price) – driven by rising retail investor interest, especially in Asia and America; significant global media coverage; increasing institutional involvement including CBOE / CME bitcoin futures; and increased digital token sales, amongst others.

Total market capitalization of all crypto combined scaled $660 billion in 2017 and despite price fluctuations in 2018, stands at $450 billion in March 2018. This chapter looks at – Why cryptocurrencies matter? What is the market share of major crypto-coins? Where are they traded? Rising regulatory issues? And also importantly we look at the major applications in the financial sector of the underlying blockchain technology.

The first question around cryptocurrencies is whether they should be defined as a currency or a commodity. Regulators and market experts remain divided on whether cryptocurrencies should be treated as a currency or commodity.

As the SEC Chairman Jay Clayton noted on December 11, 2017 – "Simply calling something a "currency" or a currency-based product does not mean that it is not a security .... It has been asserted that cryptocurrencies are not securities and that the offer and sale of cryptocurrencies are beyond the SEC's jurisdiction. Whether that assertion proves correct with respect to any digital asset ... will depend on the characteristics and use of that particular asset." (link to statement).

A currency is classically defined as:

1. **Unit of Account** – provides a unit of measurement to define, record and compare values.

   Due to rapid appreciation and high volatility cryptocurrencies are obviously unreliable as a unit of account over a period of time. Importantly, the so-called 'kimchi premium', as well as other smaller but persistent valuation mismatches between exchanges, makes them poor units of measurement to define, record and compare values.

2. **Medium of Exchange** – represents a standard of value which is acceptable by all parties and exchangeable for goods and services.

   Cryptocurrencies can be used for this purpose worldwide and have legal status in Japan. But, utility is low compared to the utility of the local fiat currency and charges for use are often high.

3. **Store of Value** – maintains its value without depreciating (can be saved, retrieved & exchanged at a later time with the expectation that it still has value).

   Over a suitable period, major cryptocurrencies have historically been better than a store of value and have gained remarkably against fiat crosses. However, short-term volatility as well as large charges in conversion to-&-from fiat are challenges to this role, particularly if future gains are less spectacular.

Bitcoin, Blockchain and All Things Crypto

If the Internet is a disruptive platform designed to facilitate dissemination of information, then Blockchain technology is a disruptive platform designed to facilitate exchange of value.

Blockchain is a distributed ledger database that uses a cryptographic network to provide a single source of truth, thus allowing untrusting parties with common interests to co-create a permanent, unchangeable, and transparent record of exchange and processing transactions without relying on a central authority.

Figure 79. Attractions of Blockchain Offering
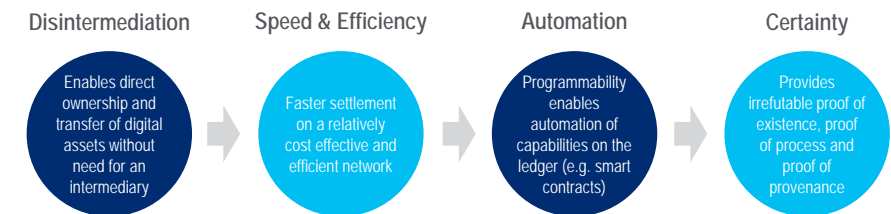
Source: Citi Research

In contrast to a traditional payment model where central clearing is required to transfer money between the sender and the recipient, Blockchain relies on a distributed ledger and consensus of the network of processors, i.e. a super majority is required by the servers for a transfer to take place.

For libertarians, Blockchain has a clear advantage relative to the current system as it enables direct transfer of digital assets without the need for an intermediary or a centralized authority. The Blockchain also allows smart contracts/tokenization that can automate and execute pre-agreed conditions once they are met.

Figure 80. Blockchain's Distributed Ledger Model has the Potential to Take Steps, Time and Cost out of Financial Flows
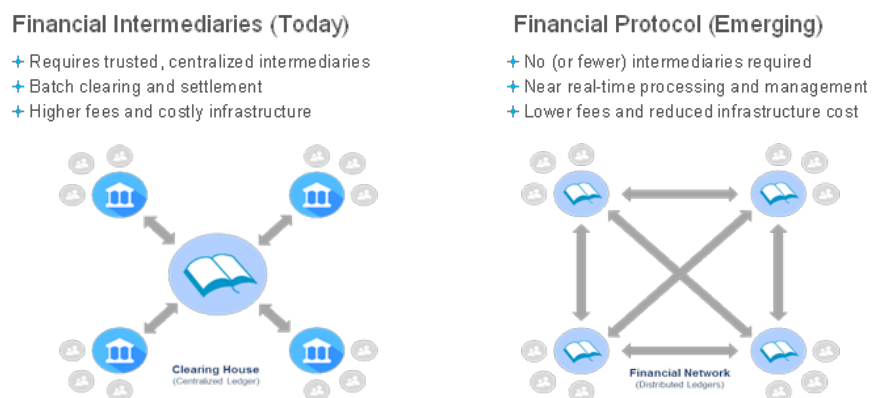
Source: Citi Research

Bitcoin (the first cryptocurrency using blockchain technology) was first presented in a 2008 white paper, by Satoshi Nakamoto, entitled "Bitcoin: A Peer to Peer Electronic Cash System". According to Satoshi Nakamoto, an electronic coin is a chain of digital signatures. Each owner transfers the coin to the next by digitally signing a hash of the previous transaction and the public key of the next owner and adding these to the end of the coin.

Abstract from the Nakamoto paper:

"A purely peer-to-peer version of electronic cash would allow online payments to be sent directly from one party to another without going through a financial institution. Digital signatures provide part of the solution, but the main benefits are lost if a trusted third party is still required to prevent double-spending.

We propose a solution to the double-spending problem using a peer-to-peer network. The network timestamps transactions by hashing them into an ongoing chain of hash-based proof-of-work, forming a record that cannot be changed without redoing the proof-of-work.

The longest chain not only serves as proof of the sequence of events witnessed, but proof that it came from the largest pool of computer processing unit (CPU) power. As long as a majority of CPU power is controlled by nodes that are not cooperating to attack the network, they'll generate the longest chain and outpace attackers".

Figure 81. Illustrative Diagram of a Peer-to-Peer Electronic cash System
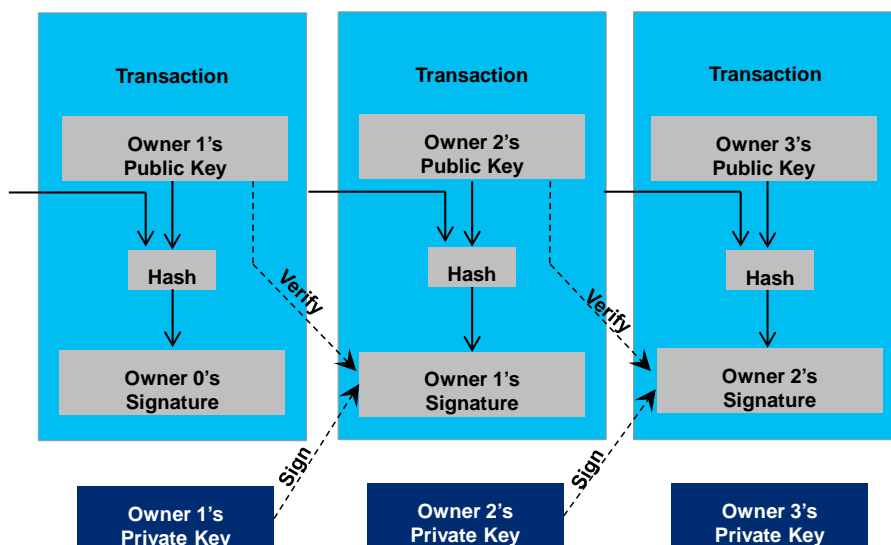
Source: Bitcoin.org, Citi Research

Internet vs. Blockchain Financial Value Capture

Blockchain is often described as "the Internet of Value", a new overlay on the underlying Internet or "the Internet of Information". An economic difference between the Internet and Blockchain, at least for now, is that the financial value capture in the latter is in the protocols and not the application layer.

In the Internet of Information, hugely valuable private companies have been created which are amongst the largest in the world such as Google ($810bn mkt cap). In the Internet of Value, the underlying protocols such as Bitcoin and Ethereum have become valuable. Bitcoin has a market value of around $190 billion, followed by Ethereum at around $80 billion. By contrast, up to now, the value of the individual companies developing blockchain use cases remains small: the total amount of venture capital funding is $2.1 billion

This framework about thinking about blockchain value was coined by Joel Monegro of Union Square Ventures (August 2016) and is a good starting point for discussion – albeit it has led to considerable debate ever since.

Figure 82. Market Cap. Comparison of BigTech Companies vs. Cryptocurrencies

Figure 83. Number of Blockchain VC Fundings and Dollars Raised
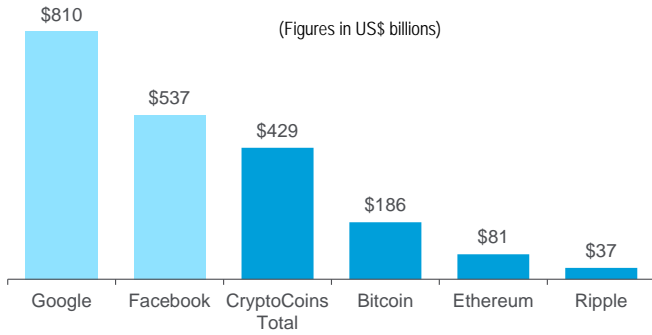
Source: Reuters, CoinDance, Citi Research; Price data as of 13 Mar. 2018
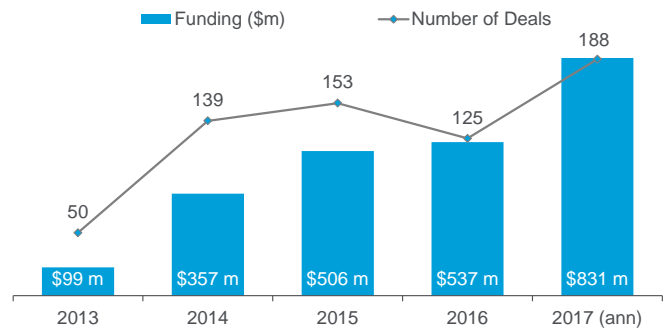
Source: CB Insights, Citi Research

2017: The Year of Crypto

Cryptocurrencies truly took-off in 2017 with growing general public and media interest, clearly evidenced by the sharp rise in Google searches for the term 'Bitcoin'. Interest was highest in emerging / frontier markets, including several in Sub-Saharan Africa, as well as in developed markets such as Singapore.

One pillar for the popularity of bitcoin is its anonymity. The informal sector has therefore been both a significant user and an early adopter of Bitcoin. As with Google search data, Bitcoin trading volume shows some evidence that the larger the informal economy for a country, the larger is its market share in bitcoin trading.

Figure 84. Google Search Result Trends Globally for the term "Bitcoin"
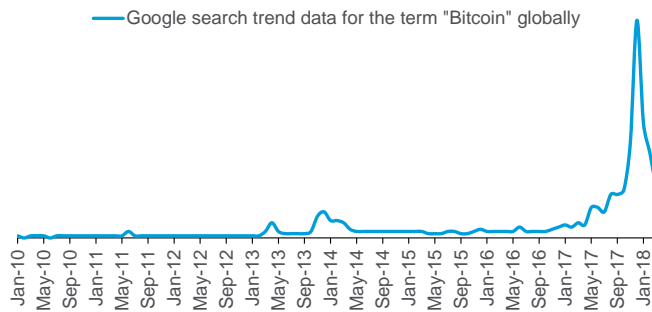
Figure 85. Top 30 Regions With Highest Google Search Result Trends for the Term "Bitcoin"

Source: Google Trends, Citi Research
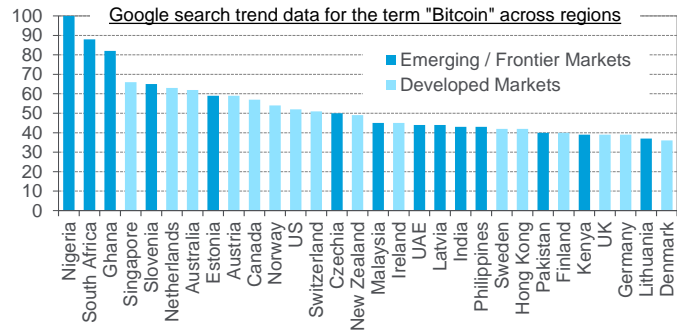
Source: Google Trends, Citi Research

During 2017, several cryptocurrency prices rose dramatically – Bitcoins were up 14x, Ethereum 100x, Ripple XRP 350x, and Litecoin 50x. The rapid increase has been driven by: (1) increased retail investor interest in Asian countries such as Japan and South Korea and also in the U.S.; (2) general media interest including emerging markets (see Google search trends); (3) increasing institutional investor and private bank client interest, including the launch of CME/CBOE futures on Bitcoins; and (4) technical factors, such as delayed forks.

Figure 86. Major Cryptocurrency Prices in 2017-18, US$
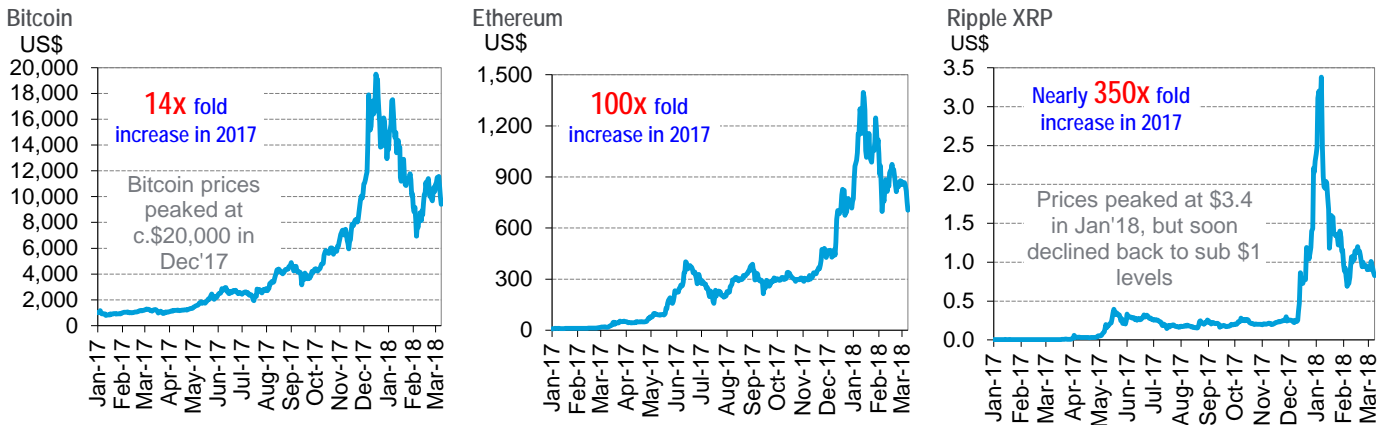
Source: Coinmarketcap, Citi Research (all charts)

There are close to 1,400 different cryptocurrencies trading globally with the total market value of widely traded cryptocurrencies at approximately $400 billion, which is substantially lower than their peak of ~$650 billion in January 2018. Interestingly, Bitcoin's dominance in the global market value has steadily decreased from ~90% in January 2017 to ~40% in March 2018.

We believe this partly reflects the larger effect that flows into smaller currencies have had, as well as the growing awareness and dissatisfaction with the flaws in the design of Bitcoin itself. In the current market pie, Ethereum holds ~20% share, followed by Ripple XRP ~10% and Bitcoin Cash 5% (subset of the original bitcoin, created after a fork on August 1, 2017).
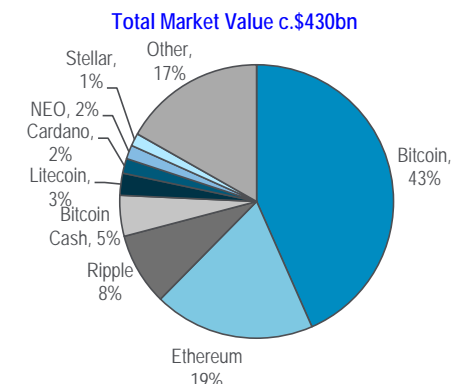
Figure 87. Cryptocurrency Market Share by Value, USD
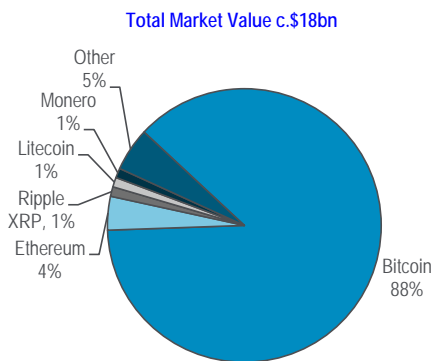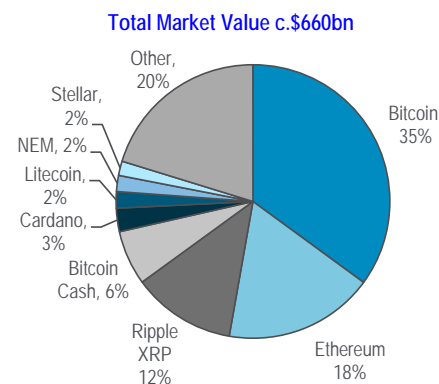
Source: CoinDance, CoinMarketCap, Citi Research

Who is Buying Bitcoins?

Nearly 70% of all Bitcoin trades are denominated in U.S. dollars (USD), followed by Japanese yen (JPY) and euros (EUR) with about 10% each. China used to be a major market for crypto-trading and at its peak in 2016, commanded over 90% of all trading volumes. However a regulatory clampdown on virtual currencies and ban on digital token sales (ICOs) in 2017 have now wiped out Chinese yuan (CNY)-denominated trading in Bitcoins.

Figure 88. Bitcoin Trading Volume Mix by Currency
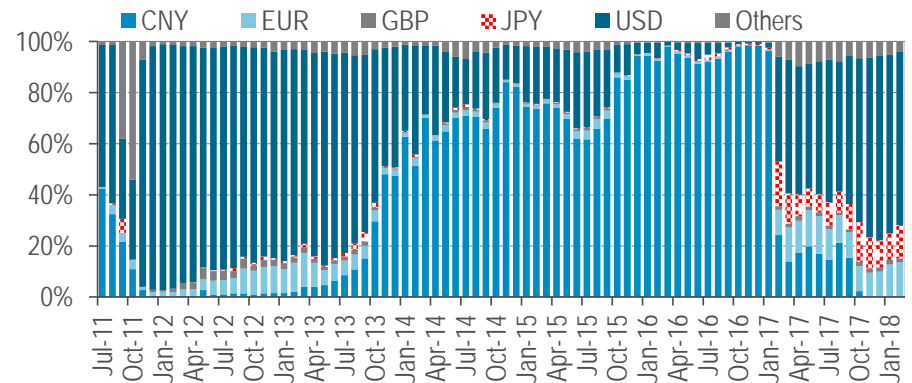
Based on monthly trading volumes in BTC across all exchanges.
Source: Bitcoinity, Citi Research

Cryptocurrency trading tends to be executed on a crypto exchange, but some trading also takes place through the over-the-counter (OTC) market. In the early years, Mt Gox (based in Japan), dominated nearly all trading done via exchanges; but after its collapse in 2014, several new exchanges have emerged with arguably better security. Bitfinex, GDAX, Bitstamp and bitFlyer are some of the prominent Bitcoin exchanges based on volumes.

Figure 89. Top 15 Bitcoin Exchanges (Past 6 Months)

	Exchange	Currency	Volume (BTC)	Trades per minute
1	Bitfinex	USD	10,716,727	97.2
2	GDAX	USD	4,095,641	70.7
3	Bitstamp	USD	2,989,973	33.0
4	bitFlyer	JPY	4,029,388	73.1
5	Kraken	EUR	1,814,145	28.8
6	Kraken	USD	1,109,437	18.5
7	Bitcoinde	EUR	166,516	2.8
8	HitBTC	USD	1,028,382	22.7
9	Bit-x	GBP	240,226	1.3
10	Bitstamp	EUR	700,653	15.8
11	GDAX	EUR	702,695	34.5
12	CEX.IO	USD	375,991	13.4
13	itBit	USD	507,418	3.7
14	Bit-x	USD	290,479	0.9
15	CEX.IO	EUR	37,573	1.7

Source: Bitcoinity, Citi Research; # ranked based on volume, calculated as sum of BTC traded on exchanges over last 6 months (latest data as of 09 Mar. 2018).

2018: The Year of Second-Layer Protocols?

Although there are relatively few 'real-world' places to spend Bitcoin, congestion on the BTC network is currently impairing its utility by raising transaction costs and reducing completion times. Operating close to its maximum of 5-7 transactions a second (tx/s), fees have risen as a percentage of each transaction. As it is less congested, transaction fees for the Ethereum blockchain are significantly lower. However, the Ethereum network is still limited to only 20 or so tx/s; as this limit approaches, we think that fees will rise and utility decline.

Figure 90. BTC Transactions Per Day, 7-day Rolling Average
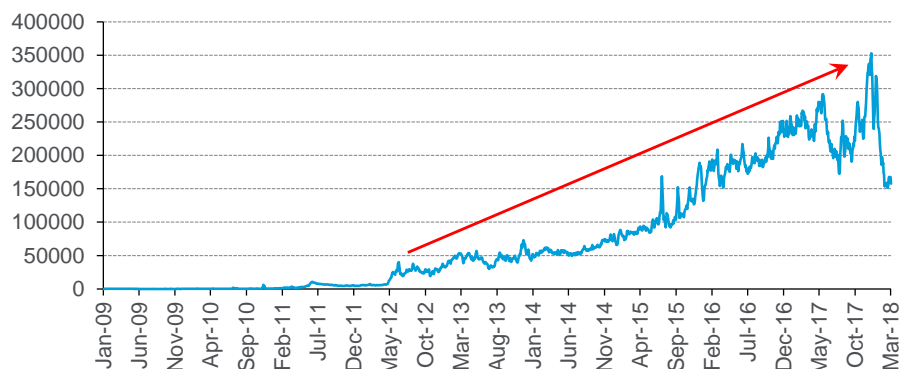
Source: Blockchain.info, Citi Research

A solution to this is simply to increase the blocksize, allowing the network to handle more transactions in a given period. However, to act as a means of payment for 7.5 billion people, a crypto-asset blockchain would have to grow by 2 terabyte (Tb) a day simply to record the volume of transactions required.

The 'step-up' in block size and blockchain growth rate would prevent amateur enthusiasts from running their own nodes and would result in large miners taking control over both the mining of blocks and the verification of transactions. In addition, these transactions would still be subject to a delay in verification (currently an hour on the BTC network) before a purchase could be considered 'settled'.

The first of these is anathema to many in the crypto community and the second is impractical for retail transactions. While using the existing payments infrastructure (with cryptocurrency denominated accounts held at third parties) is a solution to the second issue, this fails to meet the level of decentralization espoused by hard-core crypto-asset enthusiasts.

For this demographic, the most proximate solution is a second-layer of protocols which promise quick, secure, low-cost, peer-to-peer transactions 'off blockchain'. The two most prominent systems under development are the Lightning Network (for BTC and LTC) and Raiden (for ETH). We expect second-layer protocols to become a widespread reality in 2018.

Arguably, there are downside risks in the event of any botched implementation. While some live tests have been conducted, the Lightning Network and Raiden are still very much a work in progress. The complexity associated with the project creates a greater attack surface for malicious actors and, more simply, for unexpected faults to crop up.

Even in the event of a successful roll-out, critics point to worries about the possible emergence of large hubs. Although these may be necessary to allow short paths between users, there are fears that this will lead to a centralization of control of the system.

Interview with PwC FinTech & RegTech: Henri Arslanian

About PwC – FinTech and RegTech Team

PwC's purpose is to build trust in society and solve important problems. It offers services focused on audit and assurance, tax and consulting services with its presence in 158 countries.

About Henri Arslanian

Henri Arslanian is the PwC FinTech & RegTech Lead for Hong Kong. He is also an Adjunct Associate Professor at the University of Hong Kong where he teaches the first FinTech university course in Asia. He is the Chairman of the FinTech Association of Hong Kong, a TEDx speaker, a published author, and has been awarded many industry / academic awards over the years. Before joining PwC, Henri was with a FinTech start-up and UBS. Henri started his career as a financial markets and funds lawyer in Canada and Hong Kong.

Q: What are the main drivers of Bitcoin price volatility in recent months?

Bitcoin has seen a strong surge in prices in 2017, particularly led by increased interest from retail investors. In fact there has been a lot of market buzz not just around investors looking to buy Bitcoins but also from first-time investors looking for basics on how to open a trading account and execute trades – notably, more than 300,000 new accounts were opened by investors with a single large U.S. exchange during the Thanksgiving week alone.

On the other hand, there is also increased interest from institutional investors taking their early steps into cryptocurrencies and I believe there is still significant room for more growth, particularly from family offices and hedge funds. Breaking it down by geography, Asia seems more active in cryptocurrencies with increased momentum, backed by favorable regulatory responses from countries such as Japan.

Q: What are some of the aspects we need to look-out for in the crypto and ICO space in the coming months?

2017 may be remembered as the Year of Cryptocurrencies – where cryptocurrencies moved from being a toddler to a preschooler. And we are all expecting more growing up in 2018! Some of the areas I am paying attention to in the coming months include:

■ **Evolving regulatory landscape globally** and especially regulatory enforcement cases that may take place. There are a lot of bad apples in the ICO space for example and I expect regulators to launch enforcement cases not only to set the example for the industry but because there are a lot of low hanging fruits.

■ **Rise of "institutional" grade solutions** to cater for the increasing interest from institutional investors. There is currently a gap in the market across the crypto spectrum from exchanges to custody solutions catered to institutional investors.

■ **Continuous maturing of the ICO / token sale space** – where we see not only the continuous development of industry lead best practices but also the industry gradually moving into the regulated space. I also expect to see increasingly asset backed/security tokens compared to utility tokens.

- **Increased interest from tax authorities** – not only to provide clarity on some of the grey areas from a tax perspective but in many cases to try to ensure that investors who have made gains on crypto trading pay the required amount of tax.

Q: How are you seeing the ICO market change?

The ICO market has changed a lot in the past 6-9 months and I expect this to continue in 2018. We have seen the emergence of best practices in the ICO space from KYC and AML processes to governance and transparency standards. I expect this trend to continue, not necessarily driven by regulations but rather industry best-practice initiatives – the recent ICO best practice document from the Hong Kong FinTech Association being a good example.

I also expect that we will see more asset backed and security tokens. However, there are still a number of challenges with asset backed tokens from uncertainty around tax to the right controls and governance around guaranteeing their asset backed nature. There are many people working on these issues but we still are far from the final solution.

Q: Which are the preferred jurisdictions for ICO issuances?

I see interest from companies around the world in doing ICOs. However many are preferring using jurisdictions like Switzerland, Delaware, Hong Kong, or Singapore to conduct their sale for a multitude of reasons including ease of doing business, tax, maturity of ecosystem, availability of talent, experience of service providers, etc.

However, I still see many entrepreneurs who are naive and believe that by just conducting their ICO using an offshore entity, they will not need to pay any taxes. This is obviously very simplistic as many other factors need to be considered like the location of senior management or where decisions are taken. Once again, this is an area I would expect some enforcement as there are a lot of low hanging fruits.

Q: What are the risks / concerns you see in the crypto space?

The crypto world is not immune to business risks. For example, like in the traditional "start-up" space, many, if not most, of these ICO projects will fail. I think that one of the biggest risks in the ICO space are the bad apples i.e., people trying to make a quick buck and often resorting to fraudulent tactics. For example, many ICOs have to deal with a series of fake impersonators setting up fake websites or launching fake telegram channels that resemble the real ICO issuing company. These fraudsters are very clever and sophisticated and, unfortunately, often successful.

There is also a segment of the ecosystem that does not have the institutional or best practice mindset and may not focus on topics like KYC and governance or don't get the appropriate type of legal and regulatory advice. Such teams often end up giving a bad name to the broader ecosystem.

On a more macro level, I am always worried about the risk of cyber-attacks particularly against crypto exchanges. Whilst some of the "sophisticated" investors are familiar with the counterparty and security risks that crypto exchanges may pose, I don't think that the majority of retail investors understand that risk. The risk of a big cyber-attack or a similar black swan event is real and can be a major setback for the crypto community.

Q: What about crypto funds and crypto exchanges?

We are definitely seeing the rise of crypto funds, both active and passive. What is really interesting is that we are seeing many of the best practices developed in the hedge fund world, from corporate governance to investor reporting, start being used by crypto funds. Many of the individuals launching crypto funds are former traders, portfolio managers or analysts from "traditional" hedge funds and it is normal that they are building these new businesses with the same institutional mindset they had in their previous life. There are however still many grey areas, from tax to custody, where there are no clear answers or solutions yet but I am confident the ecosystem will find ways to address these.

We are also seeing the same trend when it comes to crypto exchanges. Many of the existing exchanges grew very quickly and did not have the time to focus on making their offering suitable for institutional investors. I expect many new players to look at covering this gap in the coming months. So should be an exciting 2018 in cryptoland!
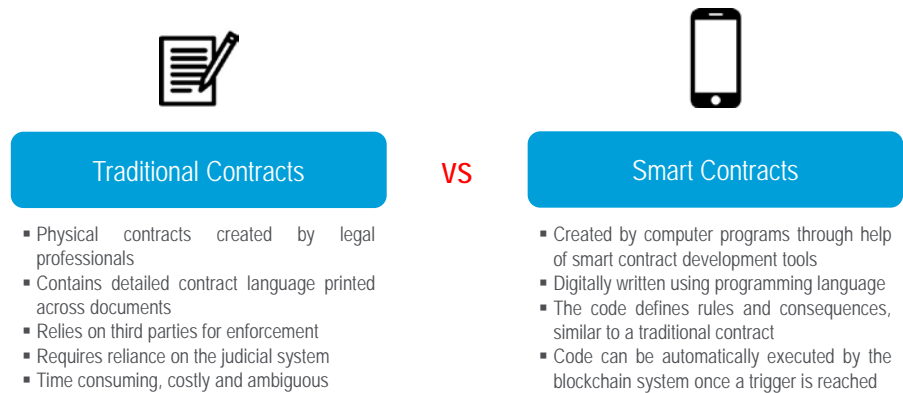
Blockchain Applications

Arguably most cryptocurrencies are currently bought and sold with the intent of trading or speculation. Nonetheless there are also several applications of the underlying blockchain technology emerging; such as: (1) use of Ethereum for building decentralized applications that can be automatically validated and executed according to their encoded rules; thus making them ideal for applications such as smart contract and managing identity (KYC-Chain); (2) use of Ripple RTXP for real-time gross settlements, ideal for some types of cross-border payments; and (3) implementations in AML systems.

A.] The Power of Smart Contracts

What are Smart Contracts? Contracts entered between two or more individuals, written as a code into blockchain public ledger. Smart contracts are automated and are able to execute / enforce themselves automatically on reaching a trigger event (such as expiration date or a strike price) according to coded terms.

Smart contracts are executed on Ethereum blockchain as it supports a broader set of computational instructions including triggering data reads and writes, do expensive computations like using cryptographic primitives, make calls (send messages) to other contracts. Smart contracts allow developers to program their own smart contracts or 'autonomous agents' that can: (1) function as 'multi-signature' accounts, so that funds are spent only when a required percentage of people agree; (2) manage agreements between users; (3) provide utility to other contracts (similar to how a software library works); and (4) store information about an application such as domain registration information or membership records.

Figure 91. Traditional Contracts vs. Smart Contracts

| Traditional Contracts	VS	Smart Contracts
▪ Physical contracts created by legal professionals ▪ Contains detailed contract language printed across documents ▪ Relies on third parties for enforcement ▪ Requires reliance on the judicial system ▪ Time consuming, costly and ambiguous		▪ Created by computer programs through help of smart contract development tools ▪ Digitally written using programming language ▪ The code defines rules and consequences, similar to a traditional contract ▪ Code can be automatically executed by the blockchain system once a trigger is reached

Source: Citi Research

Smart contracts can be used to help:

■ Streamline post-trade processes in derivatives;

■ Facilitate automatic payment of dividends, stock splits and liability management while reducing operational risks;

■ Initiate letter of credit and trade payments in trade finance;

■ Automate land title recording and facilitate property transfers; and

■ Automate renewal and release processes of records.

B.] KYC-Chain and Digital Identity

Built over the distributed ledger, KYC-chain allows individuals and companies to securely manage their identity – users own the key to their personal data and identity certificates, choosing which information is to be shared with whom. KYC-chains can also help financial institutions ease the process of onboarding new customers by eliminating manual paper-entries, making it convenient to handle enormous datasets and ensuring compliance of regulatory standards.

Figure 92. KYC Blockchain
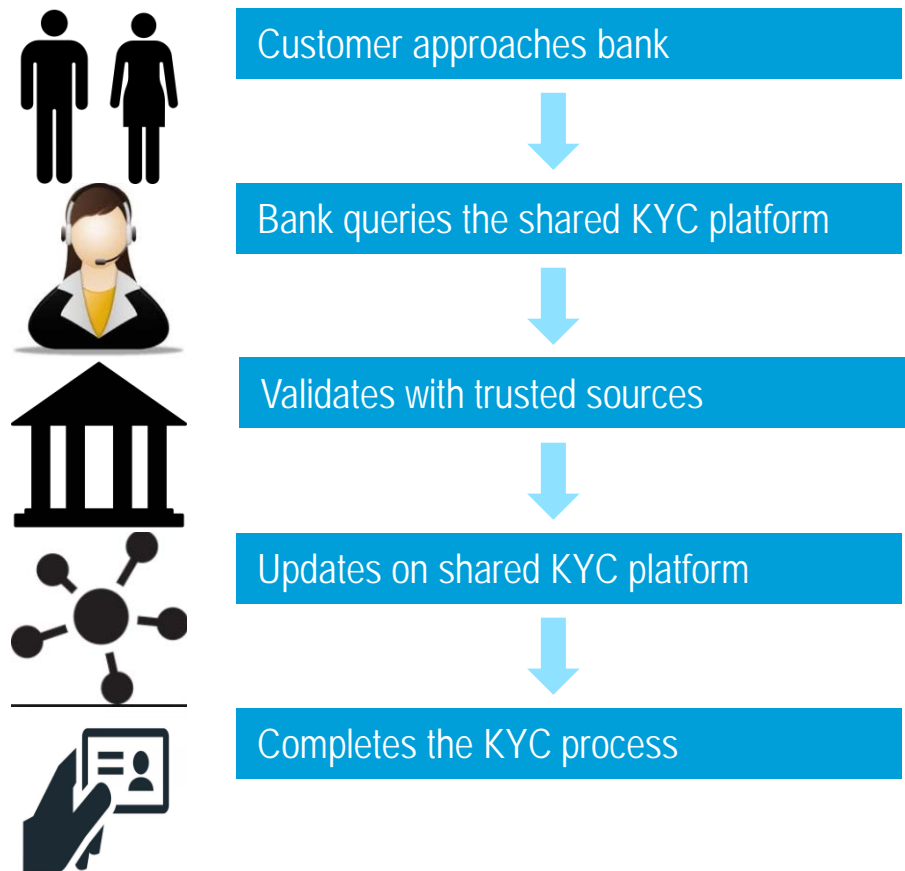
Source: Citi Research

Recently, banks in Singapore (OCBC, HSBC and MUFJ), together with the Infocomm Media Development Authority (IMDA), completed testing a prototype blockchain-shared KYC platform that allows banks to record, share and access customer information in a single platform, protected with cryptography. Encrypted customer information can also be validated by other govt. registries, tax authorities and credit bureaus.

C.] Reg-Tech

Regulatory Technology (RegTech) is leveraging new technologies to improve regulatory reporting, monitoring as well as compliance processes for financial institutions. The area has been gaining prominence as banks attempt to keep up with new regulations, KYC / AML norms and are looking for ways to be more efficient.

Notably, blockchain technology can help improve data security, digitize manual processes, verify authenticity of customer onboarding documents and improve speed/accuracy of regulatory reporting.

Figure 93. RegTech Annual Global Financing (US$m)
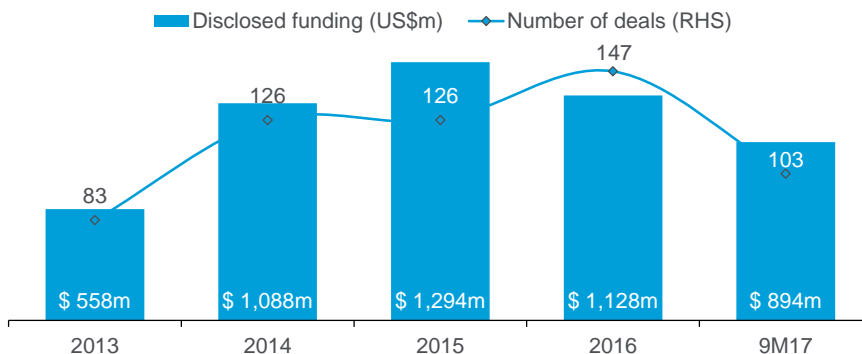


Source: CB Insights, Citi Research

Global VC-backed funding into RegTech companies over the past 5 years has reached nearly $5 billion, spread over 585 deals. In the first nine months of 2017, RegTech startups have seen 103 deals with total funding of $894 million. This translates to $1.2 billion at an annualized pace. Banks such as Santander, Barclays and Goldman Sachs are seen actively making investments in RegTech, particularly for identification and background checking software, blockchain and trade monitoring.

D.] ICOs – A Risky New Paradigm?

An ICO (Initial Coin Offering) is a fundraising mechanism which gives investors participation rights in a future project via newly issued tokens or digital coupons (new crypto-currencies) in exchange for legal tender or existing, more liquid crypto-currencies such as Bitcoin or Ethereum. The token confers participation rights in the underlying project but usually no ownership rights in the company.

Figure 94. Total Amount Raised via ICO Offerings
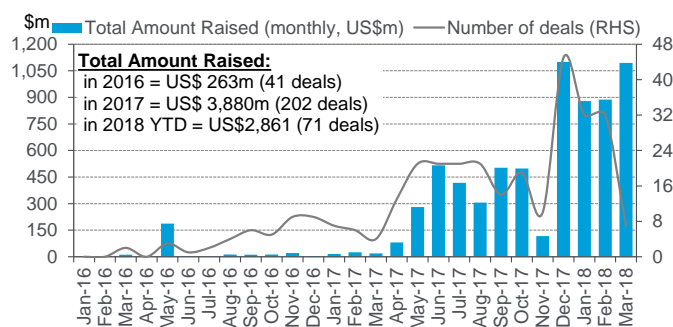
Source: CoinSchedule, Citi Research

Figure 95. Initial Coin Offerings by Category, 2017
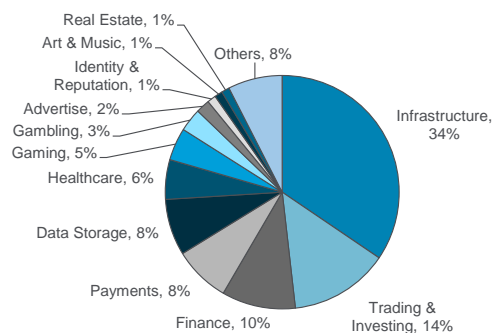
Source: CoinSchedule, Citi Research

ICO's emerged as a material source of early stage funding in 2017 with total issuances of close to $4 billion, spread over 200 deals during the year ($3 billion issued in 2018 YTD over 71 deals). Nearly a third of all ICO funding raised in 2017 was for infrastructure-related companies, followed by trading and investing firms (14%). The finance sector accounted for ~10% of funds raised via ICOs in 2017.

Regulatory approach to ICOs differ significantly across countries

FINMA, the Swiss Financial Market Supervisory Authority, has said (link) that in assessing ICOs it will focus on the economic function / purpose of the tokens and whether they are already tradeable or transferable.

FINMA's analysis indicates that money laundering and securities regulation are most relevant to ICOs; whereas projects that would fall under the Banking Act (governing deposit-taking) or the Collective Investment Schemes Act (governing investment fund products) are not typical.

At present, the classification terminology of ICOs/tokens is evolving, but FINMA categorizes tokens into three types which we believe is a useful framework that many market participants and policy makers will increasingly adopt:

- **Payments tokens** – synonymous with cryptocurrencies and have no further functions / links to other development projects. In this case, FINMA requires compliance with anti-money laundering regulations and such tokens will not be treated as securities.

- **Utility tokens** – intended to provide digital access to an application or service. Ordinarily these tokens do not qualify as securities if their sole purpose is to confer digital access rights to an application/service. However, if the tokens function as an investment in economic terms, they will be treated as securities.

- **Asset tokens** – participations in physical assets, companies, earnings streams, or an entitlement to dividends/interest; similar to equities, bonds or derivatives and applicable to securities law requirements.

Below are some of the regulatory guidelines on ICOs issued by different countries:

- **China** – PBOC announced all ICOs to be considered illegal and disruptive to economic and financial stability, putting a halt to all fund-raising activities.

- **Europe** – ESMA states wherever ICOs qualify as financial instruments, firms involved need to comply with relevant legislation (incl. MiFID and AML laws).

- **Hong Kong** – SFC highlights where sale of digital token falls under definition of 'securities', dealing in or advising on such digital tokens will constitute a regulated activity and engaging parties must be registered with the SFC.

- **Japan** – The FSA has clarified that while there are no specific laws on ICOs, they may fall within the scope of the Payment Services Act and Financial Instruments and Exchange Act laws. FSA has warned investors on possible ICO-related risks.

- **Singapore** – MAS released guidelines on digital token offerings (in Nov. 2017) explaining the application of securities laws to these offerings with case studies.

- **South Korea** – FSC issued a complete ban on ICOs, margin trading; a few days after a similar ban imposed by China (Bloomberg)

- **United Kingdom** – FCA stated in Dec. 2017 that it will gather further evidence to check if more is needed beyond the consumer warning issued in Sept. 2017.

- **United States** – SEC ruling on token sales states that U.S. securities laws would apply to offers, sales and trading of interest in virtual organizations. The report confirms that issuers of blockchain technology-based securities must register such securities unless a valid exemption applies.

Regulatory Approaches to Bitcoin

The regulatory definition for bitcoin is unclear and varies across countries. We believe depending on the use-case for bitcoin, different regulations are likely to be applied. For instance in remittances and money transfer, bitcoins are likely to be categorized as a currency, and therefore subject to anti-money laundering (AML) laws. On the other hand, bitcoin as a commodity would be subject to tax laws.

■ **Japan** – Government recognized bitcoin as a valid payment method in Apr. 2017 and required crypto-currency exchanges to register with regulators. In Sep. 2017, the FSA officially licensed 11 new operators of crypto-currency exchanges. After the recent hack on Coincheck, the FSA has also stepped up on-site inspections on cryptocurrency exchange operators to check for vulnerability.

■ **Switzerland** – FINMA states that bitcoin operators and virtual currency platforms are subject to the AML Act and must therefore be a member of one of the self-regulating organizations or be regulated by FINMA. Regulators also introduced a regulatory sandbox to promote FinTechs including bitcoins.

■ **US** – The U.S. Commodity Futures Trading Commission (CFTC) ruling in 2015 defines crypto assets as commodities. In 2017, the CFTC also approved the first federally regulated digital currency options exchange / clearing house for cryptocurrencies. CFTC published a primer in Oct. 2017 on virtual currencies, explaining that the structure of the token will determine classification as security/commodity. CFTC also published a backgrounder in Jan. 2018 outlining the oversight and approach to the virtual currency futures market.

Elsewhere globally, bitcoins are still in a grey area, with some countries like China, South Korea and Russia banning them to varying degrees; whilst others are still working on possible regulations.

■ **Australia** – The govt. has proposed a set of reforms to bring digital currency exchanges under the remit of the Australian Transaction and Reporting Analysis Centre (AUSTRAC) as a way to regulate exchanges (link).

■ **China** – Regulators have termed ICOs as unauthorized and halted all fundraisings (link). In addition, regulators are also contemplating a ban on Bitcoin and other virtual currency trading on domestic exchanges (link).

■ **European Union** – Issued warnings on the risk of investing in virtual currencies and indicated that AML and anti-terrorist financing rules will apply. Recently, EU finance head Valdis Dombrovskis warned that EU will regulate cryptocurrencies if the risks associated are not tackled (link).

■ **India** – Reserve Bank of India currently working on policy for crypto-currencies including Bitcoins and is exploring a possibility of issuing its own fiat crypto-currency (link). In a press release in Dec. 2017, RBI has cautioned users, holders and traders of virtual currencies including Bitcoins (link).

■ **South Korea** – FSC banned all forms of ICOs and the practice of loaning funds to trade cryptocurrencies (i.e. margin trading). In a recent move to curb speculation in cryptocurrencies trading, the FSC announced that it will ban virtual currencies traders from using anonymous bank accounts (link).

■ **United Kingdom** – Bitcoin is currently classified as a private currency. In Dec. 2017, FCA said in a press release that it is monitoring DLT-related market developments and keeping its rules and guidance under review.

Interview with King & Wood Mallesons: Urszula McCormack

About King & Wood Mallesons

King & Wood Mallesons, founded in 1993, is an international law firm based in Hong Kong with a team of over 2000 lawyers in 27 locations. The firm's practice areas include banking and finance, competition and antitrust, corporate and mergers and acquisitions, employment law and industrial relations amongst others.

About Urszula McCormack

Urszula McCormack is a Partner at King & Wood Mallesons. She is a financial regulatory specialist based in Hong Kong primarily focusing on financial technology and financial crime. Urszula's key areas of expertise include financial services licensing, digital assets/stored value facilities, payments/remittance systems, digital banking platforms and AML/CFT sanctions; and she has played a significant role in developing the Hong Kong AML/CTF framework with the Hong Kong Association of Banks. Urszula is an ACAMS Certified Anti-Money Laundering specialist and is admitted to practice law in HK, England & Wales and New South Wales (Australia).

Q: Let's talk about ICOs. Your firm is involved in a couple of dozen ICOs in Hong Kong. So, are ICOs a fad or the future of investing?

It is an interesting question, as there is a lot of debate out there about whether or not tokenization is a bubble or whether it is here to stay. I think what we are talking here is a much broader question of the digitization of value – capturing it, shaping it, sharing it and even regulating it in new ways.

Blockchain and smart contracts have created a perfect storm of sorts, because they enable you to capture and transact almost anything, in a really efficient way.

Many ICOs relate to digital software rights (like a voucher system); some effectively power large platforms (like Ethereum and other new protocols), while others just operate as a medium of exchange (like bitcoin). You can even use blockchain to represent regular things like loyalty points and certain rewards. What is fundamentally new, however, is the liquidity in these types of digital assets. This is adding a new dimension to the economy. It will undoubtedly stay, but the shape of it is certain to evolve.

Q: Do ICOs replace VC investing? Are they a threat or a complement to VC investing?

ICOs have become an extremely popular way to crowdfund very early stage projects. We know that they have overtaken venture capital funding in terms of quantum – for example, recent estimates suggest that they have delivered over three times more capital to blockchain startups than VCs.

However, there are genuine questions about the long-time sustainability of a crowdfunding-only model for two reasons. First, there is an element of token fatigue in the market, meaning that projects really need to 'pop' to attract attention. Second, as we move into the post-sale execution phase of many projects, failure risk is high. Certain reports suggest that over 45% of last year's ICOs have already failed. Both of these issues link into one of the pivotal aspects of VC contribution – expertise. VCs typically have a longer investment time horizon and therefore the success of their investment is linked at least to the medium-term success of the project.

Something interesting is emerging however. We hear many VCs are now participating in token sales. The upside for a token issuer is fast and early stage funding, sometimes without even having to go to public sale, coupled with at least some contribution of expertise. VCs tell us they like it because the time horizon is shorter. They don't need to wait seven years to exit, but might be locked only for a year or so. They also expect to experience financial upside more quickly, if a token appreciates in value swiftly following sale, rather than waiting for shares to go public. But this isn't always in the interests of the project and ICO dump schemes (buy at a discount, sell fast on public sale) are unfortunately highly prolific.

Q: How are regulators responding to ICOs? Are they legal in HK and other key jurisdictions? What do issuers and investors need to look out for?

The regulatory approach differs dramatically across jurisdictions. Some have cracked down heavily, particularly where capital flight and speculation have been a concern, such as Mainland China. Others are proactively supporting the nascent space – often in the form of creating smartly regulated markets (not necessarily allowing free-rein). For example, Japan has fostered a very sophisticated regulated market, with two of the leading banks even creating their own cryptocurrencies, which means you have a much richer and safer ecosystem. Gibraltar is also taking a strong lead.

Hong Kong and Singapore adopt a very balanced approach, but are watching the market and international developments. The most challenging jurisdictions are those where there is regulatory uncertainty – currently, and most publicly, the United States.

As an issuer or a purchaser, I would be following reliable news sources closely, but also reading the tea leaves at the transnational level. I am personally most interested in what bodies such as the IMF, Bank for International Settlements, IOSCO, the G20, and FATF are saying, because this will undoubtedly inform the next wave of regulation. There are very real and significant long-term monetary policy and systemic risk considerations that need to be balanced against the incredible innovation that ICOs have fostered.

Q: From a legal perspective, what's the best jurisdiction to do ICOs in and why?

This is the question everyone asks – and links back to your previous question. It is usually selected after several iterative discussions covering an overlay of regulatory, business conduct / opportunity, tax, IP and optic considerations. Never follow "market practice" alone, as it is regularly non-compliant. Suffice to say, you need to be well advised before issuing a token. This space is changing at break-neck pace.

What is Ripple? How is it Different?

Ripple generated considerable attention in late 2017/early 2018 due to price action, but it is important to differentiate its two components: (1) a native cryptocurrency (XRP) that can be traded; and (2) a transaction protocol (RTXP) for RTGS payments.

Ripple XRP – The Cryptocurrency

Ripple XRP improves upon Bitcoin by doing away with mining, which is energy-intensive/inefficient. Ripple does this through a technique called consensus, which is a way for the entire network to agree on the current state of the blockchain even though they don't trust each or any central authority. This is achieved via validating nodes agreeing on a specific subset of the transaction using an iterative process until a supermajority of peers agree on the same set of transactions.

XRP saw strong price movement in December 2017 to January 2018 (albeit from a lower base), reaching a peak level of $3.38 in January 2018. Positive rally likely led by: (1) new strategic partnerships with Japanese credit card companies ([CNBC](#)) and greater focus on Asia; (2) growing discussion on Ripple's protocol; and (3) retail/institutional interest in crypto. However, XRP prices soon corrected and are now back to sub-$1.00 levels in March 2018.

Figure 96. Ripple XRP Price Performance in 2017-18, USD
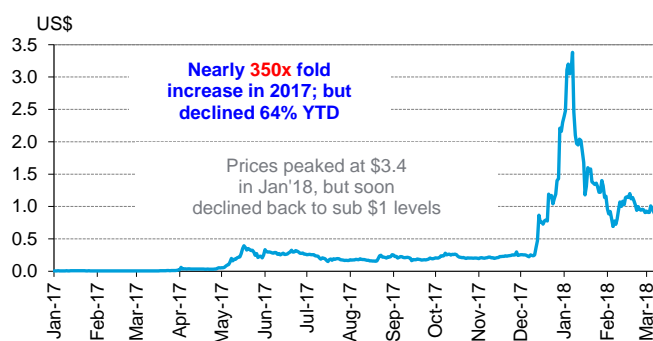
Source: Coinmarketcap, Citi Research

Figure 97. Ripple XRP Trading Volume by Currency, Mar. 2018
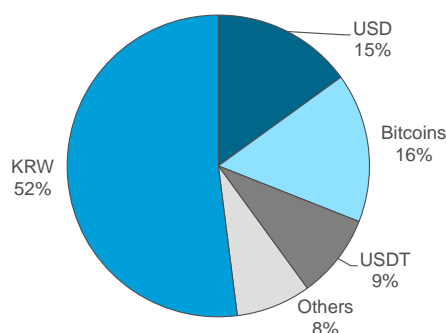
Source: Coingecko, Citi Research; # USDT (Tether) is a cryptocurrency asset issued on the Bitcoin blockchain. Each USDT unit is backed by a US dollar held in the reserves of the Tether Limited and can be redeemed through the Tether Platform. USDT can be transferred, stored, spent, just like bitcoins or any other cryptocurrency.

XRP differs from other crypto as it: (1) is design-optimized for speed of processing transactions, ideal for real-time settlements; (2) allows for execution of automated scripts; and (3) is centralized, created by Ripple (the company). Despite this, we think XRP is unlikely to be used for global settlement by banks – due to factors such as possible compliance risks as XRP can also be bought/sold on exchanges that may not be adequately monitored by regulators; and risks from large ownership by a single stakeholder (Ripple).

Banks and the Ripple Protocol

Ripple's Transaction Protocol (RTXP) is a real-time gross settlement system built upon a distributed open source Internet protocol. Ripple purports to enable "secure, instant and nearly free global financial transactions without chargebacks".

Today's global payment infrastructure moves money from one payment system to another through a series of internal transfers across financial institutions. This makes the system slow, error-prone and costly. For instance, a typical cross-border payment by a U.S. bank to a Japanese bank requires several hops, which potentially delays the process (see Figure 98).

Figure 98. Global Payment Infrastructure Today
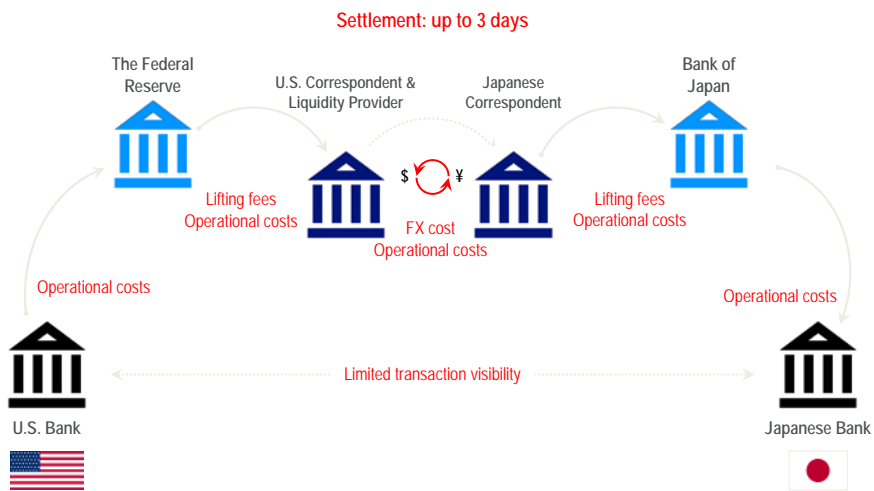
Source: Ripple Labs white paper titled The Cost-Cutting Case for Banks (Feb. 2016)

The Interledger Protocol (ILP) solves for interoperability and could ultimately lead to building an entire network of trust and facilitate peer-to-peer payments. ILP could help reduce settlement times and facilitate low-value payments.

The protocol allows banks and non-bank financial services companies to incorporate the Ripple protocol into their own systems, and therefore allows their customers to use the service. The process facilitates payments, exchanges and remittance in a distributed process.

Figure 99. Ripple's RTXP Protocol for Real-Time Value Exchange
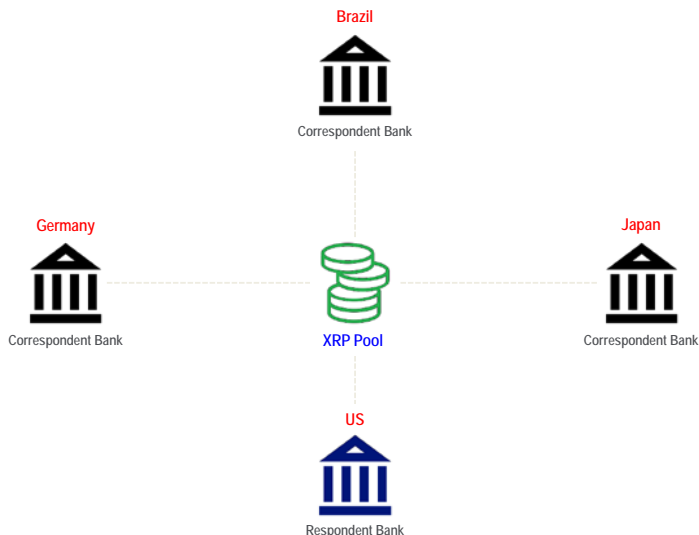
Source: Ripple Labs white paper titled The Cost-Cutting Case for Banks (Feb. 2016)

Ripple has partnered with 75 banking clients to test the Ripple RTXP technology (disclosed on company website) including global banks like MUFG, RBC, Santander, Standard Chartered, Westpac, Credit Agricole and Axis Bank to name a few. Most banks are however still internally testing the system, before moving to commercial production. MoneyGram (a U.S.-based money transfer company) also recently teamed up with Ripple to use XRP in its payment flows, enabling faster international transfers at reduced costs (Bloomberg).

We believe RTXP is unlikely to be a huge benefit to Tier 1 banks and large value payments. This is because the system would still have to rely on large banks to be connectors for high value payments, as they are the only players with liquidity. Having said that, it could benefit Tier 3 banks, which have smaller transaction sizes, as it reduces longer settlement times in today's system, especially through low volume corridors, where there may be additional hops. The biggest hurdle these banks face is the need to send funds through central banks to the correspondent's for payment. ILP essentially converts those central bank settlements to sequential book entry transfers, which will be much faster.

We believe the toughest hurdle Ripple faces is getting banks to adopt their technology and consequently build a network, which existing players (SWIFT) already have.

How Are Central Bank Cryptocurrencies Different

While privately issued virtual currencies remain potentially risky and unstable, we have seen increased interest from central banks globally around the concept of central bank issued virtual currencies or Central Bank Crypto-Currencies (CBCC). CBCCs could enable entities (individuals/businesses) to make real time payments and store value in electronic central bank money form – which could be denominated in the national currency. However, the very concept raises more questions than it answers, including – How is monetary policy transmission impacted? Would banks lose client deposit funding? Will it increase risks to financial stability? Should these transactions be anonymous or routed through some central clearing?

IMF Managing Director Christine Lagarde spoke at a BoE event on how virtual currencies are among the top three factors that could change central banking over next generation (the other two factors being new models of financial intermediation, and AI). Ms. Lagarde foresees countries with weak institutions and unstable national currencies readily adopting such virtual currencies – which she calls "Dollarization 2.0". Taken to its logical conclusion, officially issued digital currencies could allow non-bank entities to hold an account directly with the central bank. Commercial banks could face the ultimate disintermediation, at least for client deposits.

Figure 100. Money Flower: A Taxonomy Of Money
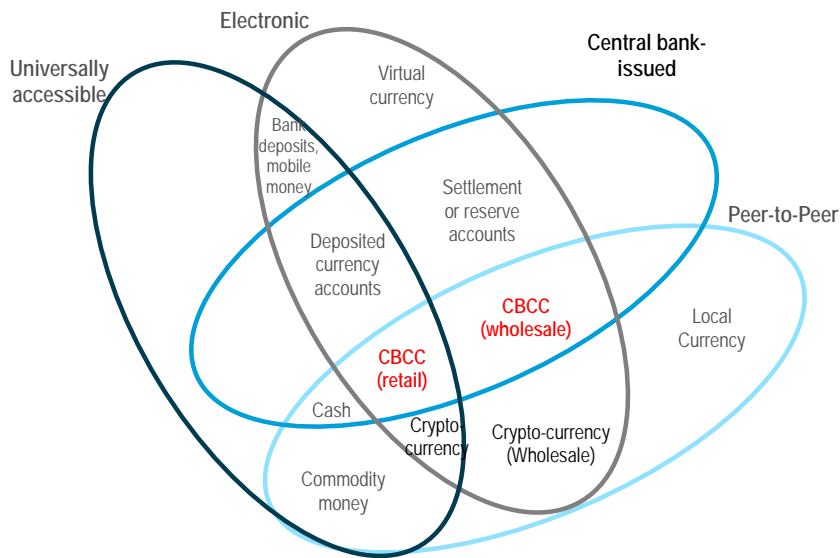
Source: BIS, Citi Research

A recent BIS paper outlines what CBCCs may look like and provides a taxonomy of money (see Figure 100). The taxonomy distinguishes between two possible forms of CBCC – a widely available, consumer-facing payment instrument targeted at retail transactions; and a restricted-access, digital settlement token for wholesale payment applications. The BIS paper further states that while it seems unlikely that bitcoin or its sisters will displace sovereign currencies, they have demonstrated the viability of the underlying blockchain or distributed ledger technology.

However, it must be noted that CBCCs are differentiated from other forms of central bank money such as cash and reserves as they can be exchanged in a decentralized manner, distinguishing them from other existing forms of electronic central bank money (such as reserves), which are exchanged in a centralized fashion across accounts at the central bank.

What Are Central Bankers Saying on CBCCs?

■ **Canada** – Bank of Canada is studying digital currency in a different way. It is actively involved in a research paper on the concept as well as experimenting on it through the projects i.e. Project Jasper.

■ **European Union** – In Sep. 2017, the ECB rejected Estonia's plan to launch its own state-run digital currency and indicated that the ECB will not allow any other EU member states to introduce their own currency.

■ **Japan** – Yoko Kawai, the head of the FinTech Center at the Bank of Japan said in Dec. 2017 that the central bank doesn't see a need for issuing a digital currency as there is no demand. (link)

However, Japan banks plan to introduce a J-coin for 2020 Tokyo Olympics and have gained support from central bank / regulators. These coins are expected to be convertible into yen on a one-to-one basis, operating via a smartphone / QR codes that can be scanned in stores (FT).

■ **Saudi Arabia** – Saudi Arabian Monetary Authority is working with the UAE central bank to issue a digital currency. The two countries would accept it for cross-border transactions.

■ **Singapore** – Monetary Authority of Singapore is working on "Project Ubin" to study if central bank money can be transferred real-time. Recently Ravi Menon, Managing Director of MAS said at a UBS Wealth Insights event in Singapore that he would not rule out the possibility of the MAS issuing a cryptocurrency directly to the public; however he was not sure it would be a good idea. (link)

■ **Sweden** – Riksbank published a report on "E-krona project – First interim report" in Sept. The central bank is studying if E-krona can be issued in place of cash and if a safe and efficient payment system can be developed.

■ **United Kingdom** –.Bank of England has no plans to issue a central bank issued cryptocurrency, however it does research on the topic. Recently BOE's Governor Mark Carney said he sees fundamental issues with central bank backed cryptocurrencies.

Epilogue: Emerging Market BRATs beyond China and India

While China and India have seen phenomenal growth in FinTech led by a large unbanked user base and favorable technological/demographic factors; FinTech startups are also eyeing growth opportunities in other emerging/frontier markets.

We find BRATs (Brazil, Russia, Africa, and Turkey) as the next logical step beyond China and India where FinTech innovations have the potential to lead the way. New FinTech technology and innovations are helping banks reach the underserved populations in these markets. Additionally, the payments industry is also seen evolving with branch banking gradually turning into e-banking and increased use of payments wallets.

Introducing the BRATs

While geographically disparate, the BRAT countries share common features such as a relatively high level of social media and Internet usage, high return on equity (OE) private sector banks but lesser international attention versus the likes of China and India in the VC FinTech space. We find that the BRAT markets are developing FinTech ecosystems via co-working spaces, incubators.

■ **Brazil** – Has a large online user base, deep financial markets, an oligopolistic banking sector with generous spreads, innovative FinTech companies, and a scalable market with a population of over 200 million. Brazil has arguably the most number of startups across LatAm for payments, lending, and investment. Notable names include Nubank (digital cards) and Neon (the first digital bank).

Vostok Emerging Finance, a leading early stage investor in FinTechs in emerging/frontier markets, made one of the largest FinTech investments in the country with an investment of $30 million in GuiaBolso (a personal finance platform) in Oct. 2017. According to EY's FinTech adoption index 2017, Brazil is the fourth largest adopter among the 20 markets studied, after China, India, and the U.K.

■ **Russia** – Overall FinTech adoption rates in Russia appear low with only close to half of the population having access to Internet/smartphones and high cash dependence, especially when compared to matured markets like Hong Kong, London, and the U.S. – but there has been a rapid acceleration in recent years.

The largest segment in the Russian FinTech industry is arguably non-bank money transfers and mobile payments, followed by online banking services (i.e., savings and investments). Prominent Russian FinTech companies include Yandex.Money, QIWI Wallet and Webmoney (offering e-payments), Unistream (money transfers) and Touch Bank (an online bank, launched by OTP Group).

In order to support FinTech growth in Russia, the Bank of Russia launched a regulatory sandbox with the Russian FinTech consortium in February 2017, to facilitate new financial services technologies and boost innovation. Other initiatives aimed at supporting development of the FinTech ecosystem include: (1) a phased transition to open API (three participants of the AFT – PJSC Bank Otkritie Financial Corporation, JSC Qiwi Bank and JSC Gazprombank announced the opening of their own interfaces for third-party); (2) implementation of pilot projects on blockchain technology; and (3) enablement of a unified digital identification environment.

■ **Africa** – The South African population is becoming increasingly digitally-enabled. 54% of South African adults (out of ~69% banked adults) have access to the Internet, while 34% of adults have a smartphone. Even more staggering is the fact that Internet users in South Africa are online for about 8 hours a day (5 hours via a computer and 3 hours via smartphone) (see Figure 105). Since 2008 Internet penetration in South Africa has increased dramatically from 9% to its current 54%. We believe that this is an indication of how important mobile banking will become within South Africa, especially when one considers that 69% of adults are banked. This means that almost 80% of banked adults have Internet access. It's hardly surprising that app/mobile banking is the fastest growing transaction origination platform in South Africa, averaging 55% growth over the past year. App transactional volumes have increased by 55% on average, while both ATM and branch transaction growth is negative.

■ **Turkey** – Turkey's FinTech ecosystem has seen strong growth led by striving startups and a growing young population with a push towards promoting the use of alternative payment systems (over cash). Turkey also enjoys reasonably good levels of technology use and infrastructure with ~60% Internet users. FinTech growth has been a priority for the government and major banks have partnered with FinTech companies to develop online/mobile banking services and branchless banking services. In 2017, a partnership of 13 public and private Turkish banks established TROY, the first and only Turkish domestic card scheme, with an aim to reduce cash usage with increased financial inclusion. Prominent FinTech startups in Turkey include Iyzico (an online payments company) and Cardtek (an end-to-end payment solution provider for financial institutions/telcos).

A.] Share Unique Banking Sector Characteristics

Banking systems across BRATs are highly concentrated by top five banks, with the exception of Russia – this means a lower degree of prevailing competition and possibly higher fees/interest rate charges to customers. We believe a concentrated market provides huge opportunity for FinTechs as it allows them to offer more competitive products.

Figure 101. Top 5 Banks Market Share by Country
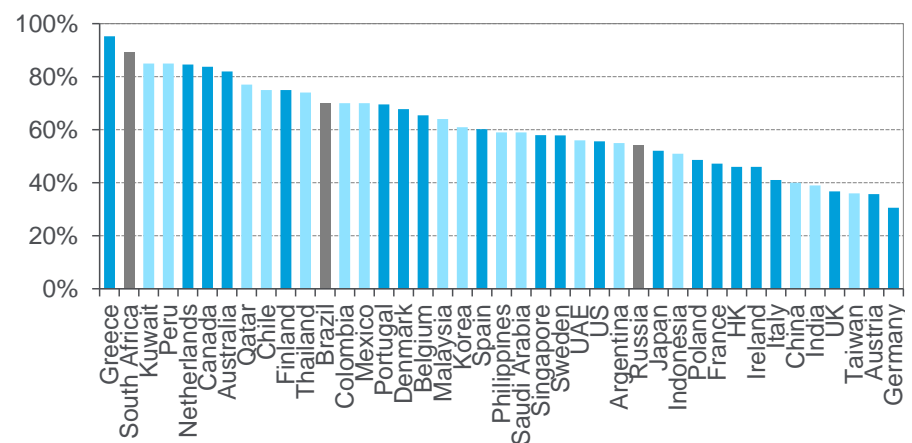

market share measured as percent of assets
Source: ECB, Company Reports, Central Bank Websites, SNL, Citi Research

In fact we find several incumbent banks have lead FinTech innovations across BRATs, including – (1) Banco do Brasil's launch of a structured open banking operation for incubating digital innovations; (2) Itau co-founding Cubo (a co-creation

space for FinTech); (3) Bradesco's launch of an online-only bank; (4) Bank VTB / Alfa Bank's interest in technology/blockchain adoption; (5) Yapi Kredi + Monitise partnering to offer branchless banking.

We believe another factor possibly pushing FinTech innovations are the high bank net interest margins (NIMs) that offer new nimble players an opportunity to disrupt traditional banking. Notably, bank NIMs in Brazil are the second highest globally (~6%), whilst those for Turkey and South Africa are also relatively high (~4%). Not surprisingly, disruptive tech startups are seen targeting generous margins enjoyed by incumbent banks. For instance, Nubank, Brazil's biggest FinTech, offers digital cards solutions at a fraction of the cost charged by traditional banks. However, we think it's worth pointing out that higher NIMs for Brazil banks can also be attributed to structurally high non-performing loans (NPLs) vs. the rest of LatAm (average cost of risk of ~5%).

Figure 102. Banks' Net Interest Margin by Country
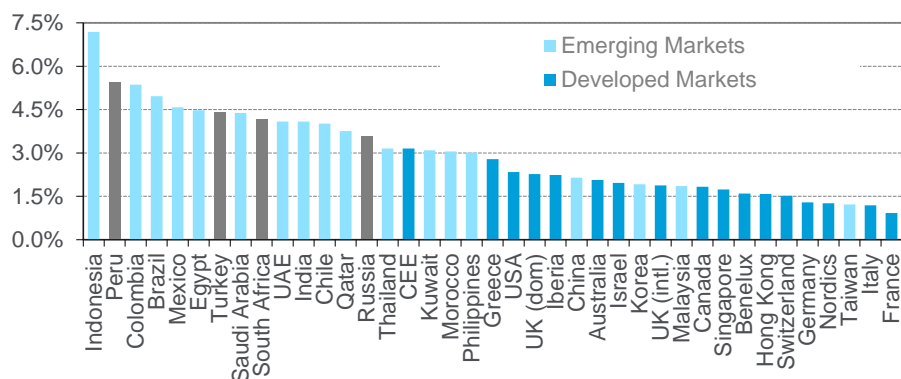
Computed bottom-up based on stocks under Citi Research coverage for 2016 data.
Source: Company Reports, Citi Research

B.] Favorable Demographics

Brazil and Russia, with populations of 150-200 million each, offer new FinTechs a large scalable market for growth. By contrast, Turkey with a young population of 80 million has a strategic advantage to become a FinTech hub, given its proximity to Europe and Asia; whereas South Africa (albeit with a total population of 55 million) has a large share of unbanked consumer demand.

Across BRATs, 60-70% of the populations have some form of banking relationship versus large unbanked consumer markets in emerging markets such as the Philippines and Indonesia. This provides FinTechs a fertile ground, as customers often just need to be converted to a more competitive product as opposed to being taught the broad array of financial products (which is often the case in emerging markets with high unbanked users).

Figure 103. World Population by Countries, 2016
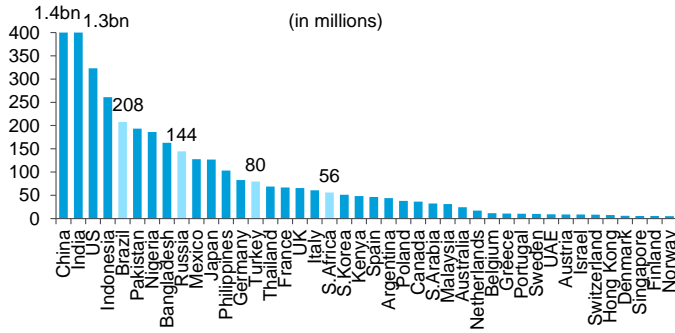
Source: World Bank, Citi Research

Figure 104. Banked Adult Population (% of Adults with an Account at a Financial Institution)
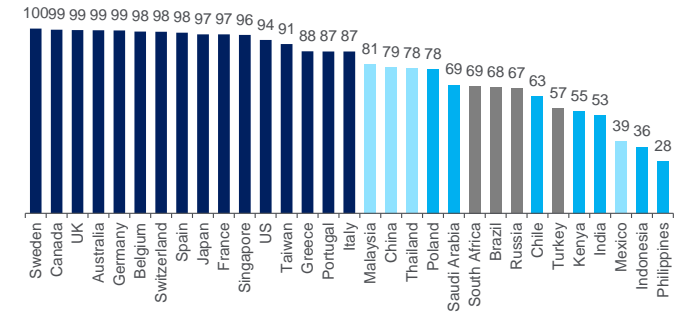

#Dark blue shading shows DMs, light blue EMs.

Source: World Bank Global Findex 2014, Citi Research

C.] Technology Enablers

■ **Very Online Population** - Adults in Brazil and South Africa are amongst the highest time spenders on the Internet, clocking an average of 5 hours per day. Russia and Turkey are lower with average time spend of 4 hours per day.

■ **Rising Internet Penetration** - Nearly 76% of individuals use the Internet in Russia – one of the highest rates in Central Europe and Asia. Brazil, Turkey, and South Africa fare moderately with 55-60% of their populations using the Internet. This presents a unique opportunity to maximize the benefits of the digital age. Over the last 5 years, Internet penetration rates across Russia and South Africa have risen as much as 60%, whilst those for Turkey and Brazil saw a 30% increase.

Figure 105. Time Spent on the Internet (Hours Per Day, Jan 2017)
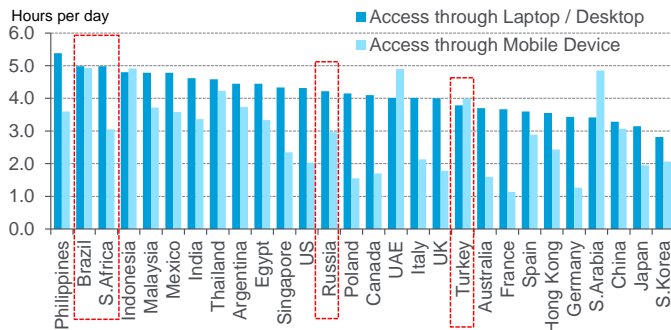
* Based on a survey of Internet users aged 16-64, across 33 markets
Source: Global Web Index

Figure 106. Individuals Using the Internet (% of Population, 2016)
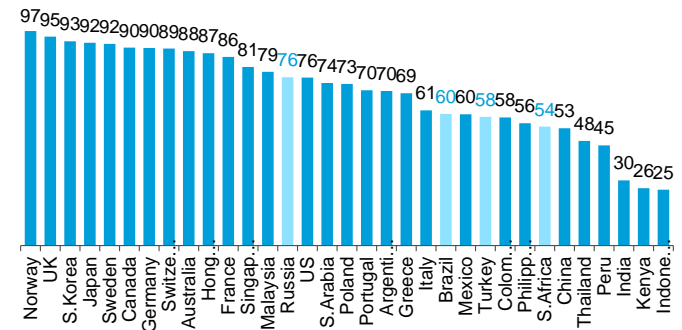
Source: World Bank, Citi Research

■ **Modest Smartphone Penetration** - While smartphone ownership rates continue to rise in developing nations, the digital divide remains. Amongst BRATs, Turkey has the highest smartphone adoption rate of 60%, followed by Russia, Brazil and South Africa.

■ **Low Cash Dependence Relative to GDP per Capita** - Comparing GDP per capita with cash penetration rates, we find that cash penetration in Brazil and South Africa is relatively lower (vs. size of GDP per capita) – a positive factor for FinTech adoption.

Figure 107. Percent of Adults with Smartphones, 2016
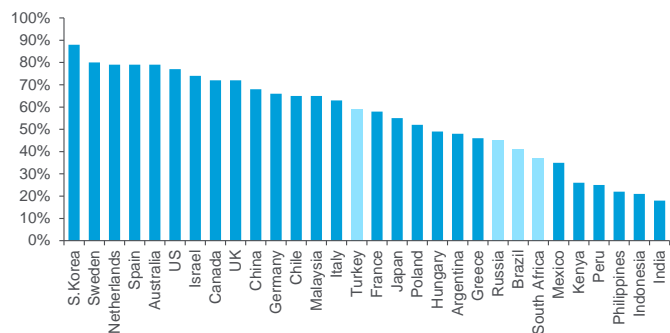
Source: Pew Research Centre

Figure 108. Cash Penetration vs GDP/Capita, 2016
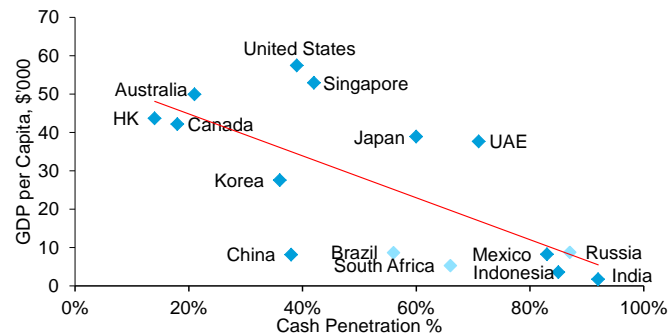
Cash penetration defined as % of transactions done in cash and check
Source: : IMF, Visa Investor Day, Citi Research

FinTech Investments Trends

Data for VC FinTech investments across frontier markets are small/undisclosed; therefore we look at broader VC investments across sectors to see trends (albeit FinTech is likely to have dominant share). Data suggests startup frontier markets have seen rising deal activity since 2012, with total VC funding crossing $40 billion across over 7,000 deals (2012-2017). However, it still accounts for only up to 0.5% of global VC deals. VC-backed funding totaled $11.5 billion across 2,000 deals in frontier markets on a 2017 annualized basis.

Figure 109. Start-up Frontier Markets Annual VC-Backed Funding
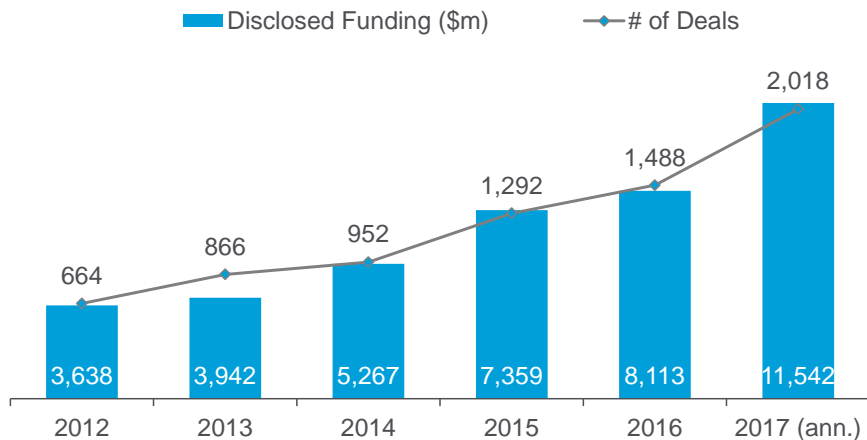
Source: CB Insights, Citi Research

Interview with Vostok Emerging Finance: David Nangle

About Vostok Emerging Finance

Vostok Emerging Finance (VEF) is a listed investment company with a market capitalization approaching $200 million that invests in fast-growth FinTech companies in emerging markets. VEF takes minority stakes/board representation and helps drive value creation through to exit. VEF has taken the view that there is a plentitude of focus in developed market FinTech (in the U.S., the U.K., Sweden etc.), where there is an abundance of VC and bank incubator capital. Vostok, on the other hand, focuses on the often overlooked emerging market arena, especially as beyond China and India (and arguably Brazil) there is limited FinTech venture capital in play. Public market investors can gain exposure to emerging market FinTech through VEF, which makes it a fairly unique market asset. To date, VEF has invested in 11 companies across the emerging world.

About David Nangle

David Nangle is CEO of Vostok Emerging Finance. David has spent his career to date focused on emerging market financials. Initially David was with ING Baring's Emerging Markets Research team from 2000-06, where he was head of EMEA financials research. David then joined Renaissance Capital in Moscow and has spent the majority of his professional career there, helping the firm develop and grow their financials franchise and research footprint from a strong Russia base to a leading pan-EMEA and frontiers franchise. Through his career he has worked across many diverse emerging market countries on projects, deals, and research mandates all within the broader financials space, spending the latter years with more innovative financial sector plays like Tinkoff Bank in Russia and Alior Bank in Poland. David holds a degree in B. Comm International (French) from University College, Dublin, Ireland.

Q: You've recently been spending a lot of time in Brazil, meeting FinTechs and other market participants. Why Brazil? What is so exciting about Brazil right now? What are the key growth drivers for the market?

True that, and we are not just spending time there, we are putting significant capital to work. Apart from some of the larger Asian markets (mentioned below), we struggle to find a FinTech market that is more exciting and ripe for investment then Brazil right now for a number of reasons:

- **Scale** – With over 200 million inhabitants, Brazil is the kind of scale market that at VEF we like to invest in. FinTech is similar to most industries, in that most companies tend to succeed within their own borders and destroy value beyond.

- **Online** – Brazil is one of the most "online" markets in the world with top 5 per capita usage across most top named social media sites and a very robust and growing ecommerce market.

- **Deep financial market** – The Brazilian banking system is First World in many aspects and its population is experienced and comfortable in the use in a broad array of financial products, which is untrue of many emerging markets where the product penetration evolution is still ahead of them.

- **Massively inefficient oligopolistic banking system** – A key factor for us, Brazil is one of the most beautifully inefficient financial systems we have engaged with, with generous interest rate spreads and payment terms ripe for disruption, all driven by a tight oligopoly of banks (think the U.K., South Africa etc., but with extreme pricing).

- **People and ecosystem** – We have found many strong entrepreneurs and teams in Brazil and also a very supportive VC and investment eco-system into which to invest and partner.

- **Regulatory support** - Regulation in Brazil has taken to supporting the FinTech ecosystem as a way of levelling the banking playing field and improving customer service and pricing over time. As opposed to over-regulating the incumbent banks directly.

- **And of course exits** - Whether it's the recent IPO of PagSeguro or the acquisition of XP (digital broking) by Itau, Brazil offers healthy exit opportunities for the FinTech VC investor.

In summary, Brazil continues to be one of the most fruitful FinTech markets we have experienced and we continue to put our money where our mouth is with 5 holdings (almost half our portfolio) there now.

Q: Brazil yes, we get it, but why not spend that valuable time and capital in maybe the more obvious opportunity markets of China or India, or even regionally in somewhat comparable Mexico?

We get asked the China and India question a lot, given that they are *the* 2 scale emerging/global market plays, coupled with the fact that China is the global FinTech benchmark market, as you and your colleagues have written about on numerous occasions. China first. As impressed as we are with everything that has been achieved there and most notably within the BAT ecosystems, we conclude that China is for the Chinese and while we will happily engage and learn there, it has moved on so quickly that we simply don't have a natural place to enter that space.

India is a market that is definitely more open to us and one we have done much work on. Running behind China (but where isn't), with a uniquely state-driven FinTech core through the JAM initiative, we have found certain FinTech sub segments like online and offline (wallet) payments, through the likes of Paytm and the MobiQwik have broadly played out. Similar, comparison and Insurance has been swallowed up by the hugely impressive Policy Bazaar. Opportunities are ripe in the broader credit space today, both online and offline, consumer and SME, with numerous companies attacking this space. Also the savings and investment space is starting to show opportunities.

Broader LatAm is just a few steps behind Brazil and the opportunity cost of time spent outside Brazil today (given what we say above) is just not worth it. That will change, however. Mexico should be further along, but has some exciting early stage companies coming through. Consumer credit is very competitive today while anything online is still riddled with fraud issues. That said, we like the SME credit space in Mexico, in particular. Outside of Mexico, the Argentine FinTech system seems to have woken up in line with a turn in its political and macro fortunes.

Q: Tell us a little bit more about the business models you've come across in Brazilian FinTech: how similar or different are they to what you see in other emerging markets? Are the Brazilian FinTechs a Bay Area copy-paste or is there significant business model or technology innovation?

Yes, Brazil is one of the few deep varied FinTech markets that we have experienced in the emerging world and is pretty similar to how developed market FinTech ecosystems have developed. In Brazil, there are a bunch of separate companies that have been created to attack a certain strand of the incumbent financial systems business (i.e. credit card, offline payments, SME lending etc.). It is this depth and variety that is quite unique in Brazil, which we probably only see in China, and then maybe India. In many emerging markets, certain sub-segments are out by regulatory boundaries (savings), or the country's population simply isn't wealthy enough or financially sophisticated yet (on average) to have scale demand for them (investments/robo-advisory), or in many cases, one company (could be ecommerce, ride sharing or social media etc.) which has a deep loyal consumer following has simply decided to broaden out and own everything, which is a growing trend in Asia.

So Brazil in that regard has similarities to the U.S. and is maybe why U.S. capital, the Valley, is happy to play there. So I agree with the comment that in Brazil you get many copy paste and execute plays from the Valley (or other developed markets) with a local twist. If you take our portfolio for example, our biggest investment to date is into Brazilian Personal Finance Manager, GuiaBolso. Very similar to Credit Karma or Mint in the U.S. Indeed the CEO/founder of CreditKarma is an investor there. Elsewhere, we also own a stake in Magnetis, which is Brazil's largest robo-advisor, think Betterment or Wealthfront in the U.S., while Nibo, in the account SaaS space is similar to Intuit QuickBooks. And there are many more examples in this vein.

While we see some of this in other markets, where we have invested in Iyzico, which is Stripe meets PayPal of Turkey. But then we have Jumo, out of Cape Town, which is like nothing else out there and a unique FinTech model for very unique frontier market needs.

Q: Your first love in finance was Russia I believe. You've spent a lot of time working, analyzing, and tracking the Russian financial sector. How does Russia compare to Europe or North America in its adoption and use of technology in finance?

First, someone has to love Russia, especially with the global VC and PE community still largely ignoring it. Their loss, we love lack of competition and there are some great local entrepreneurs in Russia, great tech, as you would expect given Russia's history of scientific education, and real value creation opportunities. Nothing that Russia is or does has stopped Tinkoff Bank (Russian leading digital bank), Yandex (Russian Google) and Avito (leading Russian marketplace) from being successfully built and creating millions/billions of dollars of value for founders and shareholders alike.

Specifically in the FinTech, Russia is quite unique, as the leading local bank, Sberbank, which has anywhere between 20-50% market share across key financial metrics, has been front and center of the Russian FinTech revolution. Despite being a state bank, under the leadership of German Gref, Sberbank has a technology-driven strategy. Along with the likes of Tinkoff Bank and Alfa Bank (leading private bank), there is an unusual squeeze out trend from above with respect to FinTech in Russia.

So the incumbents are innovating from above and leaving little space, margin or opportunities for entrepreneurs and VCs to take advantage of, like they do in other emerging markets. Poland is not dissimilar in this regard.

Q: Any real visionaries or standout institutions in the Russian market when it comes to business models, innovation, and use of technology in finance — both among "incumbent" players and newer entrants? What makes them stand out?

If you are looking for a great example of a company that was ahead of its time in driving a digital-first offering in financial services, look no further then Tinkoff Bank in Russia. While the business started out in the early Capital One mode of pre-approved mailed credit cards, over the last 10 years it has transformed itself into Russia's leading digital first (online only) retail bank.

It offers core products of consumer credit, via card as well as current and savings accounts through the core Tinkoff brand, and then leverages the brand and high consumer traffic to cross-sell partner products in related areas like mortgages through its Tinkoff financial marketplace. Today it has 6 million+ credit card holders and over 2 million current account customers and a whopping 50% plus return on average equity (RoAE), It has also branched out into the SME space, with much the same offering and phenomenal early success.

For a VC investor focused on FinTech, we see in Tinkoff as many new FinTech business lines coming through as we do in maybe a dozen separate FinTech companies in other markets we focus on. It has many aspects to what the broader Chinese groups have done, except it is pure play financial services.

The only issue for us, if any, is that Tinkoff is a publicly listed asset, has already been a phenomenal return play for us and our shareholders and hence we have begun to gradually reduce our holding there and recycle some capital gains from it to greater return opportunities within our core mandate in the private emerging markets FinTech space.

Q: Are FinTechs friends or foes of the incumbent banks in the key markets you've looked at, such as Brazil, Russia, Africa, Turkey and others? Have your views on the friend vs. foe question changed over time? What determines if the bank-FinTech relationship is collaborative or hostile?

There is no one answer to this question and it does tend to vary wildly market to market. But generally, I don't think we have seen all-out FinTech love in any of our markets from incumbent banks, but we have generally moved away from a stage of all-out hate or ignorance. Turkey would be the market where we see the least acceptance or embracing of FinTech partners by the banks and relations are still tense, with maybe Akbank being a notable exception from the bank side. In markets like Russia and Poland where the banks dominate the FinTech landscape, which is unique versus many developed markets, they feel less threatened and we see very little animosity to those smaller FinTechs that exist. While in Brazil the smaller banks have openly embraced FinTech partners as a way to differentiate their product offering and gain an edge against the entrenched scale players who still have a love/hate relationship with the larger FinTech peers.

Overall though, we have seen most markets changing for the better over time. Specifically, Jumo in Africa has been a great example of this trend. The partner banks and mobile network operators (MNOs) generally got to define the nature of the relationship in the earlier iterations of the partnership, but as the product and volumes improved and the partner banks/MNOs realized the value the Jumo

platform could bring to the distribution of their bank products and value to their Telco clients, the nature of the relationship improved and became more like a true partnership.

Q: How long do you think it will take FinTech companies to have meaningful market shares in the markets where you invest?

It's hard to generalize about meaningful market share, but the most successful names who gained meaningful market share in their area of focus include Tinkoff Bank, and it took them about 10 years to gain 10%+ market share in the Russian credit card space. However in newer growth areas of finance like online payments, in Turkey, Iyzico is part of a duopoly that dominate that space along with PayU (Naspers) and that only took about 5 years to achieve.

Market share is just one metric or measurement of success for the companies that we invest in. We clearly care more about return on capital then meaningful market share. I say that in the context of a market like Brazil where you have an existing consumer credit pool of $500 billion. Should one of our companies chisel out a 1% market share, that's a $5 billion loan book. With an average rate of 40% per year, and that's lowering the average, you are talking a $400 million revenue pool to play with. That's meaningful in terms of potential value creation and return. And with 1% market share you haven't even touched the sides of the system or woken up the incumbent banks to care. Similar story in India and China where small market share can still mean significant value creation.

Q: What are your preferred FinTech models? Do you think the FinTech opportunities are greater in payments, credit/lending, investing or other areas? And would the answer to this question differ materially if you are looking at EM or DM?

What we have found when looking across geographies is it generally ends up being more a case of which financial services or FinTech sub-segment is most attractive or likely to succeed in that specific operating environment, then we have a predefined notion of which segment we like most before entering and target or prioritize that. For example, there are no FinTech credit plays in Turkey, big banks and the regulator combined just haven't allowed it to date, so we targeted the best online payments company in the country. In Mexico, where online payments (and credit) are still struggling to master fraud and there is a competitive hard in the consumer credit space, we ended up targeting the SME credit space, which profiles very well. Brazil obviously runs contrary to this argument as highlighted above.

More generally, across EM there is simply more fat, low hanging fruit for FinTech companies to eat into, coupled with a penetration game growth advantage versus DM. To date, competitive capital for quality deals is still a lot lower then DM, one might argue for very good macro or political risk reasons. All in, EM is the hands down better risk/reward FinTech opportunity.

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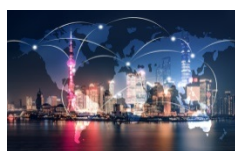March 2018

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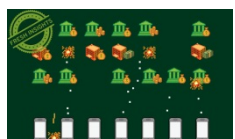*Automating e-Commerce from Click to Pick to Door*
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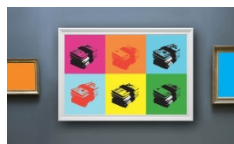**Investment Themes in 2016**
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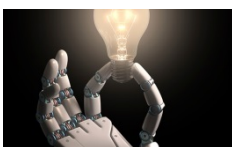*Perspectives on Current Drivers & Future trends*
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Key Insights regarding the future of Banking

INNOVATION

Large incumbent banks lag digital natives and their technology stacks are struggling to compete in a world that is mobile first. / Banks are exploring AI uses in consumer and wholesale banking with the help of robotics (automation of routine tasks), analytics (big data mining), chat bots (digital dialogue with customers), and cognitive (changing rules and adapting).

TECHNOLOGY

Today's global payment infrastructure moves money from one payment system to another through a series of internal transfers across institutions which makes the system slow, error prone, and costly. / The use of Blockchain will enable direct transfer of digital assets without the need for an intermediary or a centralized authority plus smart contracts/tokenization that can automate and execute pre-agreed conditions once they are met.

SHIFTING WEALTH

The old question was whether new entrants – FinTech startups – were going to nibble away at incumbent bank's profit. / The new question is how to stop established tech giants – BigTech – leveraging their strong customer bases, vast user data pools, agile tech platforms, and deep funding pools to disrupt banks.