



Capital Markets: innovation and the FinTech landscape

How collaboration with FinTech
can transform investment banking

Foreword

Until recently, FinTech was mainly focused in the payments, remittance, peer-to-peer lending and equity crowdfunding sectors. But, over the course of the last year, we have seen an increase in activity in capital markets: solutions to complex front-, middle- and back-office problems are emerging in the form of FinTech solutions.

These solutions are using technological advances such as Artificial Intelligence (AI), Robotic Process Automation (RPA), distributed ledgers and cloud technologies, among others, to deliver innovation that was previously hard to achieve.

Wholesale digital solutions are coming of age in capital markets and will help managers focus on delivering superior performance for their firms, clients and counterparties. Whether FinTech solutions help the front office make better investment decisions through Advanced Analytics or reduce costs through improved post-trade processing platforms, the opportunities appear vast.

No one can argue that making better risk-adjusted returns for clients and firms through the efficient deployment of digital technologies deserves serious consideration. Regardless of macroeconomic trends, the era of digital has arrived in capital markets, and we must all become better digital data, knowledge and process managers across the end-to-end business to maximize our overall performance and contribution.

Investment banks, through their accelerators and labs, have started to engage with FinTechs to understand how to work better together. There are hundreds of entrepreneurs, many with excellent capital market pedigrees, developing innovative solutions to complex problems and seeking partnerships, and getting the engagement model right is critical.

There is more innovation going on outside of an institution's four walls than inside, and the investment in participating in that innovation is low relative to the risk of not being abreast of the FinTech landscape and players.

As an independent members association for FinTech, Innovate Finance is dedicated to open and inclusive collaboration of all players in the ecosystem. We were delighted when, during our first Capital Markets Members' Working Group in January 2016, EY committed to deliver the group's first actionable request for a "FinTech landscape report in capital markets."

The report is a guide to the areas in which FinTechs and institutions can better collaborate to help transform capital markets; it was compiled following consultations with a number of Innovate Finance members across the (global) working group. On behalf of the group's co-chairs and participants, and the Innovate Finance team, we would like to thank EY for this excellent contribution to the community.



Lawrence Wintermeyer
CEO, Innovate Finance

About this report

Driven by a powerful blend of innovative startups and major technology players, the global FinTech industry is growing apace, using technology innovation to capture market share from incumbents in many areas of financial services. While the FinTech entrants' greatest impacts to date have been at the retail end of the market, the opportunity for collaboration in capital markets is real and growing; this is great timing given the challenges faced mean that innovation has become mandatory.

In this global report that we have produced in conjunction with Innovate Finance, we shine a light on the investment banking industry, examining why and how capital markets firms across the globe can and should collaborate with FinTech organizations to drive their own evolution in the years to come, and to secure their future role and position in the fast-evolving financial services ecosystem.

The analysis and recommendations expressed in this report were produced by EY, and informed and shaped by more than 40 stakeholder interviews conducted with investment banks and FinTech firms across the globe. We would like to express our sincere thanks to all the individuals and organizations listed on page 81, who contributed their valuable time and insights to help make the production of this report possible.

We hope this report will be used by capital markets players and FinTech companies to help drive innovation and collaboration to shape a brighter future. We also hope it will provide a useful source of insight and analysis to other stakeholders across the FinTech ecosystem, including policy-makers and regulators.



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Definitions

Capital markets – the provision of services relating to primary issuance, securities trading, M&A, facilitation of trade and advisory services, in a business-to-business (B2B) context.

FinTech – organizations that are combining innovative business models and technology to enable, enhance and disrupt the traditional financial services industry.

Contents

1. Executive summary	4	4. The “how?”: a practical guide to making value-generating collaboration happen	59
2. The “why?”: collaboration with FinTechs will be core to the evolution of capital markets	8	How should FinTechs approach investment banks?	60
Background and context	9	Value proposition: be clear on who you are, what you intend to be and the problem that you solve	60
Innovation in capital markets is no longer optional	9	Innovation approach framework	60
The way forward: collaboration, not competition	10	Understand the regulations and set a high bar with regard to conduct	61
Key challenges faced by the capital markets industry	11	Initial engagement: pick the best route in	61
Identifying sources of future growth	11	Industry experience is essential for credibility and navigation	62
Reducing structural costs	12	Preparedness: start with the end in mind	62
Delivering regulatory-driven change at acceptable cost	13	Proving the concept – a major hurdle to overcome	62
Rebuilding trust	14	Protect your “crown jewels”: intellectual property (IP)	63
Impacts of global megatrends	15	Be prepared to build a robust business case	63
The global rise of the entrepreneur	15	Be prepared for procurement	64
The evolution of the global marketplace	16	How should investment banks position themselves to engage with FinTech?	65
Digital future	17	Set the right “tone from the top”	65
3. The “what?”: many opportunities for collaboration have emerged	18	Select the right operating model	66
Nine technology-enabled trends that support innovation	20	Innovation operating models	66
Cloud technology	22	Centralized model	67
Process and service externalization	22	Decentralized model	67
Robotic Process Automation (RPA)	24	Hybrid model	67
Advanced Analytics	25	Don't expect a risk-free bet	69
Digital transformation	26	Establish a “roots and branches” culture of innovation	69
Blockchain	27	Consider how to transition to the architecture of the future	70
Smart contracts	28	Motivate the retained organization	70
Artificial Intelligence (AI)	28	For all parties, dialogue with regulators is essential	71
Internet of Things	29	Conclusion: building the investment bank of the future	72
Opportunities by functional or service area	32	The investment banking ecosystem of the future	73
Client servicing	33	5. The “who?”: a directory of organizations offering FinTech innovation services to capital markets	74
Trading	38	World map of organizations offering FinTech innovation services to capital markets	78
Business management	40	6. Acknowledgements	80
Data management	41	7. Contacts	82
Post-trade operations	43		
Risk management and control	49		
Financial control	51		
Compliance	53		
IT	56		
Legal	57		
HR	58		

1. Executive summary

In this report, we map out how the investment banking industry can evolve over the coming years by collaborating effectively with FinTech organizations.

We articulate our vision in four sections:

Why?

We examine **why** collaboration with FinTechs will be core to the evolution of capital markets.

What?

We highlight **what** opportunities for collaboration are possible now and in the future, given the range of underlying technologies that are currently available.

How?

We discuss **how** investment banks and FinTechs might collaborate to create value for all parties.

Who?

Finally, we consider **who** is likely to play key innovation roles going forward.

Here are the core messages from each of the four sections:

Why?

There is potential for a bright future for the industry

If investment banks can take the right steps today, the outlook for the industry is much brighter than many commentators are currently suggesting. Some of the megatrends – ranging from the rise of emerging markets and the growth in entrepreneurship to the pervasive shift to digital – are likely to play nicely to the strengths of investment banks. In combination, these forces mean that hundreds of thousands of businesses will need access to capital and support in managing risk in the years ahead, with many of them growing into the global corporations of the future. So it's important for investment banks to look beyond today's downbeat industry mindset. A whole world of businesses is emerging that will need to be served, but isn't being served today – and investment banks are ideally placed and equipped to fill the gap.

Innovation is mandatory

Today, innovation in capital markets is no longer an option, but an absolute imperative, for investment banks to survive and thrive into the future. To sustain their business in the long term, they need to change the game. Continuing with existing operating models, business models and ways of working will not achieve that. So today's capital markets firms face a stark choice between undertaking radical innovation or sliding toward irrelevance.

Collaboration – not competition – is the way forward

While FinTechs in retail financial services have often competed with traditional players by disintermediating them and taking their market share, the higher barriers to entry in capital markets mean rules of engagement are likely to be different. While some disintermediation opportunities exist, our view is that the better answer for both FinTech and incumbent firms is to collaborate rather than compete. This means building collaborative ecosystems that help to reduce investment banks' structural costs and enable enhanced regulatory compliance and better service to customers.

What?

There is no shortage of innovation ideas; the challenge is validating them

There are countless ideas for innovation being brought to market. The challenge faced by the investment banks is, therefore, validating which to actively pursue.

There are opportunities everywhere, front to back, throughout the bank

Historically, investment banks have invested heavily in front-office innovation. During the boom years little attention was paid to the middle and back office due to the healthy profit margins achieved. As a result, these functions have become heavily reliant on additional headcount and spreadsheets, and have not addressed challenges relating to underlying infrastructure.

As FinTech offerings come on stream, new opportunities exist to transform the middle and back offices, especially through externalization and use of Regulatory Technology (RegTech) solutions to transform compliance.

Innovation opportunities are also now available in the front office as Advanced Analytics and AI help to improve decision making, enrich insights and reduce costs.

Start with proven technologies before venturing into emerging ones ...

In technology terms, we believe the best near-term opportunities for FinTech collaboration can be found in established areas such as RPA, Advanced Analytics, externalization of processes and services, and digitalization. While more maturing technologies such as AI, smart contracts and Blockchain have clear potential to be game changers further down the line; they will take a few more years to come fully to fruition.

... but keep scanning the horizon and testing out new frontiers

It's important for investment banks to stay involved in developments at the frontiers of innovation by testing out and piloting new technologies such as Blockchain and AI. While tangible results may take a while to achieve, firms need to be actively engaging in proofs of concept in order to determine which use cases are most viable.

How?

Who?

Clarity is vital for both investment banks ...

In order to engage in FinTech collaborations that deliver truly transformational value, investment banks need to be clear about the innovation model that they're going to operate. It's important to accept that there's no innovation without risk, and set the scope and mandate for innovation, procurement and, indeed, retained technology functions accordingly. Investment banks also need to work out how best to engage with FinTechs, given the contrasting size and cultures of their respective organizations.

... and FinTechs

For their part, FinTechs need to have absolute clarity on the purpose and need that they aim to fulfill, the problem that they are solving for the investment banks and other market participants, and the context in which they solve it. They must also know how best to approach and navigate their way through investment banks, in an industry where organizational structures are often complex and opaque, and where attention spans can be short.

Focus on business case – and IP

For any collaboration to deliver value sustainably, the FinTech partner must focus rigorously on building a credible business case – including the pricing model. And it must keep its IP “crown jewels” secure, an imperative that can present some tough choices about what information to share with whom and when.

The winners will be those that build the strongest ecosystem

The successful investment bank of the future will look quite unlike many existing banks today. The retained organization will likely be stronger and leaner, augmented through external collaboration with FinTech firms, market utilities and managed service providers. The technology landscape will likely be modular and interoperable, and ultimately, simpler. The culture will be one of collaboration, not protectionism.

Achieving this will not be straightforward. It will require strong leadership, governance, tenacity, and commitment; the stakes are high, and failure is not an option.

Organizations offering FinTech innovation services to capital markets

Our list of organizations offering or enabling FinTech innovation in capital markets does not claim to be exhaustive. But it does include over 130 diverse active participants in the FinTech ecosystem, spanning not just startups, but more established players that are pushing the innovation agenda.

2.

The “why?”:

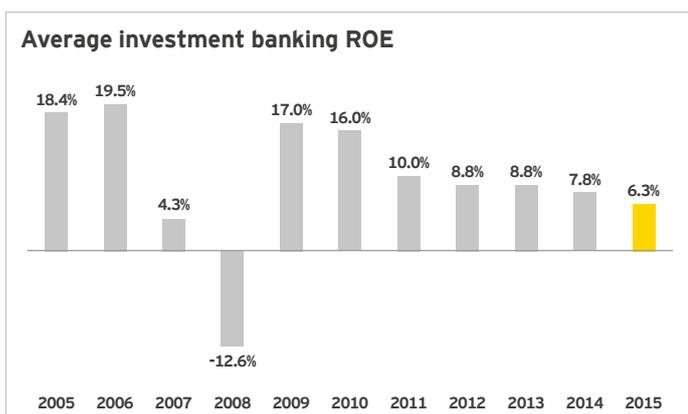
collaboration with
FinTechs will be core
to the evolution of
capital markets

Background and context

Innovation in capital markets is no longer optional

The capital markets industry is continuing to work hard to address several challenges. Faced with stubbornly high structural costs, heavy capital charges and stagnant revenues, investment banks' returns on equity (ROE) continue to disappoint. While steps are being taken to transform culture and rebuild trust, progress in these areas takes time.

So, given these challenges, where are capital markets firms directing their resources? The answer is that they're primarily focusing on delivering changes mandated by regulators or driven by external threats. Yet this brings its own problems: the combination of complexity and unrelenting pressure to meet regulatory deadlines is causing organizational fatigue, while also leaving management short of bandwidth to step back and look further ahead with a view to investing in initiatives that will improve ROE.



Source: EY investment banking quarterly analysis for 1Q16.

Put simply, the capital markets business model needs to evolve – and to do so quickly. Historic evidence indicates that the industry has been only partially effective in delivering change and managing its cost base, creating the need to evolve in a different way. As a result, innovation is no longer optional. Yet, for most firms in the industry, organic evolution toward a new model would be very difficult to achieve.

Help is at hand. A new FinTech ecosystem is starting to form that can address many of the challenges confronting today's investment banks. The even better news is that the emerging FinTech sector is well funded, energized to help, and powered by a blend of seasoned industry professionals and fresh talent unencumbered by the old way of doing things.

“Our industry is going through a transformational time, driven by competition, regulation and advancements in technology. As a leading global bank, we are committed to driving industry change by investing heavily in internal development, but also by collaborating with the talent of determined, young startups.”

Daniel Pinto, CEO of the Corporate & Investment Bank, J.P. Morgan

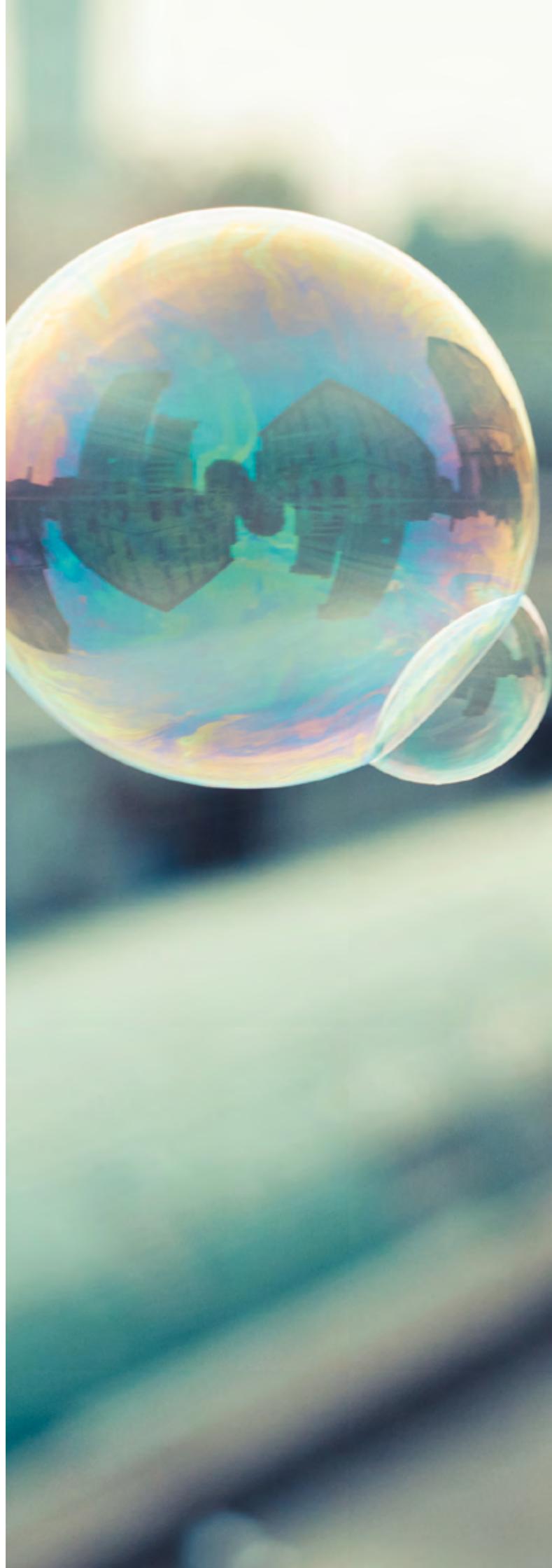
“We are at a point where we have an opportunity to reposition financial services. With the technology available, we can change the way transactions are done, reducing costs from dollars to pennies. Through collaboration, we have the opportunity not only to revive businesses that have died, but also to create new ones that haven't even been thought of.”

David Rutter, Founder and CEO, R3 CEV

The way forward: collaboration, not competition

These positive factors are accentuated by the distinct role that FinTech firms can play in capital markets. In retail financial services, FinTechs often have greater opportunity to disintermediate, disrupt and take market share. In capital markets, by contrast, the barriers to entry tend to be higher – pointing the way to a different mode of FinTech participation, on the basis of collaboration rather than competition.

By building a better ecosystem, firms can reduce structural costs, comply more easily and effectively with regulation and, ultimately, become better providers of capital markets services to the end users of finance and the real economy. The concept of open innovation, whereby firms actively pursue external and internal ideas and paths to market, has already taken off in other industries, such as pharmaceuticals. Now, it's the turn of capital markets to exhibit the collaboration gene.



Key challenges faced by the capital markets industry

Identifying sources of future growth

Over the course of 2015, the operating environment for the global investment banking industry was impacted by a number of macro events. The year started on a largely constructive note, as the sector benefited from a number of interventions from central banks and robust global trading volumes. However, the second half of 2015 turned distinctly more challenging, as plunging commodity prices, mounting concerns about slowing global economic growth and extreme market volatility led to a sharp drop in client activity. Fixed-income trading customers fled to the sidelines, equity trading slowed markedly, and many companies delayed planned issuances of debt and equity. Also, while M&A activity remained robust throughout the year, the strong performance in this business was not sufficient to offset slides in trading and underwriting.

Overall, investment banking revenues fell by almost 4% in 2015 from the previous year,¹ led by an 8% decline in fixed income, currencies and commodities (FICC) and a 5% drop in advisory and underwriting revenues. Average ROE for the top 14 global investment banks slid from 7.8% in 2014 to just 6.3% in 2015, well below the typical 10% to 12% cost of equity for an investment bank.

6.3%

Average ROE for top 14 global investment banks in 2015

While 2015 was dismal, 2016 started off even worse. Extreme market volatility in January and February impacted virtually all investment bank business lines in what would normally be the strongest quarter of the year. Even M&A advisory – which had been a revenue engine in 2015 – slumped in the first quarter of 2016, perhaps reflecting a loss of confidence among chief executive officers (CEOs) amid warnings about a slowdown in global economic growth. In June 2016, the UK referendum with respect to its European Union (EU) membership caused further market dislocation and uncertainty.

With interest rates set to remain low (and even negative in places), GDP growth under pressure in China and other emerging economies, and commodity prices still relatively low, revenue prospects for the near term are limited.

For capital markets firms, this low-growth environment brings two considerations into sharp focus:

- 1 How to increase revenues and market share from the available universe of current and future clients.
- 2 How to innovate in products and services to deliver more value to underserved client or market segments.

If growth isn't possible, the only other path back to acceptable ROE is to address structural costs.

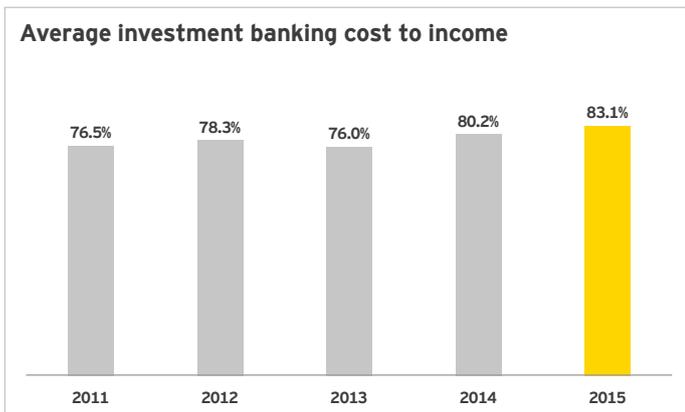
“Capital markets and investment banking firms invested heavily in digitizing their front offices years ago, because there was a commercial imperative to do so. While ROEs were high, there was less of an immediate need to innovate in the back office. That is no longer the case. The business model is changing, and we have to find new ways to reduce structural costs and simplify our architecture. We have to innovate, and we are engaging our people at every level in the organization in the innovation agenda.”

Anthony Woolley, UK Chief Information Officer, Société Générale

¹ Source: EY's investment banking quarterly analysis.

Reducing structural costs

In 2015, global investment banks reduced their expenses by 1.5% from the previous year. While lower compensation costs were one factor in this improved expense performance, the primary contributor was a notable decline in legal costs. However, the small decrease in costs was not nearly enough to offset the weak revenue performance in 2015, and the industry's cost-income ratio deteriorated to 83.1% from just over 80% the previous year.



Source: EY investment banking quarterly analysis.

Looking back over the past five years, investment banks continued efforts to address their structurally high cost bases through expense programs, simplification initiatives and repositioning. Despite these sustained cost programs, the investment banking sector's overall costs were still almost 25% higher in 2015 than they were a decade earlier. This lack of progress on costs is causing frustration for investors, many of whom have been waiting with evaporating patience for belt-tightening measures to yield material savings and boost profitability. And they are becoming increasingly insistent that banks accelerate expense progress, particularly given the headwinds on revenues.

83.1% | Cost-income ratio in 2015

Arguably, some costs are unavoidable – particularly those related to the development and implementation of regulatory compliance systems. In fact, many banks have pointed out that a substantial proportion of the savings generated through efficiency programs have been reinvested in regulatory compliance. But another – less easily justifiable – barrier to improved cost performance is the huge expense associated with maintaining disparate systems, legacy landscapes and manual processes. The simplification of investment banks' tangled IT estates is arguably the most difficult cost to address, and also the one that most have struggled to tackle. The complexity of their technology architectures has increased significantly over time as a result of incremental change, mergers, the need for speed to market, short-term decision-making and underinvestment.

Application rationalization is hard, time-consuming and risky. Some may conclude that it is preferable to jump straight to an external FinTech solution than to transform legacy technology.

25% | Increase in overall costs from 2005 to 2015

Delivering regulatory-driven change at acceptable cost

Investment banks are struggling to comply with an evolving raft of reforms, including new capital and liquidity regimes, over-the-counter derivatives reform, structural change and transparency requirements, and new investor protection provisions.

The new rules have heightened the focus on reporting requirements and the supporting data, analytics and algorithms needed to produce the information and reports required by regulators. Efforts to comply are complicated by the fact that the implementation requirements of global reforms – even the definitions of data and reporting formats – vary substantially at a national level.

As we noted earlier, the burden of designing and building complex compliance systems has consumed efficiencies gained in savings programs. And while many in the industry expected regulatory compliance costs to peak in the next year or two, they will never run down to nothing. Without innovation, high compliance costs will probably remain a permanent feature of the capital markets industry, even when the systems are stable and banks enter the maintenance and reporting phase.

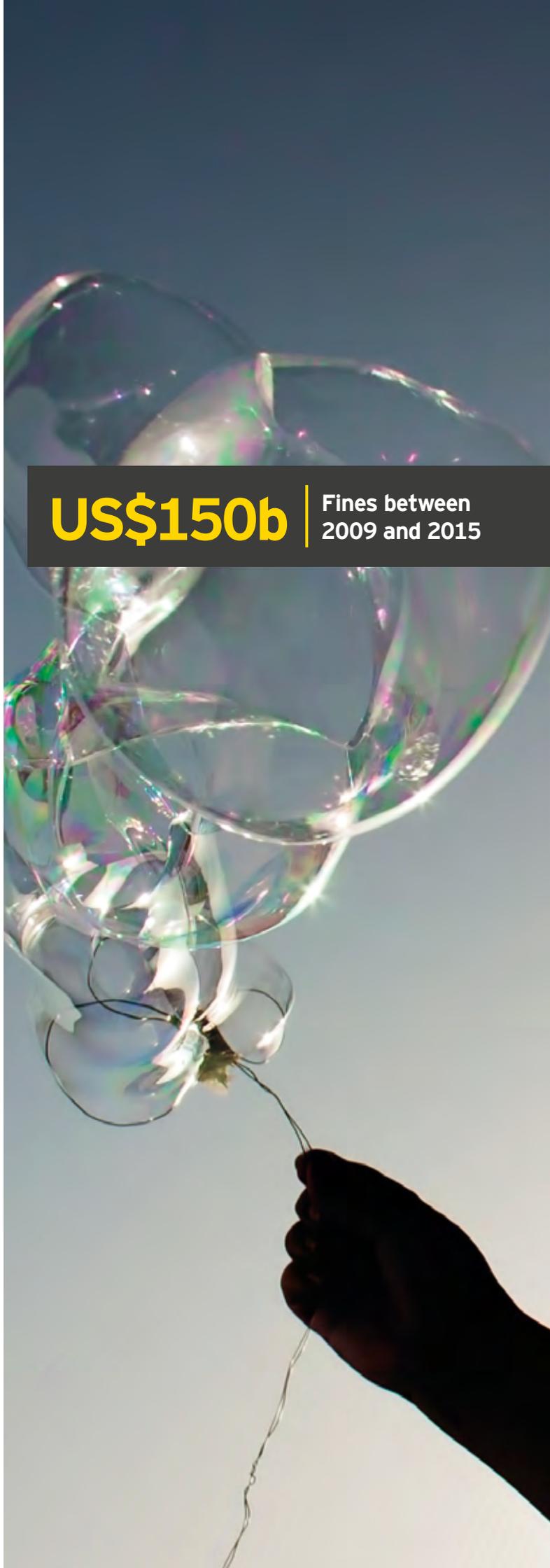
Regulatory bodies such as the UK's Financial Conduct Authority (FCA) appear to be waking up to this issue. In November 2015, the FCA issued a call for input from the RegTech sector, stating: "We are seeking views on how we can support the development and adoption of new technologies that facilitate the delivery of regulatory requirements." The FCA's stated intention is to identify technologies that can help the banking sector manage regulatory reporting effectively and efficiently. If the FCA and its global counterparts are willing to put a "stamp of approval" on RegTech-driven solutions for compliance, banks may be more willing to seek outside assistance from these vendors.

Forward-thinking regulators are not stopping at merely providing domestic support for FinTech and RegTech. In 2016, FinTech "bridges" were set up between the regulators in the UK and Singapore, enabling regulators to refer FinTech firms to each other across the globe. The Monetary Authority of Singapore (MAS) has also signed an agreement with the Australian Securities and Investments Commission (ASIC) that is intended to allow FinTech firms to establish initial discussions in each other's markets faster and receive advice on required licenses – thus helping to reduce regulatory uncertainty and time to market.

Rebuilding trust

In the years since the financial crisis, investment banks have suffered from a drip feed of regulatory actions and bad press that have eroded the public perceptions of the banking industry. At the time of writing, most investment banks had made significant progress in resolving the legal issues that stemmed from claims of pre-crisis misconduct. With approximately US\$150b in fines having been paid to supervisory authorities between 2009 and 2015,² and just a few big-ticket cases left to be resolved, most banks believe the worst is over.

While a steep reduction in litigation reserves will undoubtedly be a tailwind for profitability, banks still need to take steps to limit their future conduct risk. According to EY's *2015 Risk management survey of major financial institutions*, banks agree that one of the key factors in mitigating misconduct is to increase the accountability of the front office. Other areas of focus include reducing product complexity, exiting certain product and transaction types, leaving selected countries and reducing activities with some customers.³



US\$150b | Fines between
2009 and 2015

² www.ft.com/intl/cms/s/0/7993ab16-f2c0-11e5-aff5-19b4e253664a.html.

³ www.ey.com/bankingrisk.

Impacts of global megatrends

Believe it or not, the future for investment banking has the potential to be bright

Disruption driven by global megatrends is fundamentally changing the way the world works – a development examined in detail in the EY report *Megatrends 2015: making sense of a world in motion*⁴. We have identified three megatrends that support the view that the capital markets industry can track back to more acceptable levels of ROE.

With changes in demographics, the explosion of new business creation, rising prosperity, maturing markets and hyper-connectivity of society globally, the demand for capital markets products and services is set to increase.

The fundamental purposes of capital markets firms – to provide access to capital, facilitate trade and manage risk – are reinforced rather than negated by the megatrends.

We do not see any of these trends reducing the need for the types of services provided by investment banks, although as we discuss later in this report, the ecosystems delivering these products and services will inevitably evolve.

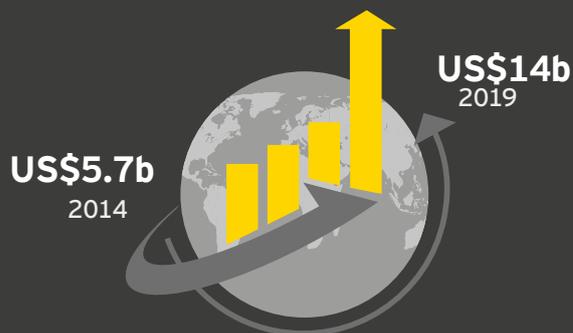
The global rise of the entrepreneur

The growth and prosperity of all economies – whether emerging or mature – remains highly dependent on entrepreneurial activity. Entrepreneurs are the lifeblood of economic growth: they provide a source of income and employment for themselves, create employment for others, produce new and innovative products or services, and drive higher levels of economic activity.

While some entrepreneurial activity around the world is still driven by necessity, “high-impact” entrepreneurship – once largely confined to mature markets – is now an essential driver of economic expansion in rapid-growth markets as well. In many cases, these high-impact entrepreneurs are building innovative and scalable enterprises that capitalize on local needs and serve as role models for new entrepreneurs.

The face of entrepreneurship is also changing. Across the world, entrepreneurs are increasingly young and female, and many of the new enterprises founded today are digital from birth. Access to funding remains the primary obstacle for entrepreneurs from all markets and at all funding levels, with microfinance beginning to generate interest among institutional investors. It’s clear that capital markets organizations have an important role to play in the success of these entrepreneurial businesses as they grow, and by supporting financial inclusion globally.

19%⁵ | Annual rate of growth in microfinance expected over the next five years



Rising from US\$5.7b in 2014 to nearly US\$14b in 2019.

Source: Microfinance Market Outlook 2015: Growth driven by vast market potential, responsibility, November 2014.

⁴ [www.ey.com/Publication/vwLUAssets/ey-megatrends-report-2015/\\$FILE/ey-megatrends-report-2015.pdf](http://www.ey.com/Publication/vwLUAssets/ey-megatrends-report-2015/$FILE/ey-megatrends-report-2015.pdf).

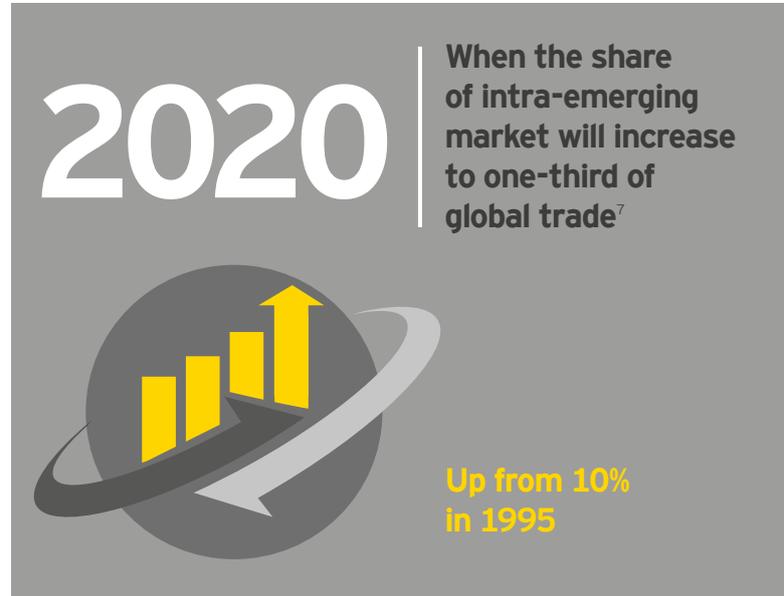
⁵ www.responsibility.com/funding/data/docs/es/10427/Microfinance-Market-Outlook-2015-DE.pdf.

The evolution of the global marketplace

Faster growth rates and favorable demographics in key rapid-growth markets will continue to be a feature of the global economy for the next decade or so. The gulf between mature and rapid-growth countries continues to narrow. A new tier of emerging nations, driven by their own nascent middle classes, will gain a rising global profile. Also, innovation will increasingly take place in rapid-growth markets, with Asia surfacing as a major hub. Services such as trade finance will remain critical.⁶

As less developed markets emerge, their rising middle classes will demand more sophisticated financial services. Over time, we expect to see greater appetite for securities in these locations. In February 2016, for example, the European Bank for Reconstruction and Development (EBRD) announced SEE Link, a regional electronic platform bridging exchanges in Bulgaria, Croatia, Macedonia, Serbia and Slovenia.

Economies across the world will remain highly interdependent through trade, investment and linkages between financial systems, driving a need for stronger global policy coordination among nations and more resilient supply chains for companies. At the same time, domestic interests will continue to clash and compete with the forces of global integration.



⁶ www.ey.com/emergingmarketsbanks.

⁷ "Lamy says Europe needs a good compass to sail through crisis," World Trade Organization website, www.wto.org/english/news_e/sppl_e/sppl275_e.htm, accessed 17 October 2014.

⁸ World Trade Report 2013, World Trade Organization, July 2013.

3.

The “what?”:

many opportunities
for collaboration
have emerged

In our view, there are countless opportunities for collaboration between investment banks and the FinTech community. The proliferation of financial technology startups is increasing, taking advantage of today's low costs of technology platform development and the lack of innovation within banks. At the time of writing, it is estimated that there are over 5,000 FinTech firms in existence, and this number is set to continue to grow.

To pinpoint and explore these collaboration opportunities, we first examine the underlying technology trends that are enabling the development of different solutions. Then, we look front to back across the business functions of investment banks to identify areas where there is the potential for them to benefit from the thinking, innovation and investment associated with FinTech.

As this section will show, there is no shortage of ideas for innovation. Validation and execution may prove to be a bigger challenge. It's also worth noting that some of the ideas set out in this section are not new. What is new is that the technology now available has increased their feasibility.

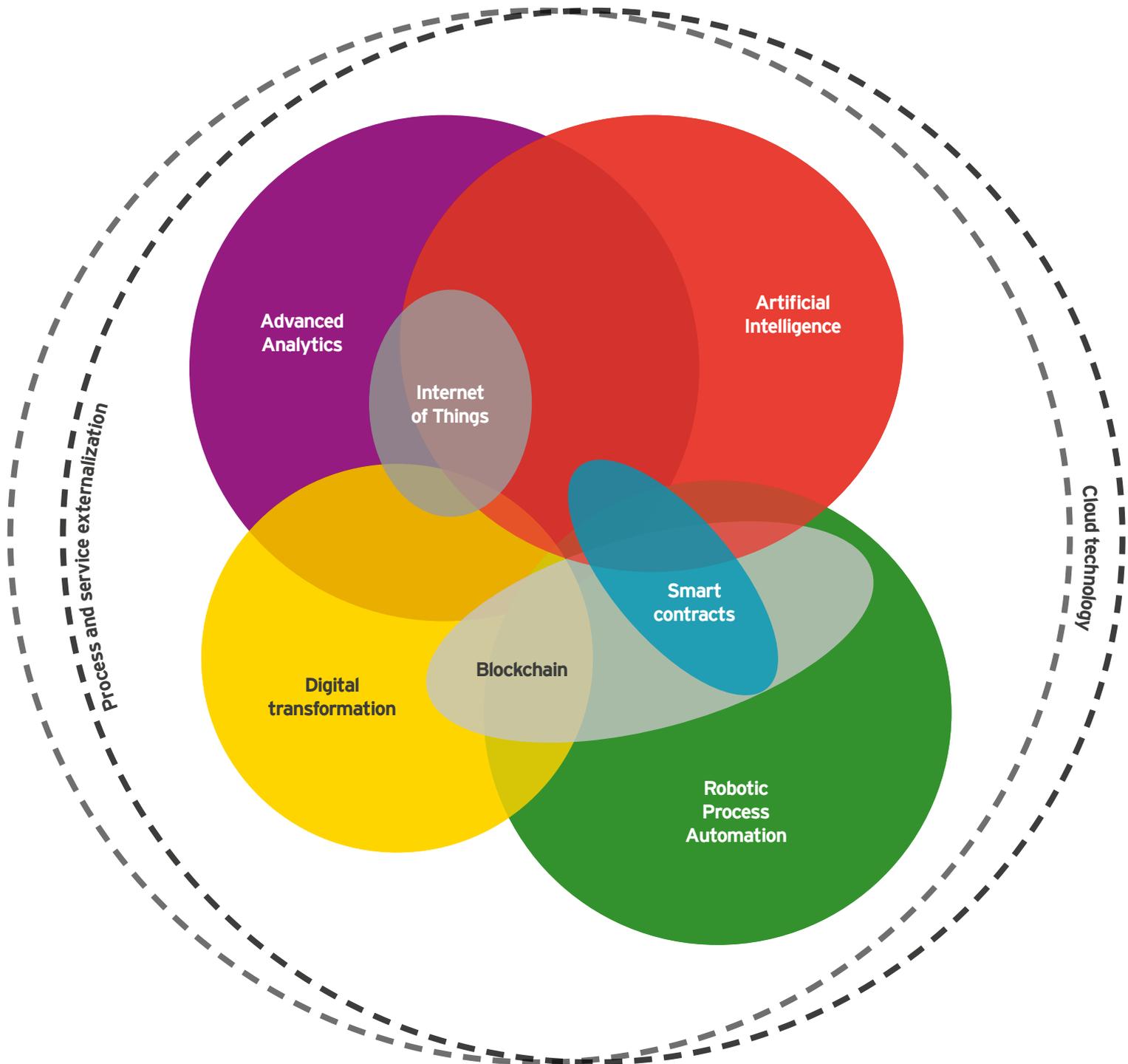
5,000 | Number of FinTech firms



Nine technology-enabled trends that support innovation

We've identified nine technology or technology-enabled trends that, individually or collectively, make innovation possible to address the challenges faced by the industry.

Nine technology-enabled trends that support innovation



The diagram above illustrates the inter-related nature and convergence of technology trends. 'Cloud technology' and 'Process and service externalization' are universal trends that could underpin any, and all, aspects of innovation. This diagram is not to scale, and does not depict all possible overlaps.

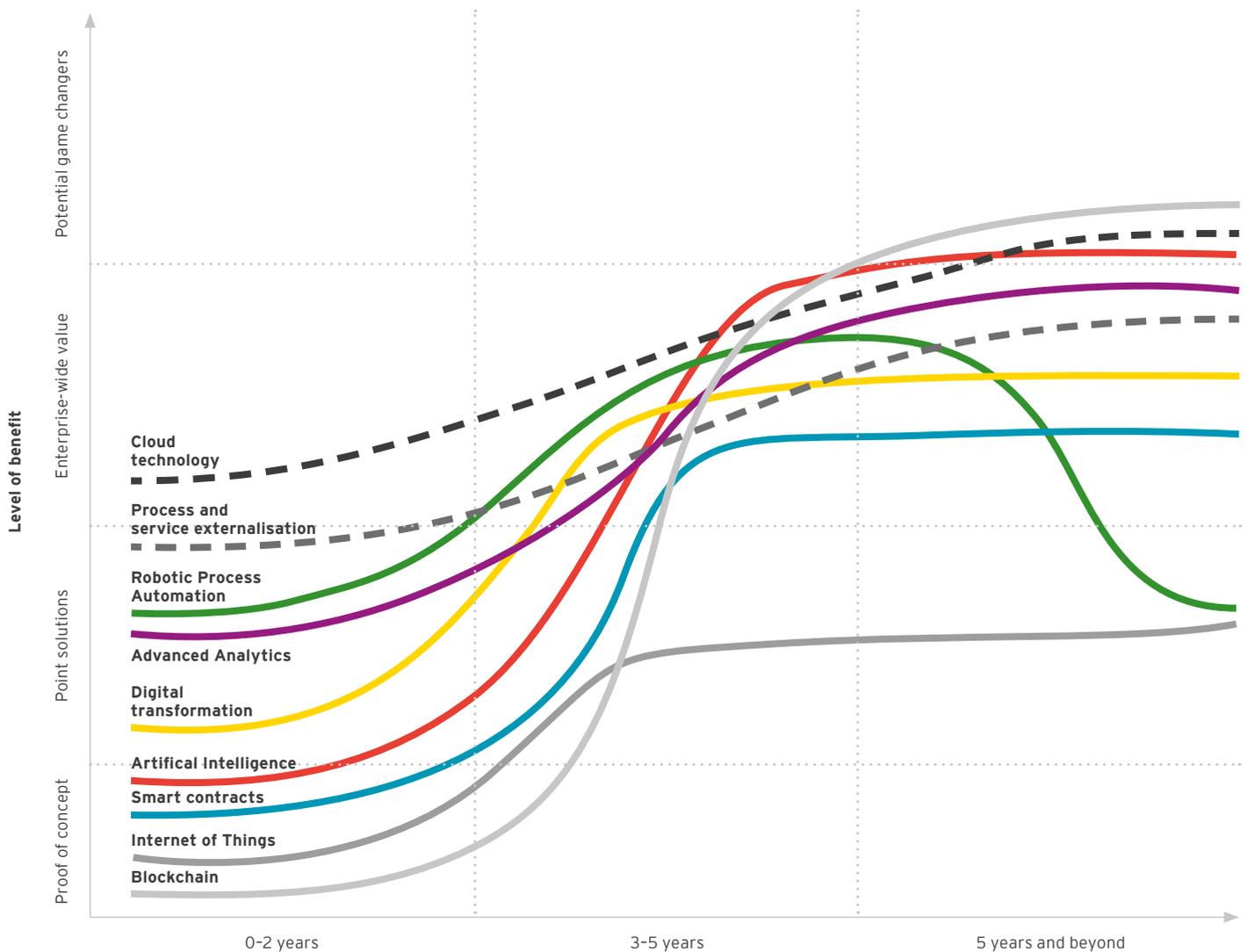
Source: EY analysis.

In trying to put the potential benefits of each trend into context, we recognize that providing scientific estimates is challenging. So, instead, we have illustrated the level of benefit that we expect each trend to reach over time. The four benefit tranches are:

- 1. Proof of concept** – active experimentation with little immediate, tangible or realizable benefit.
- 2. Point solutions** – benefits being derived in isolated areas to address specific challenges.
- 3. Enterprise-wide value** – significant benefit being driven in multiple areas across the organization.
- 4. Potential game changers** – material benefit and the potential to revolutionize the business model of organizations and the industry as a whole.

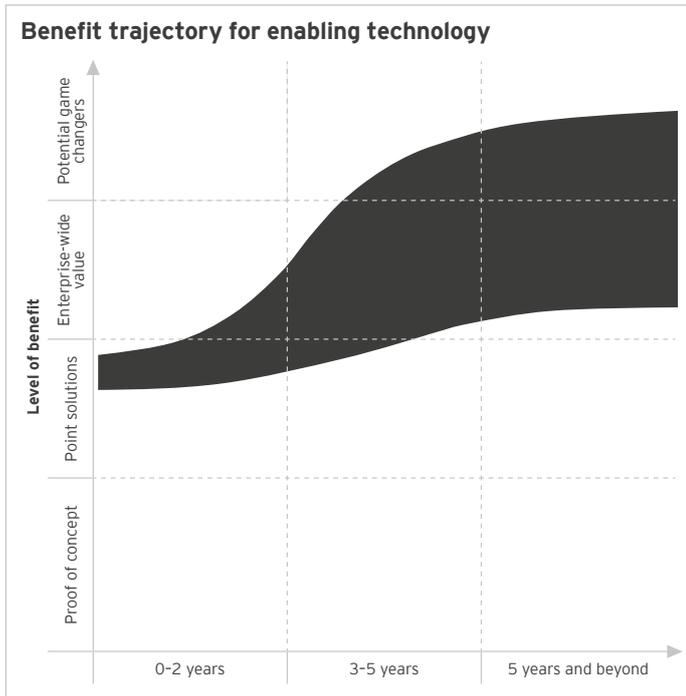
We believe that the greatest benefits in the near term will come from innovation based on Advanced Analytics, RPA, digital transformation, and externalization of processes and services. Blockchain and AI could present game-changing opportunities in the longer term. The benefits of cloud technology are available today but, for many firms, deriving full value from widespread adoption will take some time.

Illustrative benefit trajectory for enabling technologies



Source: EY analysis.

Cloud technology



Cloud computing (anytime, anywhere access to IT services delivered dynamically as a service) has been around for over 15 years and is now regarded as mainstream. The primary benefits of cloud – namely lower costs, reduced capital expenditure, scalability, flexibility and speed of setup – are widely understood.

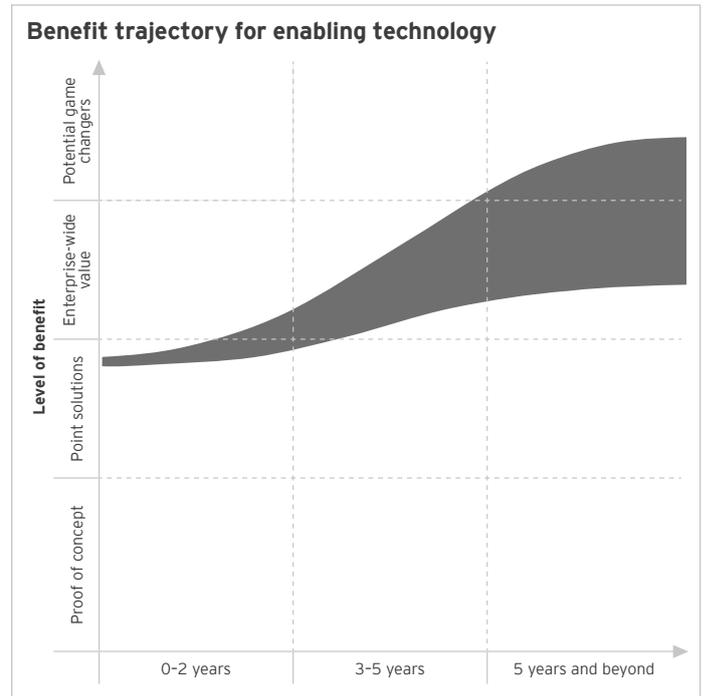
While investment banks have started to adopt cloud solutions, there are still perceived barriers to full adoption, i.e., risk management or regulatory considerations over data privacy, location and transfer. For these reasons, many are choosing a hybrid strategy by adopting private clouds that provide some, but not all, benefits.

Cloud computing has significantly lowered the barriers to entry of innovation. Startups no longer have to build and maintain their own infrastructure or make the up-front capital investment required. The challenge comes when a FinTech firm that has designed its solution for the cloud approaches an investment bank that has reservations.

“As a software vendor, cloud technology has been a game changer in terms of the value we can deliver to our clients. It allows us to provide a truly flexible and scalable post-trade processing platform at significantly lower cost than legacy technologies.”

Tim Marsh, Chairman, Serisys

Process and service externalization



Our definition of “process and service externalization” includes:

- ▶ Managed or outsourced services.
- ▶ Industry utilities.
- ▶ Application programming interface (API)-enabled collaboration.
- ▶ “Co-opetition” (collaboration with a competitor) – creating interoperability with peers to enhance geographic or product reach.

All these aspects of externalization share the underlying principle that the service can be performed more effectively – whether that means at a lower cost, greater speed, higher quality or lower risk, or a combination of some or all of these – by a dedicated external third party than it can within the business. The move to externalized services, generally accessed on a pay-per-use basis, also reflects a strong economic drive to shift from fixed cost to variable cost models, and from CapEx to OpEx.

Determining factors of core vs. noncore infrastructure

◀ Retain in-house	◀ Could influence in either direction ▶	Seek external solutions ▶
Competitive advantage	Client experience	Commoditized service
IP	Expertise and capability	Cost
Customer data	Speed to market	Ecosystem maturity and availability
Regulation	Flexibility	Value from data aggregation
Risk appetite	Security	Opex vs. Capex

The outsourcing of commoditized business processes (such as reconciliations) and application development and maintenance is already mature. Extending beyond this, we're now seeing a growing trend toward the external procurement of more specialist processes and services, such as tax operations and know-your-customer (KYC) remediation. We expect this trend to continue.

While the externalization concepts listed above could be described as established, there are two more that are rapidly emerging and of considerable interest. Both have their roots in the widely observed pivot toward a sharing economy.

The first is **API-enabled collaboration**, which is being driven by two forces. In retail financial services, the drive toward API-enabled collaboration is fueled by regulation, as Payment Services Directive 2 (PSD2) and open API standards come into force. In addition, the Competition and Markets Authority's *Retail banking market investigation report*,¹⁰ issued in May 2016, includes a requirement for banks to build open APIs over a two-year implementation timeline. This effectively marks the beginning of the end for closed banking in retail banking markets.

In capital markets, our expectation is that the primary driver of API-enabled collaboration will be the need to innovate. Established capital markets firms are starting to see the opportunity to accelerate innovation by making IP in the form of business logic and data available to external parties via APIs, in turn allowing them to prototype new products and services. This reduces the cost of innovation and boosts speed to market.

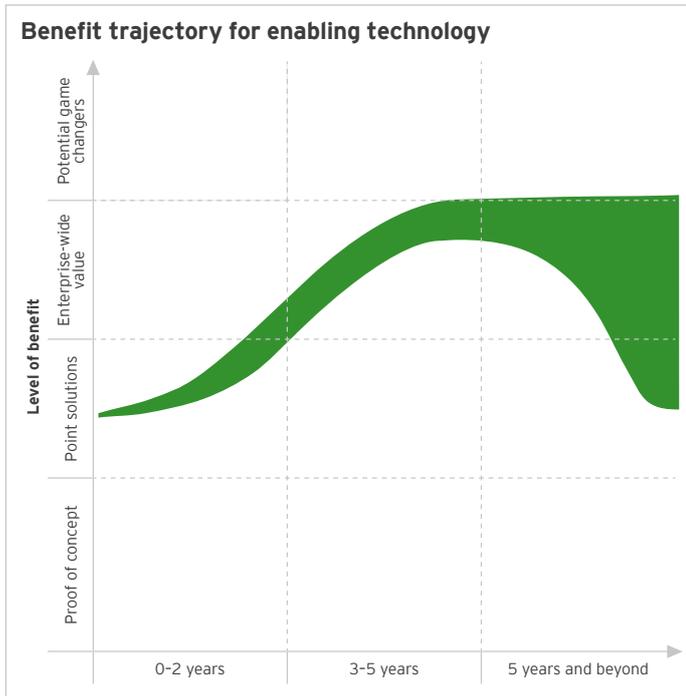
The second concept coming to the fore is **co-opetition** – collaboration with a competitor. Our analysis suggests that, in the future, there will be fewer full-service, global investment banks. Instead, we expect to see greater specialization by region, products or services. This reflects the plain fact that few firms can afford the structural costs of being all things to all people.

This move toward specialization is somewhat at odds with the trend toward a global marketplace. And it raises an important question: as capital markets firms specialize, how will they continue to serve their global clients – who are increasingly seeking to rationalize their relationships and access points within investment banks?

To solve this quandary, we expect to see capital markets players embrace collaboration to a greater degree than ever before, underpinned by greater interoperability of products and services. A precedent for this shift is the emergence of the correspondent banking model in the payments space.

¹⁰ <https://www.gov.uk/cma-cases/review-of-banking-for-small-and-medium-sized-businesses-smes-in-the-uk>.

Robotic Process Automation (RPA)



RPA involves using software robots to undertake operational tasks. From its early incarnations in primitive screen-scraping, RPA has evolved dramatically to become an enterprise-grade technology that can eliminate clerical roles and processes.

Operational processes change regularly and with short lead times – and this level of volatility has historically hampered their automation via IT systems integration. RPA differs from traditional automation in that the software robots typically “use” the user interface of existing platforms, as opposed to automating processes within the software code and database layers of the applications themselves. The software robots can often be programmed or trained by business users who have a deep understanding of the processes. RPA can generate many benefits, including:

- ▶ **Cost reduction** – typically, costs can be reduced by 50% to 70% for high-frequency tasks (one-third of the cost of an offshore full-time equivalent (FTE)) and increased productivity (automated solutions can work 24/7). In cases where teams of people have been performing manual processing with little subjective judgment, the cost benefits can be immediate.
- ▶ **Improved performance** – real-time processing improves the service and reduces the number of exceptions in a process. Batch processing during out-of-hours windows reduces the load on legacy platforms at peak times.

- ▶ **Improved quality, consistency, reliability, control and traceability** – RPA generates a full audit of process flows, actions and exceptions.

- ▶ **KPIs for automated processes** – process flows can be identified by capturing activity metrics to automate on a wider end-to-end basis.

- ▶ **Support for strategic platform upgrades and regulatory change** – cost-efficient, tactical RPA solutions reduce the pressure on the development road maps for IT platforms. They also provide an alternative to platform customization, reducing deployment and upgrade costs, and enabling data migration and automated regression testing through proven user interfaces.

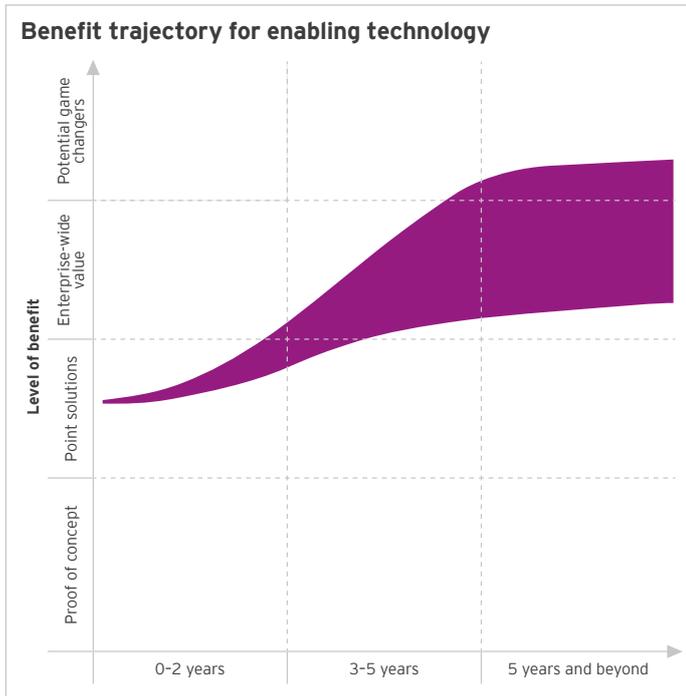
- ▶ **Increased agility and accelerated innovation** – RPA allows product and service innovations to be created and piloted rapidly, without expensive upgrades to legacy systems or risks around integration dependencies. Business users can control the robots, reducing dependencies on IT.

- ▶ **Morale** – retained humans can be freed up from repetitive, low-value work and reallocated to more fulfilling, value-adding activities.

RPA is being used by a number of organizations in specific areas such as operations and finance where value can be gained from the automation of repetitive tasks. Many firms have progressed RPA from being a proof of concept to being part of “business as usual” activities, and are now building a case for more widespread adoption. RPA typically offers a compelling business case compared with the costs of employing labor to handle the same tasks (including offshore labor), and we expect it to play a growing role in the near term.

While RPA technology has the potential to generate quick cost savings, it is not a cure for everything. Its applicability is limited to automating processes that are often suboptimal in the first place, and it does not address the root causes of process inefficiency. This is why, as organizations go through the process of rationalizing and simplifying their business and systems architecture, and as game-changing technologies are introduced that eliminate the need for specific operational activities, we believe that the relative value of RPA may diminish in the longer term.

Advanced Analytics



Advanced Analytics help organizations to gain more precise insights and make better decisions through the use of sophisticated tools and extensive data sets.

The term encompasses a number of techniques and disciplines. These include:

- ▶ **Behavioral analytics** – examining how and why humans make decisions (for example, judgments on client due diligence).
- ▶ **Predictive analytics** – using a data-driven simulation approach to determine future outcomes with greater certainty and confidence (for example, the modeling of future commodity prices).
- ▶ **Sentiment analysis** – discerning sentiment from structured and unstructured data (for example, sentiment toward specific stocks or market sectors).
- ▶ **Data visualization** – presenting insights in pictorial form to improve the quality and speed of people's decision-making (for example, the visualization of trading patterns to identify instances of market abuse).

Like RPA, Advanced Analytics are being used today to solve specific problems. Going forward, we believe there is significant scope for more widespread adoption across multiple functions – with the main limiting factor being the ability to source, access and understand the enormous volume of structured and unstructured data available. The cost and complexity associated with sourcing and organizing the data greatly exceeds the cost of the analytics engines themselves. For this reason, we believe that Advanced Analytics may only start to deliver to its full potential value in the medium and long term.

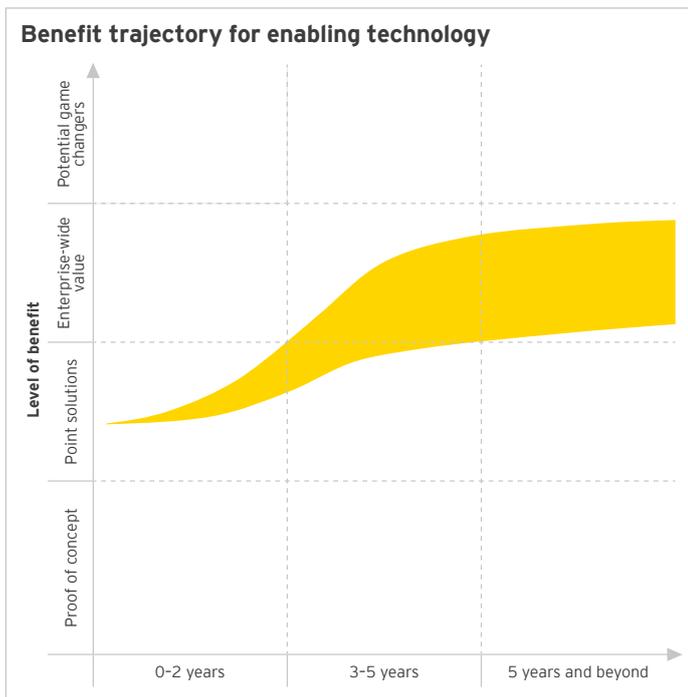
80% | Average amount of customer data which isn't used by businesses¹¹

"We are partnering with startup and established FinTech organizations that are solving business problems that require an underlying data management and analytics capability. SAS provides access to existing software and industry expertise as part of the solution and supports accelerated development of a minimal viable product. Our deep relationships with existing clients, coupled with a knowledge of their business, presents an opportunity to trial new solutions where they can add most value. This collaborative approach has benefits for all parties."

Vincent Kilcoyne, Capital Markets and FinTech Industry Lead, SAS

¹¹ Beth Schultz, "IDC: Tons of Customer Data Going to Waste," AllAnalytics website, 19 December 2013, www.allanalytics.com/author.asp?section_id=1411&doc_id=270622&_mc=MP_IW_EDT_STUB, accessed 8 January 2015.

Digital transformation



Digital transformation includes:

- ▶ The channels through which capital markets organizations interact with other market participants (for example, client portals).
- ▶ Systems and processes used as part of an organization's end-to-end value chain (for example, workflow tools for limit approvals), with a focus on increasing straight-through processing where possible.
- ▶ Enterprise tools used in daily working life (for example, collaboration tools).

The benefits of digital transformation include:

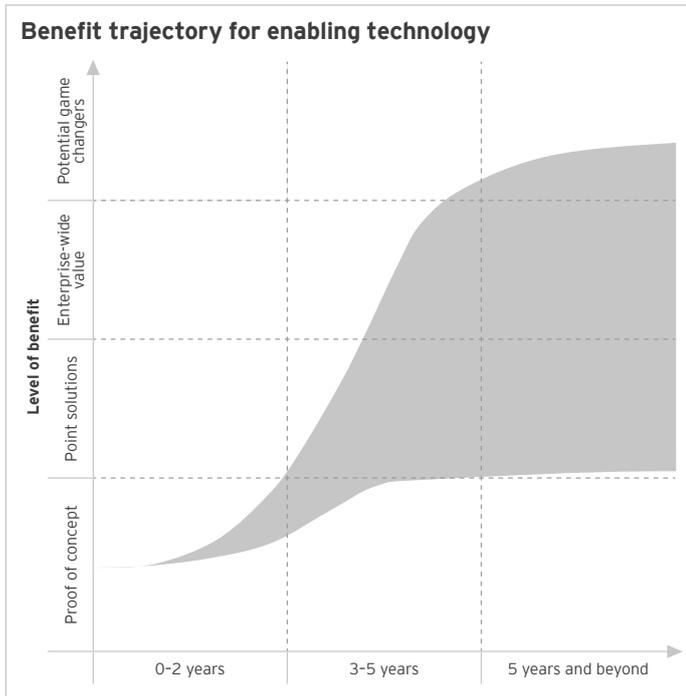
- ▶ Improved customer experience
- ▶ Increased client "stickiness" with lower attrition
- ▶ Improved efficiency and productivity
- ▶ Better control
- ▶ Quicker decisions
- ▶ Improved staff morale
- ▶ Reduced environmental waste (especially paper)

Digital transformation has been an area of significant investment in other areas of financial services where the user experience of a consumer is increasingly important as a competitive differentiator. Digital channels have seen less investment within the B2B model of capital markets, as competitive differentiation in the sector has historically been driven by relationships, the range of products and services offered, and pricing.

However, to dismiss the need for a customer-centric digital experience in capital markets would be short-sighted. As trades have moved away from the telephone and on to exchanges, relationships have become harder to sustain. And organizations are increasingly recognizing that a high-quality digital experience can boost client attraction and retention, while also helping to contain or drive down post-trade costs. Given these benefits, we expect to see greater adoption of digital customer experiences in the short and medium term.

To support a client-focused digital strategy, fundamental changes are required to the core infrastructure of the bank. The focus areas prioritized to date have mainly been around front-office processes because of the commercial imperative and profit and loss (P&L) impacts associated with them. Typically, middle- and back-office processes have not been accorded the same degree of attention thus far – and we expect to see more investment in digital transformation in these areas as risk and cost issues drive a need for higher levels of automation and control.

Blockchain¹²



Distributed ledgers, the most prominent of which are Blockchains, comprise secure data that can be shared across a network of participants to a process. Changes to the ledger are agreed using a consensus-based approach without the need for central validation, and are reflected across all instances in near-real time. Use of cryptography facilitates the authenticity of the individual transactions and provides a high level of security in a model that does not require a central party as a “trusted” intermediary.

The cryptocurrency Bitcoin has served an enormously valuable purpose in showcasing the art of the possible, specifically by demonstrating that a fabric of trust can be created across the internet for recording holdings. As such, the capital markets industry has been quick to recognize the potential benefits of the underlying technology beyond cryptocurrencies.

Distributed ledgers potentially reduce costs and transaction times while improving security, control, resilience and auditability. As well as optimizing existing processes, they could themselves enable the development of new products. Instruments that can be tokenized can potentially be securitized and, therefore, collateralized.

Use cases currently undergoing proofs of concept in 2016 include:

- ▶ Clearing and settlement of trades
- ▶ Trade finance
- ▶ Syndicated loans
- ▶ Issuance of primary shares
- ▶ Tokenization of assets (such as precious metals)

Distributed ledger technology is a hot topic and the subject of considerable hype. In our opinion, it could have a profound and positive transformational effect on the capital markets industry over time. However, before this can happen, there is much work to be done to prove the technology (in terms of attributes such as resilience, scalability, security and integration) and define standards and protocols. Regulation will also need to be reconsidered in the light of such a new paradigm. Industry-wide adoption and investment will follow only when the technology has been proven and the risks have been quantified. As a result, it will probably be a number of years before the full benefits are realized.

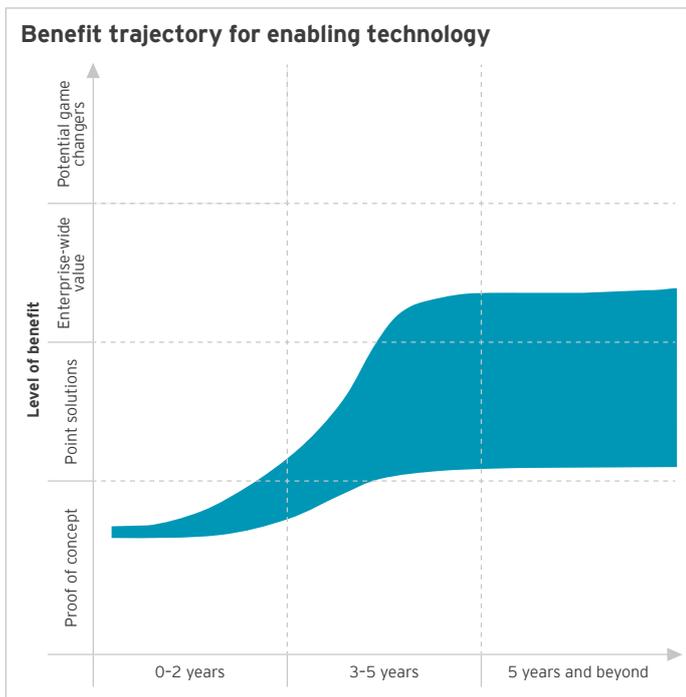
A word of caution: many commentators are citing Blockchain as the solution to problems where better – albeit less fashionable – solutions may be available. So it’s important to assess these claims with care.

“At IBM, we’re already using Blockchain to generate significant benefits within our Global Financing business. By creating a comprehensive record of immutable, non-repudiable versions of each transaction across the data silos of partners, suppliers, shippers, banks and IBM, we’re able to reduce settlement time, bring down the total number of disputes and the time to resolve them, and therefore provide much greater capital efficiency. And the decentralized nature of Blockchain gives us a solution that scales as our supplier/partner network grows.”

Keith Bear, VP, Global Financial Markets, IBM

¹² In order to align with current industry convention, we use the term “Blockchain” to refer to distributed ledger technologies.

Smart contracts



Smart contracts are programs that facilitate, verify or enforce the negotiation or performance of a contract, without themselves being legal contracts.

Once created, smart contracts are able to operate autonomously – independently of any party in the system, including its creator – and are consequently thought to be capable of replacing legal contracts. This reflects the fact that smart contracts can be used to model the terms of a real-world contract and automatically enforce its clauses as contractual conditions are met.

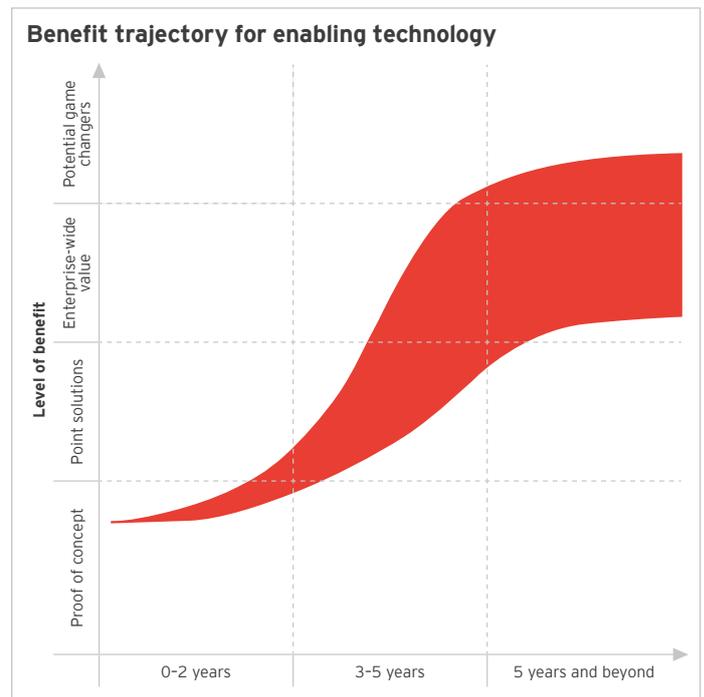
Distributed ledgers can be enhanced by smart contracts, and there is much optimism that smart contracts may ultimately be able to model master service agreements or credit support annexes associated with derivatives instruments and provide ultimate transparency over contractual terms between counterparties. This would prevent the need to wade through reams of paper-based records when renegotiation is required or a dispute arises.

While smart contracts offer significant opportunities for automation of legal agreements, they do not come without limitations and risks. Smart contracts are comfortable dealing with clear-cut issues; they are less effective when significant judgment is required or ambiguity exists.

There is often still value in having an independent arbiter to guard against scenarios where there are issues with the programmatic logic. In June 2016, the industry observed a high-profile “hack,” where millions of dollars’ worth of ether¹³ were diverted, all within the rules of the smart contracts in place. This incident will heighten regulatory interest in smart contracts and Blockchain.

¹³ Ether is the value token of the Ethereum blockchain.

Artificial Intelligence (AI)



AI is a broad concept covering the theory and development of computer systems able to perform tasks that normally require human intelligence and capabilities, such as decision-making, speech recognition and visual perception. While the term has been around for over 60 years, the relatively recent increase in vast computing power at lower prices, combined with the availability and ability to analyze Big Data, has opened up new opportunities for organizations.

AI has a number of subfields that are applied either separately or together in applications across a range of industries. These include:

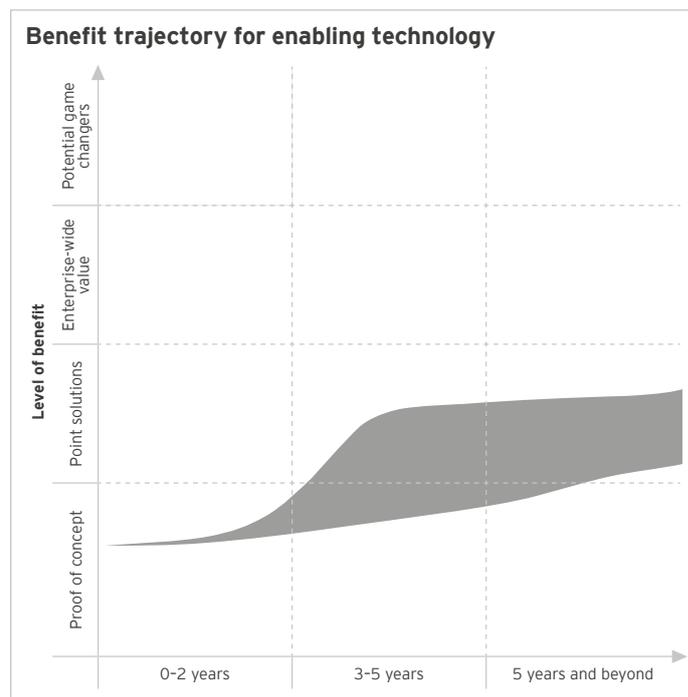
- ▶ **Natural language processing (NLP)**, which gives machines the ability to read and understand the languages that humans write or speak.
- ▶ **Machine learning**, which is the development of computer algorithms that improve automatically through experience.
- ▶ **Planning and decision-making**, which involves visualizing the state of the environment that intelligent agents operate in and making predictions about how their actions might change it.
- ▶ **Perception**, which involves using inputs from sensors (e.g., cameras and microphones) to deduce aspects of the world (e.g., speech, facial or object recognition).

Internet of Things

There are a huge number of applications of these various branches of AI that are being developed today. Leading technology corporates are aggressively pursuing AI, setting up labs and investing large sums in AI startups.

Investment banks are also joining the fray, either developing in-house capabilities or partnering with FinTechs to tackle specific challenges in areas including compliance and fraud, security, client servicing, investment research, technical support, trading support and operational resilience.

With AI having such a broad range of applications, and being further enabled by the computing power and data technologies now available, our view is that its use in capital markets will continue to increase.



The Internet of Things is a network of physical objects that are able to exchange data over the internet. While machine-to-machine exchange of information is nothing new, the Internet of Things places greater emphasis on sensors to monitor and detect physical events, and on the communication of data about these events to support either automated or human decision-making.

The potential for the Internet of Things to transform the real economy is considerable. For example, smart metering – whereby sensors within domestic and business premises record and report energy usage and environmental data – is already mainstream.

Other notable uses include media and advertising, where messaging can be contextualized based on a consumer's location, as well as applications in environmental monitoring, manufacturing, transportation and supply chain manufacturing. Given such wide potential uses, Gartner is predicting over 20 billion devices by 2020¹⁴.

But how is the Internet of Things relevant to the capital markets industry? The answer is: in many ways. Take the need of a large corporate firm to hedge coffee prices. The reason for the hedge is price uncertainty at a future date. Plenty of data is available historically about supply and demand. But how much more effective might the hedge be if the risk manager was in receipt of real-time data both from meteorological stations across the world and probes embedded in the soil on a South American hillside?

There are many other potential uses. Physical commodities traders constantly seek to optimize logistics. Knowing the exact location of a vessel, obtaining the exact weight and quality measurement straight from assayers, or being able to track containers accurately as they come into and out of warehouses can help to limit risks and enable better decision-making and forward planning.

¹⁴ www.gartner.com/newsroom/id/3165317.

Taken one step further, could devices in the Internet of Things also originate trades autonomously? For example, could an airline's enterprise resource planning (ERP) system make buying decisions autonomously based on its real-time kerosene position? Accepting trades in this way from counterparts in the "real economy" should not represent a major challenge for investment banks. At the same time, they have the opportunity to deepen their relationship with their corporate clients by advising them and supporting client connectivity.

Furthermore, giving physical objects geolocation and "statefulness" in the real world creates the potential to link the change in state or location to the provision or release of credit. This could bring positive implications for real-time funding and liquidity provisioning.

The Internet of Things could also bring big benefits to research analysts, who consume significant amounts of news and data in order to generate research, recommendations, ideas and trading strategies. Increasingly, research analysts are using Big Data analytics to model markets and stocks. Data sources for these analyses range from the traditional – earnings data, company reports, economic variables and political events – to the more recent, such as social media, including sentiment analysis. Imagine the power as Big Data converges with data from the Internet of Things.

Provided that data from the Internet of Things can be acquired – and there are plenty of concerns around data privacy and other commercial issues – scientific analysis of the true performance of businesses from airlines to utilities could be taken to a much deeper level. These insights from Internet of Things data would clearly benefit not just researchers, but those responsible for valuations or prospecting for the corporate clients of the future.

Over time, investment banks' proven strengths in terms of market knowledge, processing capacity and mathematical capability mean they may even start to derive significant revenue flows through insights from converged Big Data and information from the Internet of Things.

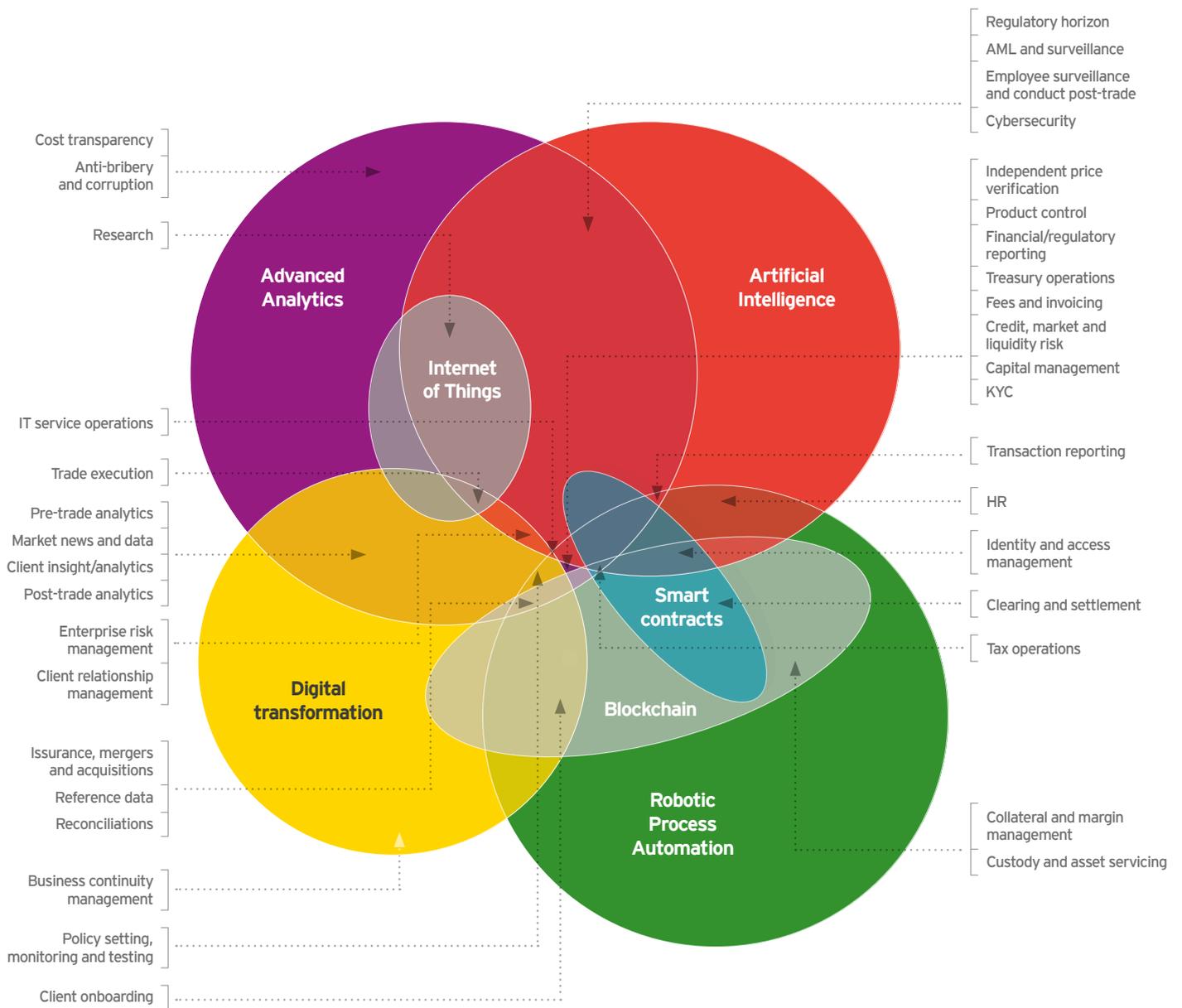
There will be a number of practical challenges to realizing these opportunities, the most prominent being in relation to security, privacy and interoperability. However, we think the Internet of Things – and its convergence with other emerging trends – presents intriguing opportunities.

Convergence presents an even greater opportunity

While the highlighted technology trends provide a basis for innovation when applied individually, when combined, they can become even more powerful and drive greater innovation. For example, RPA helps to reduce the cost of a process that is suboptimal; combine it with AI, where the software robot learns and adapts the process autonomously, and the benefits can be even more compelling.

Innovation-use cases mapped to technology trends

This illustration shows some of the innovation-use cases mapped against the technology trends, highlighting how this type of convergence is playing out. In the next section, we will go into more detail on the opportunities in each part of the investment bank. For presentation purposes, given that cloud and externalization could apply to almost all use cases, we have omitted them from the diagram.



Opportunities by functional or service area

Having considered the technology trends that will shape the investment banking landscape over the coming years, we'll now go on to consider the front-to-back business capabilities of an investment bank and set out the opportunities that those technologies present.

Mapping of opportunity areas to technology trends¹⁵

Domain	Function	Cloud technology	Process and service externalization	Robotic Process Automation	Advanced Analytics	Digital transformation	Blockchain	Smart contracts	Artificial Intelligence	Internet of Things
Client servicing	Client onboarding	●	●	●		●	●			
	Client insight/analytics	●			●	●				
	Research	●			●				●	●
	Client relationship management	●			●	●			●	
	Issuance, mergers and acquisitions	●	●	●	●	●	●			
Trading	Pre-trade analytics	●			●	●				
	Trade execution	●	●		●	●			●	●
	Post-trade analytics	●	●		●	●				
Business management	Cost transparency	●			●					
	Business continuity management	●	●			●				
Data management	Market news and data	●	●		●	●				
	Reference data	●	●	●	●		●			
Post-trade operations	Clearing and settlement	●	●	●			●	●		
	Collateral and margin management	●	●	●			●			
	Custody and asset servicing	●	●	●			●			
	Treasury operations	●	●	●	●					
	Reconciliations	●	●	●	●		●		●	
	Transaction reporting	●	●	●	●				●	
	Fees and invoicing	●	●	●	●					
	Tax operations	●	●	●	●		●	●	●	
Risk control and management	Credit, market and liquidity risk	●	●	●	●					
	Enterprise risk management	●			●	●			●	
Financial control	Capital management	●	●	●	●					
	Independent price verification	●		●	●					
	Product control	●		●	●					
	Financial/regulatory reporting	●		●	●					
Compliance	Regulatory horizon scanning and compliance	●	●		●				●	
	Anti-money laundering and surveillance	●	●		●				●	
	KYC	●	●	●	●					
	Anti-bribery and corruption	●	●		●					
	Employee surveillance, market abuse and conduct	●			●				●	
	Policy setting, monitoring and testing	●		●	●	●				
IT	Cybersecurity	●	●		●				●	
	Identity and access management	●	●				●	●	●	
	IT service operations	●	●	●		●			●	
Legal	●	●	●	●	●	●	●	●		
HR	●	●	●					●		

¹⁵ For ease of use in the table above, we have decomposed the investment bank by function/process. Where innovation relates to a specific asset class, we describe it in the relevant section.

Source: EY analysis.



Client servicing

For most investment banks, having a client-centric strategy is vital to their ability to increase revenues. This means client servicing represents a very important area of focus.

However, this is not an easy area to get right, and it involves a number of challenges, including:

- ▶ Identifying which prospective clients to target in the first place.
- ▶ Being clear on the set of services and products to distribute to current/prospective clients.
- ▶ Onboarding new clients in an efficient and effective way.
- ▶ Generating and distributing relevant high-quality research to help support and retain clients.
- ▶ Maintaining strong client relationships through the full range of relevant and available channels.

Client onboarding

Onboarding new clients is a complex process, during which banks must meet a swathe of requirements introduced to combat the incidence of financial crime (KYC and anti-money laundering (AML)), comply with regulatory rules (e.g., Dodd-Frank and MiFID II) and set up data correctly to streamline downstream processes (e.g., tax treatment for FATCA / Common Reporting Standard (CRS)).

For most banks, the number of employees involved in client onboarding (including KYC) has increased considerably. Today, it is not uncommon for the largest investment banks to have more than 1,000 people working in this area.

As well as being an area of considerable cost for the bank, complex onboarding processes have a similarly detrimental effect on the client experience, with multiple requests for client documentation and numerous forms to be completed. This doesn't give the best impression to clients during their first interaction with their new service provider.

It's not hard to see why this is an area that has been identified as ripe for shared industry utilities. Many of the same documents are used by multiple parties, and a utility model could significantly reduce the number of requests and touch points in relation to client identification and verification.

Regulations will need to become comfortable with solutions, whereby multiple parties can place reliance on the same source documentation to help firms make better risk management decisions in addition to reducing costs.

Client onboarding is also an area that lends itself to a number of data-centric point solutions, as third-party data providers can aggregate lists for screening purposes.

Further opportunities include applying RPA to many parts of the onboarding process to improve speed and quality, and reduce costs. For example, significant benefits could spring from greater automation of the file-build process as part of new client onboarding, remediation or periodic review.

More widely, there is also a significant opportunity to digitize the entire onboarding process end to end. By making the client part of the workflow, allowing electronic upload of documentation, providing an exceptional customer experience throughout, and demonstrating progress early, firms could deliver a marked improvement in the overall client experience. Already, leading banks are able to provide a client with portal access – albeit with no access to actual services – on the same day as their first contact with a relationship manager; it's a small touch, but it's better than waiting several weeks while being kept in the dark.

As industry utilities emerge to help handle client onboarding (specifically the KYC components), the primary driver is the mutualization of costs relating to a burdensome process. As the concept of digital identity evolves, smarter ways may evolve in the future for investment banks to understand their clients fully.

20%-30%

Relationship manager time consumed by onboarding and KYC

1,000+

Operational staff engaged in client onboarding and KYC activities at the largest banks

60 days

Average time to onboard an institutional client at one investment bank

Client insight/analytics

Capital markets firms have historically struggled to measure their profitability accurately at the level of the individual client.

Root causes for this include:

- ▶ Multiple relationships between clients and firms, both by region and by product or service.

- ▶ Challenges in generating a single view of the client, often hampered by poor reference data.

- ▶ Complex allocations between cost centers.

- ▶ A lack of granular activity-based cost data.

- ▶ Complex cross-subsidization between divisions.

What is also clear from many of the organizations that we work with is a growing recognition that:

- ▶ Most of the margin contribution comes from a relatively small subset of clients.

- ▶ Some clients are not served to their full potential.

- ▶ There are currently unidentified clients that have high future potential.

- ▶ There are some clients for whom there is no economic case for retention, and who need to be offboarded.

- ▶ Costs can be heavily influenced by client behaviors; examples include clients choosing to use the telephone or email rather than post-trade portals, or making last-minute changes to account allocations, which are rarely factored into pricing, fees and commissions.

- ▶ The real competitive edge in investment banking needs to come from powerful insights, rather than just being good at providing commoditized services.

At the same time, today's low-growth environment is amplifying the need for smart customer analytics. Against this background, we think a range of innovation opportunities present themselves to help clarify client profitability. These include:

- ▶ Data to provide transparency on costs, such as KPIs at a client or sub account level at each step of the transaction and client lifecycle.

- ▶ Big Data analytics to provide contextual sentiment information about each of the bank's clients, for the purpose of factoring into the "next best action" for client sales and relationship handlers.

- ▶ Advanced Analytics on position and transaction data to identify patterns and trends that inform the next best action. These could provide early warning that a client is starting to prefer another firm for a particular product or service, or that its business needs are changing so additional or alternative instruments might be suitable.

- ▶ Advanced Analytics could be used to identify the star clients of the future. By understanding the attributes of the highest performing client relationships today, and applying predictive analytics to smaller and/or potential clients to identify their potential, relationship managers can better prioritize where they invest their time.

- ▶ Dynamic behavior-based pricing to encourage client behaviors that reduce operational costs. This is a practice that has been commonplace in areas of the "real economy" for years – for example, in the fees charged by airlines for booking flights over the telephone as opposed to online.

Research

Being able to provide high-quality research is one of the services that helps reinforce the client relationship. Here are some opportunities to support this objective using new technologies:

- ▶ By combining natural language inputs with Advanced Analytics and unstructured data engineering across economic reports, monetary policy changes and political events, organizations are already gaining the ability to automate human-intensive knowledge work. Questions that would once have taken days to research – such as “What happens when the price of oil rises more than 45%?” – can be answered and visualized in minutes, providing organizations with an automated quant capability.
- ▶ Financial search engines that use linguistic search algorithms tailored for investment research are significantly reducing research time by supporting the gathering of relevant data across regulatory filings, customer presentations, earnings call transcripts and other available data.
- ▶ Powerful insights could be drawn through analytics applied to the Internet of Things. For example, research about the energy market and its participants would be significantly more insightful if actual usage data from smart meters was factored in to the analysis.

“I see potential for FinTech collaboration to add enormous value to our organization. Like all banks, we are striving to improve the richness of insights that we can derive from our data. Smarter use of analytics can help us to contain costs and at the same time improve the quality of decisions that we make. There are some obvious use cases in areas such as compliance; we also see opportunities to further improve the products and services that we provide to our clients too.”

Sean Hanafin, European Head, Global Corporate Client Coverage, Standard Chartered Bank

Client relationship management

Where clients interact directly with the bank’s systems, there are huge opportunities to increase client satisfaction and “stickiness” through well-designed, intuitive and value-adding interfaces.

Many relationship managers rely on personal knowledge of their client base to establish and maintain effective relationships, and decide the next best action to take in response to their clients’ needs. This process can be hugely enhanced by systematically improving the quality, richness, relevance and insightfulness of the available data.

Examples of innovation opportunities include:

- ▶ User interfaces (UIs) that provide a conversational experience for clients. These are becoming a reality, allowing extension to mobile applications with a combination of speech, text and touch interfaces, and enabling the accelerated introduction of new services. When applied to touch points such as client portals, capabilities such as these can be great differentiators, supporting client attraction and retention, helping to contain costs as clients opt to self-serve their post-trade needs, and enabling servicing of smaller clients via a “lower-touch” model.
- ▶ Enhanced mechanisms for client authentication using AI (e.g., biometric and continuous authentication).
- ▶ Using AI to support relationship managers in client interactions by helping them decide on the next best action.

Issuance, mergers and acquisitions

A number of the traditional services performed by investment banks are now ripe for innovation.

These include virtual deal rooms. While they have been around for some time, it is only now that their full potential value is starting to be realized through behavioral analytics. Using analytical algorithms, the investment bank can gain real-time insights into who is in the deal room, what they are looking at and how much time they are spending on certain documents. While this information is useful in isolation, over time, it allows behavioral patterns to be built up, enabling sales teams to start making even more intelligent decisions about which of their clients they should focus on.

Analytics can also be used to draw insights from unstructured data sources prior to an issue. This could include sentiment analysis of social media to help understand how a potential IPO is being perceived.

A further opportunity is to address the inefficiencies that still exist in many issuance markets. Price setting can be a mix of art and science: set the price too low, and institutions will profit at the expense of the issuer of debt or equity. There is also room to innovate in the price-setting process by using auction models.

Other models are starting to emerge to improve the connection between the issuers and dealers, and to allow them to exchange data more efficiently – notably, in the bond markets.

Given the costs associated with primary issuance, there would appear to be an opportunity to reduce costs and friction by issuing shares directly onto a distributed ledger. Early proofs of concept by market infrastructure providers have already begun with issuance in private markets.



Trading

Pre-trade analytics

As profit margins continue to be squeezed, capital markets participants are increasing their focus on pre-trade capture analytics.

The key innovation trends that we are seeing in this area include:

- ▶ Greater use of predictive analytics to model the capital, balance sheet and tax impacts pre-trade.
- ▶ Real-time analysis of trades, position and margin across multiple asset classes.
- ▶ Streamlining request-for-quote and pre-trade negotiation processes historically performed through various channels.
- ▶ Compliance with respect to quoting as required under MiFID II.

Trade execution

As a function, trading is not immune from the pressure to reduce costs, especially in flow businesses, where profit margins are small and continue to be eroded through a focus on fees, charges and total cost analysis. In addition, regulatory pressure is driving an increase in the need for transparency.

FinTech organizations are now offering the option of implementing trade execution platforms as a service. This type of offering provides clear attribution of trading costs, delivers sophisticated risk management at a lower cost than existing solutions, offers a level of transparency that is compliant with MiFID II and other algorithmic or electronic trading rules, and operates to a defined set of SLAs. We expect investment banks to make growing use of these services in order to support the setup of new trading infrastructures under ring-fencing and as they consider whether existing businesses are viable on their current cost base.

Some startups are making use of the vast array of social networking data and other public datasets now available, in order to discover and make available breaking news and emerging trends to support trading strategies.

Cloud-based, encrypted-voice messaging and collaboration services offer the ability to deploy “soft turrets” and eliminate the infrastructure and expense associated with legacy turret systems and trader voice telecommunication systems.

In the business-to-consumer (B2C) space, the past few years have seen the appearance of a number of robo-advisors – algorithms that can manage a portfolio with limited human intervention. While this aspect of the market is still at a relatively early stage of development, the promise of lower charges and greater access to previously untapped market segments represents both an indirect threat and opportunity for the brokerages that serve them.

Post-trade analytics

As we noted earlier, it can be difficult for investment banks to increase their revenues in the current environment.

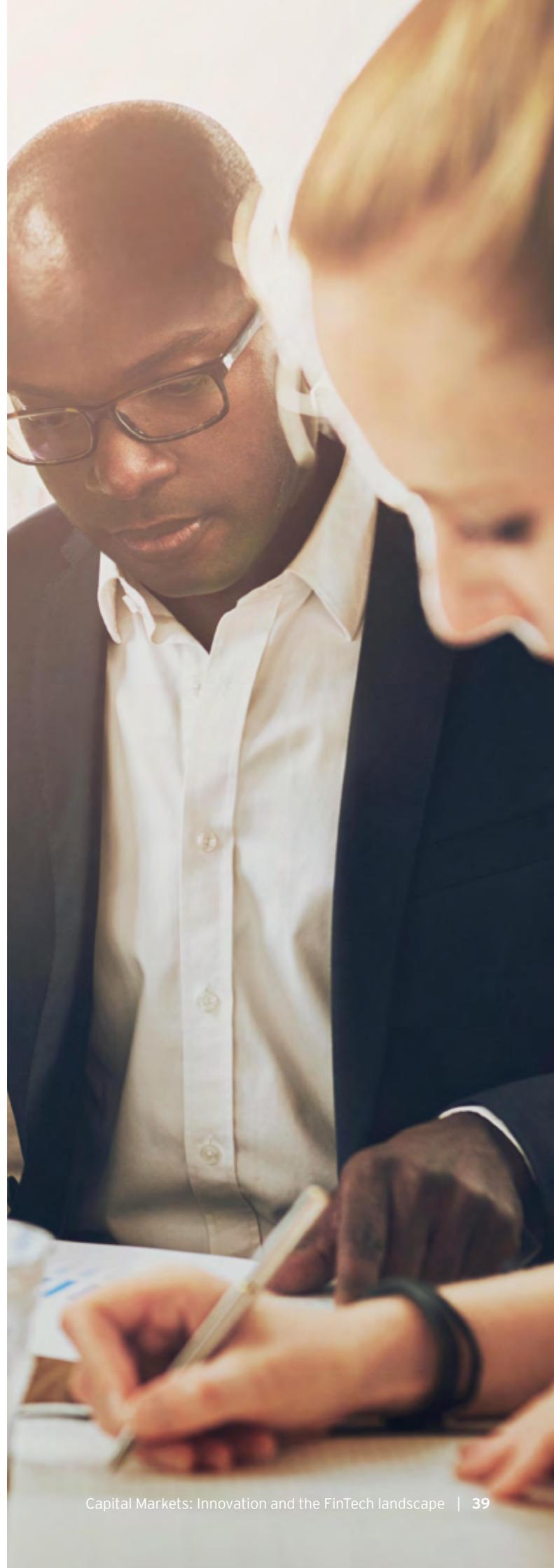
Detailed analysis of trade data can provide banks with unique insights into potential areas for profit generation. To take advantage of these opportunities, it is crucial that they have a framework in place that enables them to interpret and make sense of the “noise” – and thus identify opportunities as they emerge.

Legacy infrastructure, a proliferation of booking systems and the use of convoluted processes to enrich trade data can hamper innovation in this space. But if these issues can be overcome, there are a number of opportunities available for innovation.

One such opportunity is in enabling enhanced post-trade transparency. The need for this is being driven primarily by incoming regulations such as MiFID II, which mandates the publishing of anonymized data to the market across all asset classes.

We have observed innovative solutions that provide post-trade transparency in the FX market. This is selling mainly to the buy side to allow them to see the price achieved versus other market rates, so they can start to inform themselves on who from the sell side is providing the best prices. There's also a use case in the sell side for compliance purposes, to expose any examples of super-normal profits.

Advanced Analytics can also be applied post trade to showcase where traders have left money on the table. By analyzing the actual trades executed and comparing these with the market news and data available to the trader, algorithms can identify suboptimal trading strategies. Taken to the next level, this analysis could be performed in real time, with warnings being provided to a trader who has not appeared to act appropriately in response to a piece of economic data or sentiment analysis. The same data could also be used to support market abuse investigations.



Business management

Cost transparency

Today, divisional chief operating officers (COOs) and their business managers are constantly challenged to contain and reduce costs. However, firms rarely understand in business terms what they are getting for the money they spend on supporting areas such as technology. They can't tell if the costs are high or low, if the way they are charged across departments is fair or if the investment is effective.

In fact, the biggest challenge most businesses face is in understanding their costs. A better understanding would help answer questions such as whether they compare well with their competitors and whether the money is being spent in the most effective way to help achieve strategic goals.

As institutions increase in size, the uncertainty around costs increases too. Very quickly, businesses lose the connection between what they spend, where in the organization they spend it and how much profit they make from each activity. As a result, costs start to become opaque.

Investment banks have known for many years how cost transparency can be achieved, but only recent technological developments have made it possible in practice, by enabling the banks to handle the huge volumes of data and intensive processing required in large businesses.

Cost-transparency solutions use data analytics to make costs more transparent to the business. They are especially focused on technology and change project costs, which are frequently the least understood in a business.

The result of cost-transparency technologies is that the business knows what it is spending, and where.

Over time, organizations have gone further than just making costs transparent and are now moving into mapping costs to business outcomes. Examples include understanding the real monthly technology cost of a "standard desktop PC user" using a basic package of productivity software.

When cost transparency is applied to "cost per trade," the results can be powerful and may be used to inform dynamic pricing, whereby fees charged are influenced up or down by the way counterparties behave. Late allocations or amendments and calls to client service teams result in higher costs; in contrast, low-maintenance clients that use the technology provided by the bank in the way it was intended benefit from reduced charges.

Business continuity management/business resilience

Big Data and predictive analytics can be used to provide earlier warning of issues that could affect business continuity - from geopolitical events through to local disruption, or even internal employee actions.

Earlier issue identification through predictive analytics can also make a huge difference to how clients and counterparties are served. If a major outage can be identified early, and the impact quantified and expressed in a highly-visual manner, with a clear estimation of impact and even resolution time, expectations can be managed. Early, informed dialogue with counterparties and regulators can be the difference between an outage and a crisis.

We are seeing a growth in adoption and use of cloud-based solutions, which can help to reduce the risk and costs previously associated with IT-system upgrades and business continuity events.

This is achieved by replacing spreadsheets, emails and telephone calls, which are typically used to coordinate activities in these critical periods, with live plans that support the orchestration of activity across multiple parties, real-time visualization of status during the event, and an audit trail for review and learning following completion.

In the event that a physical space, such as a trading floor, is rendered inoperable, it is likely that those with cloud-based front-office solutions and soft turrets will be up and running more quickly than those reliant on legacy infrastructure.

Data management

Market news and data

Capital markets firms consume vast amounts of market news and data from multiple sources. This mass of information includes structured data imported directly into front- and middle-office platforms and traders' terminals, and unstructured data – such as news – delivered in human-readable form to a large number of devices and channels, including email.

We see a number of opportunities for firms to improve the way they consume external news and data. Our experience shows that:

- ▶ Firms are overpaying for the data they consume. In fact, it is not uncommon for firms to pay multiple times for the same data, often because data has been procured by different business units at different points in time.

- ▶ As well as overpaying, firms are also spending money on data that they simply do not use, often because there was a historical need that has not subsequently been re-evaluated.

- ▶ Firms are not deriving maximum value from the data that they receive. This is largely because it is often presented without context, and it is impossible for humans to derive all the correct insights manually and within an acceptable time frame from the vast array of data on offer.

- ▶ Data being supplied to the front office is not always being utilized effectively and systematically by the compliance function.

Looking across the market news and data arena, we can see several opportunities for innovation. For example:

- ▶ Solutions that can identify, measure and analyze market news and data consumption across business units, functions and geographies could help to reduce cost. Tools are now available that prioritize news feeds based on the portfolio and style of a particular trader. Taking this a step further, traders could rate the relevance of particular news items to help the algorithm to optimize what it presents. Aggregated over a front-office population, these capabilities can help to build up a powerful picture of which information is most valuable. These insights can then be used by front-office COOs to reduce costs by eliminating redundant or low-value news and data.

- ▶ Advanced Big Data Analytics engines can mine unstructured data, such as search engine outputs, newsfeeds, blogs, analysts' reports and information from social media, and combine the results with structured data, such as positions and prices, in order to derive more powerful insights. These insights can then be presented in easily digestible forms to support the development of trading and risk management strategies.

- ▶ More can be done to support the human interpretation of data through contextualization and visualization. Sophisticated graphing technologies are emerging that can show complex relationships between news and events in the context of a portfolio, enabling the portfolio manager to make better informed decisions.

- ▶ Analytics on the consumption of market news and data by the front office could also bring benefits in relation to compliance and surveillance. There are a number of potential use cases in relation to market abuse, where it is critical to understand whether a trader acted on legitimate or inside information.

Reference data

There are several challenges around reference data, often including the presence of fragmented and inconsistent data repositories, and siloed data management approaches that hamper banks' ability to streamline processing. The use of different versions of client and instrument reference data at various points within the trade lifecycle can result in outcomes such as breaks requiring manual intervention, books and records that do not reflect reality, and errors in transaction reporting.

Even where data is synchronized across functions, there are often quality issues across the existing data landscape that result in back-office processing errors.

By creating a single version of the truth for counterparty and instrument reference data that is consistent across the front, middle and back office, investment banks can not only increase efficiency through greater opportunities for straight-through processing (STP), but also achieve far greater precision in risk calculations. External utilities backed by multiple banks have now been created to help firms realize these benefits.

External services are also available for specific purposes. For example, some market infrastructure providers make standardized and enriched counterparty reference data available to support regulatory reporting.

An alternative approach is to use analytics to provide an abstracted layer across multiple data repositories in order to gain a holistic view that can be used by multiple processes. We are seeing applications of data virtualization in numerous areas, even as part of application rationalization and simplification programs.

Analytics can also be used to assess data quality. Firms often estimate the quality of their data by looking at the impact of trading errors or regulatory fines, whereas analytics can provide an objective way to measure data quality and understand which processes use which data and where the bottlenecks are. Also, Advanced Analytics combined with robotics can be embedded as a repair mechanism in the data management lifecycle to support the continuous improvement of data quality.

Blockchain also presents a huge opportunity in this area, not only to provide unambiguous reference data attributes, but also as a mechanism to support sharing of reference data across organizations, reducing the potential for intercompany inconsistencies.

Another area that we believe is ready for standardization is product reference data. Our experience shows that investment banks are grappling with inconsistent definitions, incomplete catalogues and poor governance around how products are designed, approved, maintained and retired.

Post-trade operations

Historically, investment in innovation has mainly been directed toward the front office, automating aspects of the value chain that have the most direct impacts on revenue. In the period before 2008, when ROEs were healthier, the build up of cost and complexity in the back office went largely unaddressed. Strategic transformation simply wasn't a priority and, if a problem could be solved by adding more people, that's what was done.

As costs in the back office have become more of a focus in recent years, the response has often been to move an increasing number of roles to lower-cost locations. Other traditional cost-reduction strategies have also been applied, such as layering and reviewing spans of control.

This sequence of events means many of today's post-trade operations consist of complex legacy technology: rich in functionality, yet hard to untangle. Data has been dispersed across multiple repositories. The application inventories in many investment banks show the list of post-trade systems running into hundreds, if not thousands.

The provocative question sometimes asked is: "Why do we need post-trade at all?" It's a fair challenge. And if distributed ledger technology takes off as some expect, the number of post-trade activities that are genuinely required may fall substantially.

A second question asked is: "Why does post-trade processing need to be done by us?" The answer is: it doesn't. There are already post-trade utilities on offer operated by third parties.

Additionally, a third challenge we observe relates to the cost of post-trade platforms, not least because most were designed in the pre-cloud era.

Post-trade utilities

In our view, the following trends will shape the development of post-trade utilities going forward:

Established technology vendors are evolving into full-service outsourcing players in the post-trade processing arena.

- ▶ Established technology vendors are also extending their service portfolios – for example, going beyond the traditional areas of reconciliations and data management to cover post-trade functions that are considered to be more complex, such as settlement, corporate actions and tax processing.
- ▶ Both FinTechs and established firms are developing point solutions in the post-trade space to address specific regulatory needs such as transaction reporting, and collateral and margin management.

The externalization of post-trade activities could also prove helpful in addressing other regulatory-driven requirements for investment banks, such as recovery and resolution planning (RRP) and ring-fencing.

Clearing and settlement

It's widely believed that Blockchain has the potential to bring significant benefits to post-trade operations.

The expectation is that the implementation of distributed ledgers could engineer away the need for many reconciliations that are performed today, as they provide a single source of the truth that is independently validated and available to all parties.

3,000+

Number of FTEs performing reconciliations at one investment bank

Clearing and settlement processes are likely to be one of the functions most highly impacted by distributed ledger technology. The current market practices in clearing and settlement expose firms to settlement risk in the event that counterparties will not be able to deliver cash or securities in line with their contractual obligations. Management of breaks, fails and disputes is time-consuming and expensive. Also, T+2 or T+3 settlement means firms have to model what assets may be available at points in the future in order to optimize collateral management.

Blockchain potentially addresses all of these issues. The creation of an infrastructure in which each participant holds an immutable copy of transactions where value exchange has already occurred brings profound implications. Far from just representing an incremental improvement to the end-to-end process, it fundamentally transforms it – leaving a large number of operational processes redundant as a result.

Therefore, the significant reduction in settlement risk available through using Blockchain is accompanied by a huge opportunity to reduce operational cost and risk. Estimates regarding the size of the prize vary; our opinion is that it is too early to predict this with any degree of certainty.

As far as distributed ledger technology is concerned, we are already seeing many proofs of concept being undertaken in the market to understand the costs, benefits and challenges associated with such a fundamental change in the operating model for clearing and settlement. For example:

- ▶ ASX announced an investment of AU\$14.9m (around US\$10.5m) in Digital Asset Holdings and the award of a contract to the company to design a new distributed ledger technology solution that would enable the Australian equity market to “significantly simplify and speed up post-trade processing.”
 - ▶ NASDAQ's Linq project is aimed at private equity to provide the ability to trade, clear and settle stock in private companies. It has already taken the first steps toward issuance of shares to a private investor using Blockchain-enabled technology.
-
- ▶ R3, the industry-wide consortium of over 40 financial institutions, including a number of investment banks, has facilitated the simulated exchange of value between participants using tokenized assets.
-

Blockchain's ability to tokenize assets could also have interesting implications. Take gold bars, for example. The current process for transferring ownership makes it difficult for them to be used as collateral. Once tokenized, however, owners could transfer gold tokens without the physical movement of gold bullion.

While the immediate focus of most of the proofs of concept currently being initiated is to test out technical feasibility, there are a number of major unknowns that will need to be resolved. These include the regulatory and legal implications of Blockchain, as well as an agreement on standards to allow ease of interoperability.

There has been speculation as to whether Blockchain represents the beginning of the end for market infrastructure providers. We don't see it that way. Market infrastructure firms have evolved over many years, and play a pivotal role in the orderly operation of financial markets. While some of the services they provide may be engineered away or radically changed, our expectation is that – rather than viewing Blockchain as a threat – they will embrace the technology themselves, with a view to providing even better services at lower costs.

“Everyone is looking for an ‘Uber moment.’ There are some expectations out there that Blockchain technology firms will displace market infrastructure providers. However, our approach is to partner with institutions such as exchanges and clearing houses to provide better technology to improve clearing and settlement processes for the benefit of market participants.”

Dan O’Prey, Chief Marketing Officer, Digital Asset Holdings

“Our immediate investigations are currently focused on not just assessing Blockchain technology, but understanding how our systems can interact with it. Our research suggests that systems with fine-grained modularity will be more amenable to Blockchain environments than legacy systems.”

Nick Clarke, Head of Capital Markets Solutions, GBST

“Blockchain financial infrastructure solutions, like our Bankchain settlement platform, have the potential to make existing post-trade processes faster and more efficient. These platforms also have the inherent ability to enable real product and service innovation. For example, by tokenizing gold, Bankchain can help market participants decrease capital requirements and counterparty risk while increasing operational efficiencies and revenue opportunities.”

Charles Cascarilla, CEO, Paxos (formerly itBit Technologies)

Collateral and margin management

Transforming collateral management is currently high on the priority list of most investment banks. There are two major reasons for this:

- 1 The first is regulatory. Changes to the way collateral and margins are managed are being driven by a number of new regulations and initiatives, including the BCBS-IOSCO Uncleared Margin Rules.
- 2 The second reason is operational. Collateral management has typically been an area of underinvestment and, as a result, many firms have a proliferation of systems, processes and data across regions and asset classes. We therefore see significant potential for RPA to address cost and quality issues in processes such as documentation, margin calculation, margin calls and valuation.

We are seeing a significant amount of activity in this area from established and new technology vendors, as well as from market infrastructure providers. As a result, solutions are now coming to market to transform documentation, portfolio reconciliation, margin call processing and margin settlement.

Custody and asset servicing

The potential of distributed ledger technology to provide an immutable asset ledger-supporting custody and asset servicing processes is significant. However, with such advances still likely to be some years away, banks will look at alternative technologies in this area in the short to medium term. Externalizing the “scrubbing” of corporate action data is now a real option for banks, with FinTechs offering event information that is collated across all geographies in near-real time. And given the heavy manual workloads that are often associated with reconciling corporate actions across client positions, we foresee opportunities to derive benefits from RPA in relation to entitlement capture, election instruction, payments and reconciliations.

Treasury operations

Capital requirements have increased significantly for most banks, and liquidity remains scarce. Efficient treasury operations are critical for meeting regulatory obligations to maintain liquidity and profitability.

In this environment, there is a range of options that banks can take. Externalizing the treasury management system via a cloud-based solution significantly reduces cost and harmonizes processing. Deploying RPA in areas where manual processing is still required also reduces the bottom line and increases efficiency. And deploying analytics solutions across multiple repositories of information to provide a near-real time view of cash balances and ladders offers true insight to support decision-making.

Of significant interest in the medium to long term is the opportunity for componentization of the treasury management function. This can be done by utilizing open API services provided either by the bank or by third parties to support functions such as FX, transaction services and payments, helping to meet the need for working capital and trade finance. This is one area where disintermediation by FinTechs is a real possibility, presenting the potential for banks to make cost savings and efficiency gains.

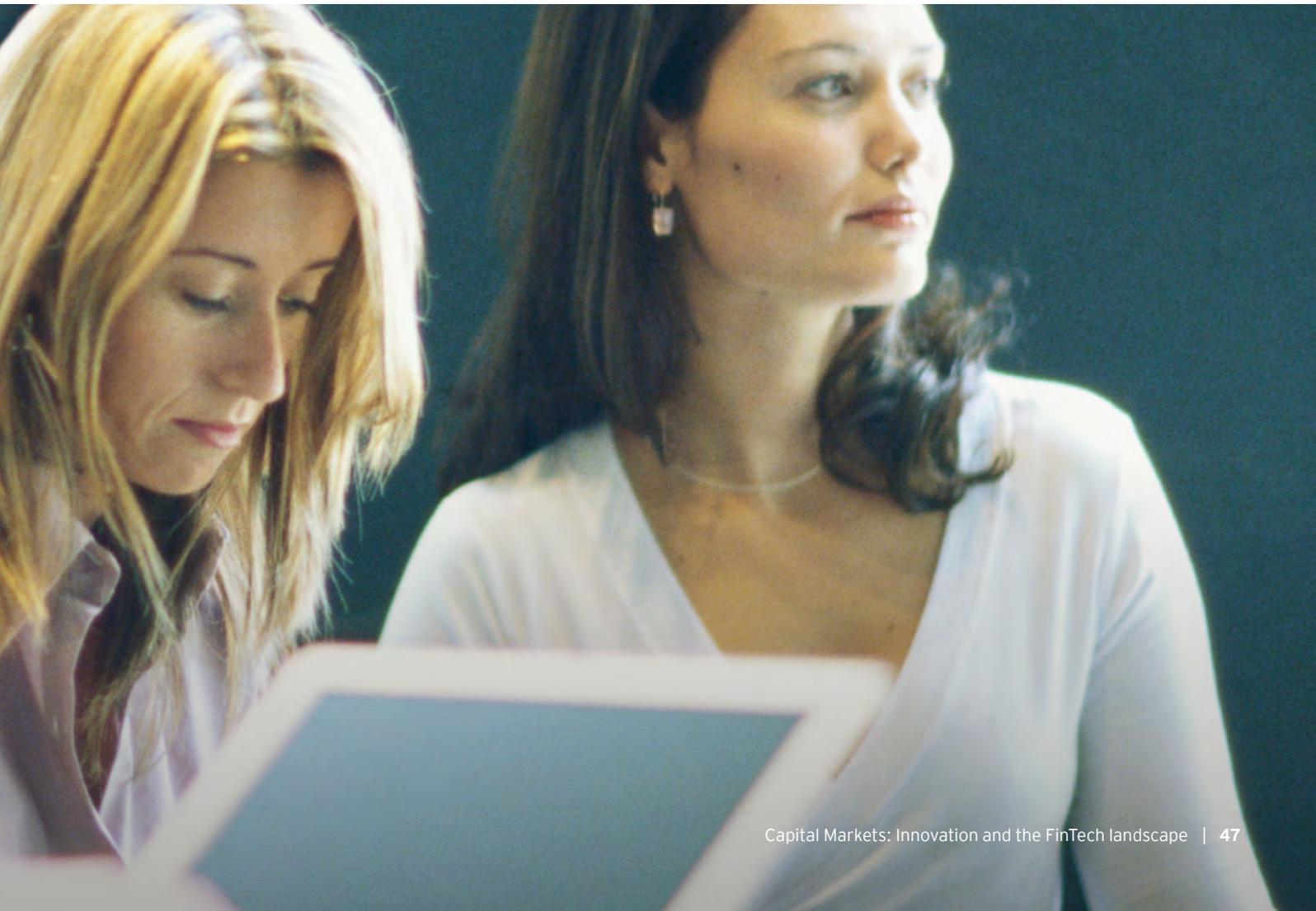
Reconciliations

Solutions to improve the efficiency of reconciliations have been around for some years. Yet we still see some investment banks employing thousands of people in this field, surrounded by a proliferating mass of end-user spreadsheets and databases.

In our view, RPA can play a key role in reducing headcount, particularly in relation to data preparation and break resolution. Software robots can also significantly reduce the time taken to complete reconciliations.

Add in Advanced Analytics capabilities, and reconciliation robots could start to provide much more meaningful data about why breaks occur. Then add in AI as well, and systems could even start to address upstream issues to prevent breaks occurring in the first place.

Reconciliation also lends itself to externalization. While basic business process outsourcing has been applied to reconciliations for close to 20 years, we are now seeing FinTech firms use cloud and data visualization technologies to enable operations users to view and reconcile their data in radically different ways.



Transaction reporting

At the back end of the transaction reporting process, externalization of reporting using Approved Reporting Mechanisms (ARMS) is a well-established practice, with a number of those on the market having the ability to take care of reporting across multiple regimes, including Dodd-Frank, EMIR, MiFID I and II, and REMIT. ARMs also take care of evolving requirements and can help to insulate their clients from regulatory change.

However, the real challenge often lies upstream, where the task of assembling the data required for reporting from multiple source systems is fraught with complexity and risk. Changes to upstream systems and data stores can create significant issues, and regression testing is essential but expensive. The consequences for transaction reporting breaches can be severe, with fines of more than US\$10m being a relatively common occurrence.

Against this background, we see opportunities to use analytics, RPA and AI to drive improved data quality, fix root cause issues and reduce costs.

Furthermore, in a Blockchain-enabled post-trade environment, we would expect regulators to have “read access” to transactions. Assuming that they themselves develop the capability to process information from such sources, the need to separately report transactions may in time be engineered away. This will be a win-win for both parties in terms of effort, cost and timeliness.

Fees and invoicing

As investment banks have become increasingly sophisticated in the products and services they offer, their charging structures for fees and commissions have also become more complex.

However, fee structure is not an area in which we have seen major investment. This is surprising, given the challenges many investment banks face in managing revenue and expenses – and the fact that a failure to do this well can result in unrecoverable fees and a corresponding impact on both the top and bottom lines.

We can see major opportunities in this area for analytical tools that can identify missed revenue and anomalous expenses. We also believe there is a strong case for using RPA to improve quality and control over invoice creation.

Tax operations

We have observed a growing appetite for externalization to reduce cost and improve the efficiency of tax operations, notably in relation to FATCA and CRS (onboarding, withholding, reporting and remediation), human capital services, and broader tax compliance reporting. Regulations, such as 871m, and initiatives such as the existing and proposed Financial Transaction Taxes may also benefit from industry-wide collaboration.

The rules-based nature of tax lends itself to increased automation. We see significant potential for AI and Advanced Analytics to be applied to tax operations in order to increase efficiency and provide deeper insights.

Implications for front-to-back vendors

Looking forward, providers of front-to-back platforms – which handle the lifecycle of a trade from execution through to settlement – will need to evolve. And as the ecosystem around them develops, they will need to be adept at interfacing with new external systems and processes.

What kinds of systems and processes?

By way of example, take Blockchain. There are many potential use cases for Blockchain, and we expect these to evolve at different speeds, reflecting the size and nature of the hurdles to be overcome. Existing platforms will need to be able to integrate seamlessly with internal and external Blockchains once they become available. This will be far easier to orchestrate if starting from a flexible, component-based architecture.

Risk management and control

Risk management in investment banks has been transformed over the past decade, mainly in response to new regulations triggered by the global financial crisis of 2008. The expectation is that financial and nonfinancial regulation will continue to broaden and deepen as regulators become even less tolerant of preventable errors, bank failures and conduct breaches.

Credit, market and liquidity risk

With the goal of making banks safer and more resilient in the wake of the crisis, the Basel Committee on Banking Supervision (BCBS) has levied a number of new capital charges and constraints on liquidity and leverage. Examples include Basel II.5, Basel III, Dodd-Frank and the Fundamental Review of the Trading Book (FRTB). And BCBS 239, the regulation governing banks' risk aggregation and reporting, has significantly increased the required risk data management capabilities.

Before the crisis, risk management was typically highly siloed across business lines and between market and credit risk functions. Recent regulatory changes, such as Basel III, have driven together a number of the market and credit risk elements – something that is at its most apparent in the new counterparty credit risk requirements.

There has also been convergence between front office and risk methodologies. Regulatory capital costs are now a significant part of trading P&L, and the emphasis on risk management is both changing and increasing. Risk functions have become an integral part of trading, and risk has now moved from a back-office to a corner-office function. Exposures are monitored proactively, and risk measures calculations continually take place throughout the trading day. In addition, regulatory risk impact is now a critical part of pre-trade decision-making.

Against this developing background, we see a number of opportunities for chief risk officers (CROs) to make use of new technology applications to support the development of their role. These opportunities include:

- ▶ Making use of external services to gain greater confidence over credit risk ratings. We are seeing examples of startups that facilitate a collaborative approach, pooling credit risk estimates and data from multiple banks and benchmarking resources, while guaranteeing anonymity for the data contributors.
- ▶ Leveraging open-source risk analytics components to handle data management and other technical issues for both the front office and risk managers.
- ▶ Partnering with vendors offering solutions to automate the capital assessment, tracking, monitoring and reporting work. These include the new Basel III (or equivalent rules in Asia-Pacific) and its associated rules on stress testing, model developments, minimum capital requirements and the liquidity-coverage ratio (LCR); adherence to financial reporting for IFRS 9; expected credit loss (ECL) models; BCBS 239 (on management of data in risk analysis); and the CRS to promote global automatic exchange of information and cross-border tax compliance. These technologies not only simplify the compliance process, but can be delivered remotely as regulation-as-a-service platforms, offering continuous compliance to multiple regulatory requirements.
- ▶ With regulations such as BCBS 239 and the FRTB dictating the mechanisms by which risk is aggregated and the way that calculations are performed, banks are seeing a move away from end-of-day batch aggregation toward incremental aggregation of data in memory. Some established players are providing data aggregation solutions.
- ▶ Balance sheet optimization. Given the many new and different regulatory ratios – such as capital, funding, leverage, total loss-absorbing capacity (TLAC) and bank levy – the composition of the balance sheet is arguably more important than ever to support profitability. The risk function can help optimize the balance sheet by working with finance and strategy functions to consider various economic scenarios, strategic choices and likely regulation. Analytical optimization tools support the process, and can result in options that improve ROE by anywhere between 50 and 400 basis points while still fulfilling all regulatory requirements.
- ▶ High-performing data infrastructure. It goes without saying that any high-performing risk function depends on this – analytics and robotics can play a major role as mechanisms to assess and visualize data lineage and support data quality management.
- ▶ Time series data management as a service. This involves cloud-based enterprise data management to support risk calculation.
- ▶ Virtualization of data across data silos. This can create holistic data sets to support risk aggregation.
- ▶ Advanced Analytics to support scenario back testing and stress testing.

Enterprise risk management

As operational processes become more streamlined and automated in response to clients' rising expectations and the drive for cost efficiencies, risk functions will need to find ways to assess risk more quickly without any form of human intervention.

The risk landscape continues to become more complex and intertwined, with geopolitical, social, vendor, regulatory compliance and cybersecurity risks all influencing each other. This rising interdependence requires greater levels of sophistication, with earlier risk visibility required in order to prioritize mitigation.

We expect to see a continued focus on risk management at the enterprise level, integrating siloes and promoting greater information transparency and collaboration. Organizations will need to turn their attention toward understanding and preparing for the management of future risks in line with their risk appetite.

Against this backdrop, we see some FinTech opportunities.

There are opportunities to digitize core processes to reduce manual interventions. There's also the potential for enhanced risk reporting, by moving from paper-based or static electronic reports to interactive solutions deployed on mobile platforms that offer information in real time, and enable users to carry out root cause analyses and identify potential risks more quickly.

Visualization can also play an important role. By providing senior management with easy to use, intuitive dashboards, enterprise risks can be identified and actioned earlier. Transparency in relation to enterprise risk can play an important part in the overall risk culture of the firm.

Financial control

In terms of financial control, there is a clear evolution from a function whose primary role was analyzing historical data to one whose focus will be providing forward-looking insights. In-memory computing and Big Data are the clear direction of travel going forward, with predictive analytics being a key driver of these changes.

However, one challenge is that the finance and risk functions require a stable consistent dataset, not the fluid and ever-changing information that is the hallmark of Big Data. So a key opportunity in the finance and risk space is technology that will allow Big Data to be audited and tracked as it changes over time.

Like post-trade operations, finance functions have suffered from relative underinvestment in technology in comparison with the front office. As a result, finance processes tend to have higher levels of manual processing and fragmentation. This opens the door to RPA as a quick and relatively cheap mechanism to address the headcount costs associated with running repetitive and low-value-adding tasks. RPA offers an opportunity to automate a tremendous range of use cases within the finance function, including:

- ▶ **Financial accounting** – P&L and balance sheet control, adjustments and month-end attestation
- ▶ **Technical accounting** – fair-value and effective interest rate calculations
- ▶ **Legal entity close and consolidation**
- ▶ **Operational accounting** – daily reconciliations of source system to sub-ledgers and general ledger
- ▶ **Financial planning and analysis** – budget preparation and capital planning
- ▶ **Asset and liability management** – management of interest rate risk and banking books
- ▶ **Tax reporting** – VAT, corporate tax calculation and reporting
- ▶ **Assembly of consolidated regulatory reports**

Capital management

Banks face a number of challenges in managing the capital they need to support their operations:

- ▶ Managing regulatory capital has become an auditable process, with a focus on the ability to evidence the robustness of the underlying data and controls. For many investment banks, this requires an overhaul of data and processes.
- ▶ The rules that define the capital requirements for banks change on a regular basis – meaning the supporting models need the flexibility to change in response.
- ▶ In light of the general increase in capital requirements for banks, there is ongoing pressure to reduce the impact on the balance sheet by using operational methods, such as trade and portfolio compression, to net the impact of buy-sell contracts.
- ▶ Internally, gaining model recognition and approval from regulators to support favorable capital requirement calculations requires detailed explanations of management information (MI) and calculations performed at a low level of granularity.

In the face of these challenges, there are a number of areas where FinTech solutions could support investment banks' efforts to make their capital management more effective and efficient. These include:

- ▶ Using robotics to support the ongoing enhancement of data quality.
- ▶ Using data analytics to enable flexible capital calculations and model waivers, and to provide visibility across asset classes, thereby supporting enhanced levels of portfolio compression.
- ▶ Facilitating collaboration across banks to help them address a number of the challenges they face. There is often a requirement for a minimum set of prices to be present on a particular asset to support the waiver; for illiquid assets where price availability is low, there is an opportunity to pool prices across institutions to attain the required waiver.
- ▶ Using an industry utility model to offer a means for capital markets firms to push much of this activity out to a central provider. With every bank performing its own calculations to determine its capital requirements, there is obvious benefit in centralizing this capability and providing it as a service. While the nature of individual waivers does result in some divergences from a standardized approach, we see this as a service that would provide significant benefits for the industry in an area that is largely non-differentiating.

Independent price verification

The current landscape of independent price verification (IPV) systems consists largely of in-house end-user computing (EUC) solutions that lack clear control and transparency. Regulations such as the Capital Requirements Regulation (CRR) and the Capital Requirements Directive (CRD IV) will directly impact this function, with mandates on prudential valuation requiring a more strategic approach to valuation.

Bond valuation practices have remained overly reliant on a single source of data, creating a number of risks. As a result, regulators are pushing managers to end their obsession of using limited sources for fixed income pricing data, and implement their own due diligence through IPV.

Together, these trends mean opportunities exist for solutions that help managers to source different prices from a variety of sources, collating, ranking and defining those prices in a central repository where records can be audited easily – not in spreadsheets.

Product control

One of the key challenges in product control is cultural: historically, every desk wants its own way of doing things, and there is little desire for a consistent consolidated solution. However, new regulations will directly impact the current model, specifically by requiring a more granular and forward-looking view.

The FRTB alone represents a major challenge as:

- ▶ Tests will have to be performed at desk level, on a daily basis, at lower levels of granularity.
- ▶ The rules and models will be computationally intensive.
- ▶ There will be a requirement to source and track price observations back to source.
- ▶ There will be a requirement for 250 days of historical data to be available for back testing.
- ▶ There will likely be an increased focus on data lineage and data quality, with material capital downsides for poor or badly understood data.

Banks will have to make major decisions on whether to build or buy new infrastructure or to explore which aspects could be undertaken by vendors or managed service providers.

Financial and regulatory reporting

One of the many challenges of external financial and regulatory reporting is keeping on top of ever-changing requirements. This is an area that is ready for cost mutualization, as professional services firms with global footprints can horizon watch, scan and analyze emerging requirements just once, but on behalf of multiple industry participants. We expect more and more of this to be undertaken in conjunction with AI tools, which can ingest and interpret vast quantities of regulatory guidance.

Taken to the next step, reporting can be delivered as a managed service, meaning that not only is the regulatory intelligence gathering performed just once, the delivery of reporting schemas, as well as the workflow around reporting, is centralized too.

Fines are not uncommon for regulatory reporting failures. Greater use of analytics, as part of quality control and quality assurance, can help to reduce issues. Often, challenges are the result of upstream changes to systems without due consideration to the reporting implications. So embedding analytics into regression testing is a good idea.

In financial and regulatory reporting, there is a growing focus on back testing and predictive modeling, and reporting through a vertical master dataset via a unified architecture will be critical. There is also further focus on implementing technology to help cut costs by avoiding duplication. For example, in-memory computing will enable one database to provide data for financial, statutory and management reporting. Having these multiple models will be vital, and the direction of travel will be toward the unification of data.

Compliance

The role of the compliance officer in investment banking has become increasingly complex. This reflects the need to maintain alignment with a raft of new regulations across multiple jurisdictions while also providing regulators with greater transparency and granularity of data to evidence regulatory compliance. The penalties for noncompliance have never been greater – and the traditional response has been simply to pump in more money and resource, a tendency evidenced by the steady rise in the proportion of spend on compliance in all financial institutions.

Indeed, EY's *Global governance, risk and compliance 2015 survey*¹⁶ revealed that the cost of compliance in banking accounts for roughly 40% of firms' total costs – and both regulators and CEOs are demanding greater efficiency in this area. Compliance officers are being asked to deliver this against a backdrop of conservative controls that generate a high noise-to-signal ratio and fragmented infrastructures that struggle to provide a holistic view of risk.

40% | Percentage of firms' total costs that compliance can account for

RegTechs have responded to these challenges by offering the promise of innovative technologies to automate routine compliance obligations, deliver near-real-time risk information, enhance efficiencies and help reduce the cost of regulatory processes, while also meeting regulatory commitments.

Regulatory horizon scanning and compliance

For any investment bank, keeping pace with the rate of introduction of new regulations is a challenge in its own right. As a result, there are major opportunities for firms to provide services that use analytics services coupled with AI to scan regulatory notices, consultation papers and policy statements in order to produce a consolidated view of the rules that firms should be compliant with.

Other organizations are adopting a backward-looking approach, performing analytics across years of regulatory fines to provide insight into causes and associated impacts, then selling this information to banks to help them prioritize areas for investigation and testing.

Taking this a step further, predictive analytics solutions will continue to be developed that hook into an investment bank's controls and data to identify whether their products and practices comply with appropriate regulations.

Regulators are also exhibiting innovation in this space, and there is the hope that "robo-handbooks" will make use of AI techniques to guide banks through the rules that are applicable to them, depending on their specific characteristics.

¹⁶ www.ey.com/GRCsurvey2015.

AML and trade surveillance

The amount of available information concerning AML risk exposures – such as sanctions, watchlists, politically exposed persons (PEPs) – increases daily. Keeping track of the relevant data is a huge challenge, and the price of noncompliance is high. Regulation continues to evolve in this space, with initiatives such as the EU's fourth AML Directive (which will take effect in June 2017) and the Market Abuse Regulation. Given these factors, utility data providers offering sources of comprehensive, real-time global AML data are becoming increasingly important in helping capital markets firms to mitigate the risks around AML and trade surveillance.

We see a significant role for OCR, AI and Analytics in trade finance in particular, especially given the forward trend of increased globalization. Given the amount of paperwork required as part of current processes, the opportunities to take out cost and achieve compliance are significant.

The need for closer trade surveillance has resulted in a massive rise in budgets for compliance staff. RegTech solutions apply cognitive computing on Big Data to improve trade surveillance and the monitoring of suspicious transactions, or to limit incidences of money laundering and terrorist financing, in order to protect banks against fraud and penalties for noncompliance.

Innovative regulatory solutions that use network analytics and automated machine-learning techniques to empower anti-fraud teams will definitely gain growing interest among capital markets firms.

KYC

KYC is another area of investment banks' anti-financial crime activities that comes with a high price tag. Financial institutions face a daunting task in providing timely and accurate KYC reports to regulators, as they are expected to track and retain in excess of 300 data attributes about their clients. Therefore, any solution that simplifies KYC compliance will deliver value.

300

Number of data attributes tracked as part of KYC processes

There are a number of external utilities that can play a role here:

- ▶ Identification and verification (ID&V) and screening services.
- ▶ Utilities that enable consent-based sharing of counterparty details to support ID&V and KYC across multiple organizations.
- ▶ Broader solutions that take an end-to-end approach, based on customer lifecycle management (CLM), while supporting regulatory compliance.

There are high expectations across the capital markets industry that distributed ledger-based solutions will ultimately provide a distributed authoritative record of clients' identities. With regulators already hinting that KYC is one of the solutions that they would like to see made consistent across a decentralized infrastructure, we expect to see FinTechs developing solutions that integrate with Blockchain.

Anti-bribery and corruption

Technology solutions that support efforts to mitigate bribery and corruption risk focus primarily on:

- ▶ Updating or renewing procurement and expense tools and systems to include bribery and corruption controls and red flag identifiers.
- ▶ Building new – or updating existing – data analytics capabilities to target bribery and corruption risk: for example, by including data points and analytics relating to relationship managers.
- ▶ Performing background checks on individuals and organizations as part of the due diligence and enhanced due diligence processes; a service delivered by some third-party providers.

Employee surveillance, market abuse and conduct

Looking internally within banks at the actions of employees and the regulators' strong focus on conduct risk, some very sophisticated solutions are now available to highlight risks around conduct and behavior.

These solutions use a combination of unsupervised learning, phonetic algorithms, string matching, fuzzy logic and advanced behavioral analytics to interrogate huge quantities of structured and unstructured data across voice, video, email, instant messaging, business applications, social networking data, security systems and more. By applying these techniques, the solutions in this area are exhibiting an ever-greater ability to identify patterns of suspicious behavior and reduce the likelihood of conduct breaches.

Policy setting, monitoring and testing

The importance of technology is evident, even in some of the more basic "second-line" compliance activities. Policy creation and amendment can be made far more efficient through the use of tools that support much more granular authoring and approval. What's more, metadata associated with policies created in this way can then be used to perform more reliable impact assessments against changing regulation. And RPA provides a powerful way to support the activities required to test and evidence compliance with policies and standards.

"We feel strongly that sharing best practice and brainstorming ideas with the capital markets community is the way to develop a future-proof approach to monitoring. Through our network, we stay on top of the latest behavior traits, be it the use of codewords, platform hopping or even strategic comfort breaks. We are very open at Behavox – we want to work with the whole industry (including regulators) to build the requisite level of immunity in the system to ensure an appropriate level of defense."

Alex Viall, Head of Regulatory Intelligence, Behavox

IT

Cybersecurity

Given the extent of sensitive data held, and the amount of funds transferred on a daily basis, banks are a honeypot for cyber attacks. Coupled with the negative press associated with high-profile cyber attacks and the regulatory pressure for financial institutions to protect customers and their data, cybersecurity remains high on the agenda for capital markets firms. As a result, a wave of investment is under way – one that opens up an array of opportunities for FinTechs to collaborate with investment banks to help manage aspects of their information security.

Threat analysis

New AI applications are being used to analyze, identify and potentially prevent cybersecurity threats, by identifying unusual activity patterns, and assessing unstructured data-like blogs, white papers and research reports to provide contextual insight into what sort of threats may need to be addressed. These applications reduce the effort associated with human research activities, while significantly increasing the speed of threat detection and ability to prioritize levels of importance.

Detection

As cyber attacks have become more sophisticated in recent years – with the emergence, for example, of advanced persistent threats that may cause breaches over long periods of time – the security paradigm has shifted, with organizations recognizing that prevention of all attacks is simply not possible. While active defense remains important, detection of successful attacks has become just as critical. Many tools have emerged that aid the identification of the signs of an attack and the corresponding analysis of the root causes.

Information sharing

There are opportunities for organizations to facilitate sharing of information about known threats and attacks, and provide real-time information on what is being seen across the market. This is an area where there is the potential to create industry-wide utilities that would have strong support from regulators, who are already demanding the ability to respond rapidly.

Identity and access management

Authentication

There is a move under way toward using more sophisticated and reliable ways to establish trust without passwords, both to make interactions more secure and to improve the customer or user experience. A number of startups are focusing on developing solutions that use physical and behavioral biometrics to prove identity.

Physical biometrics include facial recognition, fingerprint, retina scanning and heartbeat sensors. Behavioral biometrics and machine learning can be applied to provide continuous authentication, guarding against the hijacking of user sessions by authenticating users not only on what they do, but also on how they do it. For example, some banks identify users by how they hold their phone.

Identity as a Service (IDaaS)

Third parties are now providing the option for organizations to outsource their identity management and authentication processes via cloud-based authentication infrastructures, in line with the wider adoption of mobile and cloud-based services across the business.

IT service operations

With a large proportion of an investment bank's IT headcount associated not with value creation through new technology but, instead, with the cost burden of maintaining legacy systems, IT service operations is a major target for cost cutting through automation.

Investment banks are starting to invest in machine learning and data science professionals to help reduce the amount of effort expended by software engineers on monitoring and supporting their infrastructure. Giving computers the ability to run diagnostics on themselves and learn about their own state of health provides organizations with the ability to highlight potential issues before they occur and reduce operational risk. This creates opportunities to assess the potential implication of a hardware or software failure, based on the associated business applications, and prioritize the response.

AI offers further opportunities for headcount reduction, with IT helpdesks often staffed by people rather than machines. While efforts to date have typically been focused on providing enough information for people to self-diagnose their IT issues, outsourced services are now being introduced that use AI to field queries from employees or customers without actually requiring a person to answer them. Designed to avoid help desks or call centers, the technology could answer thousands of questions simultaneously, giving a tailored response to each one.

Legal

Organizations ranging from startups to global investment banks require timely, insightful legal guidance in order to navigate their way successfully in today's fast-changing financial services industry. Risk is inherent in the many thousands of contractual agreements a firm may have arranged, so there are important decisions to be made across IP, M&A, recruitment and more.

Just as many incumbents in financial services are facing disintermediation by nimble firms using technology to replace traditional banking services, the legal arena is also seeing its own disruptive shifts. In the same way that FinTech firms are offering services directly to banks' customers, "LegTech" firms are bypassing law firms and deploying their tool kits directly on clients' sites. This opens the door to improved risk analytics and cost reduction opportunities through technology and outsourcing.

The most innovative legal startups are using AI and machine learning combined with data analytics to interpret contract details and quantify risk. These types of solutions can read, interpret and summarize key information from contractual documents, perform contract analysis and visualize contract risk, and assess agreed terms with vendors across the organization to inform the future negotiating strategy.

We also see data analytics being used to support due diligence activities, and AI and machine learning being applied to aid legal research, by providing instant answers to questions with citations and suggested topical reading.

At the same time, external cloud-based providers are offering a range of services to support in-house lawyers. Examples include:

- ▶ Data mining of huge quantities of litigation information to provide insights and reveal patterns to support litigation cases.

- ▶ Digital tools to support online dispute resolution.

- ▶ Robotics to provide contract management and automation.

- ▶ Workflow tools to support time recording, matter management, document review and billing.

Looking specifically at capital markets, solutions are being developed for matching and negotiating master agreements for trading over-the-counter derivatives and commodities via a cloud-based platform.

In addition, there is much excitement over the opportunities to use distributed ledgers – especially smart contracts – to develop and enforce dynamic legal contracts that execute automatically in response to market events.



HR

While not specifically FinTech, there are a number of opportunities that we see across the employee lifecycle for enabling technologies to add value to core HR capabilities.

In the recruitment process, AI will be a key tool for identifying candidates – including those who haven't applied – by scouring online CVs to find people whose experience fits the role.

With conduct being such an important issue for banks, AI and machine learning will make use of social data to determine the level of risk that a candidate presents from a behavioral perspective. Machine learning platforms are being developed to perform background checks as part of the screening process and to verify that applicants are who they claim to be.

AI solutions already exist to support the effective integration of new employees by providing a "virtual buddy" to guide them through the onboarding processes and answer questions about corporate policy. Once an employee's onboarding is completed, these same platforms continue to operate as "digital assistants" to guide the employee through the HR process and provide automated technical support.

Externalization is already playing a significant role in the HR landscape, with cloud-based utilities providing basic features such as absence tracking, performance management and training. And there is a raft of solutions that provide the required tracking of skills and training associated with regulated roles and support the "fit and proper" assessment.

Integrated technology solutions that support compensation design and planning, and reward, are now mature, but we see opportunities ahead for analytic capabilities to link performance management more closely to compensation and provide transparency to regulators over how closely conduct is aligned with variable pay.

We are also observing innovation in how training is delivered. "Gamification" techniques are used to make training more engaging and entertaining for the learner. While still nascent, we also see potential use cases for virtual reality in training: for example, to see how employees respond in certain scenarios.

4.

The “how?”:

a practical guide to
making value-generating
collaboration happen

In this section, we look at how FinTech firms and capital markets organizations engage with each other. Selling into investment banks is tough: they are complex organizations, which can prove hard to navigate. Making a decision can often take considerable time, and the barriers to adoption and onboarding can be high.

Our research tells us that, while progress is being made, innovation engagements are not happening quickly enough. We'll take a look at what both parties could do to accelerate the rate of adoption and innovation.

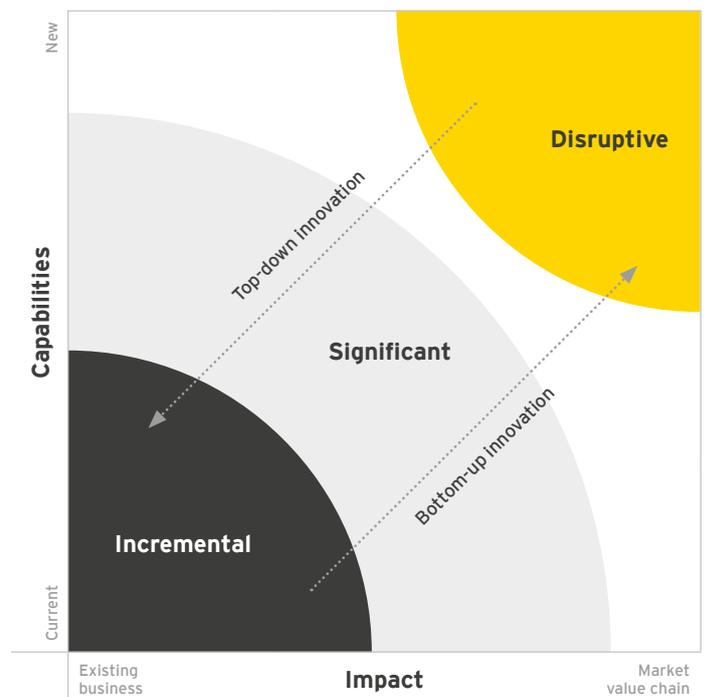
How should FinTechs approach investment banks?

Value proposition: be clear on who you are, what you intend to be and the problem that you solve

Globally there are more than 5,000 FinTech organizations – and any that lack a succinct articulation of the problem, and their proposed solution to it, should be prepared to fail. There is a clear need to be distinct, over and above a memorable name and logo.

This means FinTech firms must be clear on what they are. While investment banks are receptive to the various different types of innovation, be they incremental or disruptive, a commonly voiced frustration is that the FinTech firm itself needs to be clear. For example, is it offering a mutualized solution to many industry players or something that provides a specific competitive advantage?

Innovation approach framework



Clear communication is essential and the value proposition needs to be expressed in language that the buyer understands. Some investment banks run days where they get a procession of FinTech firms in, giving each a short slot in which to pitch – often as short as one minute.

“When it comes to FinTech, we see the ‘Fin’ as being greater than the ‘Tech.’ Our best experiences of collaborating with FinTech firms happen when firms can clearly articulate the value they bring by addressing a specific problem. They understand the context of the problem and can demonstrate to a potential business sponsor how their solution fits with upstream and downstream processes.”

Hyder Jaffrey, Strategic Investment and FinTech Innovation, UBS

Understand the regulations and set a high bar with regard to conduct

Even though FinTech firms may not be regulated themselves, as part of the investment banking ecosystem, they need to understand the relevant regulations fully and conduct business in accordance with local laws.

This is especially important because the capital markets industry has lost a lot of trust in the past few years – a process that has been well documented in the press. As a result, we are now seeing widespread efforts to transform conduct and transparency. Some of this is being driven by regulations, such as the UK’s Senior Managers Regime (SMR). Some of it is being driven by changes in the C-suite, which is starting to change the culture top-down. The rebuilding of trust is likely to take time – however, at the same time, business models and ecosystems are rapidly evolving. An increasing number of parties will need to collaborate to mitigate reputational risks.

All of this means it is of paramount importance that FinTech organizations maintain the highest possible standards of integrity. Competition in the FinTech space is fierce due to the sheer numbers of firms and offerings, and there will be commercial pressures to seek shortcuts to gain competitive edge (as noted in Q2 2016 in the peer-to-peer lending market). But firms must be sure they don’t compromise on long-term integrity in search of short-term gain.

Initial engagement: pick the best route in

There are a number of ways to engage a capital markets firm.

Interacting with their innovation labs can be a useful experience, and helpful in terms of lead generation, although this can consume considerable management time.

Most major banks have dedicated innovation teams whose role is to broker innovation by introducing FinTech firms to business sponsors with problems. The success of this route depends heavily on how well connected the internal parties are.

Many banks also have a corporate venture vehicle that invests in FinTech firms as opposed to procuring solutions from them. The biggest names in investment banking have the power to be “kingmakers” of FinTech firms, and are becoming increasingly aware of this. Therefore, care must be taken to protect objectivity: one of the principles for successful innovation is the ability to fail fast – and the decision to discard a particular initiative may be harder when the same organization has a vested financial interest.

Other participants in the ecosystem can also play a part. Consulting firms, system integrators and venture capitalists all have relationships with investment banks and a commercial interest in broking introductions. So FinTechs should be sure to understand who the preferred advisors are in the domain in which they are operating.

Finally, there is nothing to stop FinTech firms approaching business sponsors directly. This tends to be easier for those that have ex-industry practitioners with strong relationships. The trick will be quickly finding a business sponsor who will commit to the journey ahead.

“Over the last two years, FinTech organizations have become much more professional in how they approach us. Some still have challenges with the levels of access they have to stakeholders. Our innovation team exists to help balance supply and demand. They are there both to help identify solutions to known problems and to introduce new ideas that merit greater consideration that might otherwise have been missed.”

Nick Doddy, European Managing Director, Strategy & Innovation Team, Chief Operating Office, Deutsche Bank

Industry experience is essential for credibility and navigation

Sponsors of innovation have consistently told us that FinTechs that came to them with credible ex-industry practitioners were better able, on the whole, to articulate and contextualize their value proposition. In contrast, startups that presented neat solutions without a clearly defined problem to address were more likely to be perceived as naïve.

“There is still wariness about being the first to deal with early-stage businesses. We overcame this through our relationships in the industry based on our previous experience at Data Explorers, and our journey became easier once we had secured our first clients. We recognized there would be scrutiny around compliance, data privacy and security, so we were proactive in our approach to addressing this, spending significant amounts of money upfront on legal and technical infrastructure.”

Donal Smith, Co-founder, Credit Benchmark

Preparedness: start with the end in mind

While every investment bank's procurement process is different, the questions they ask and the assurances they seek tend to exhibit common themes. So there is much that FinTech firms can do to prepare in advance of the first contact. Demonstrating a good level of preparedness with regard to corporate history, funding, information security, data privacy, resiliency, scalability, architecture, processes and key people improves the perception of professionalism, and can help to mitigate investment banks' concerns about working with younger organizations.

Proving the concept – a major hurdle to overcome

One of the biggest challenges facing startups is proving the concept.

Many great ideas require access to large volumes of real-world data in order for the concept to be properly proved. However, for regulatory reasons, investment banks are usually unwilling to share data with external firms without rigorous risk mitigation. Instead, proofs of concept tend to operate within bank-owned “sandboxes” – which is fine, unless the value proposition depends on data from multiple organizations.

We are aware of other innovative approaches. Some market data providers are making data available to startups, free of charge for an initial period, recognizing that an incremental revenue opportunity will present itself once the concept is proven and taken into production. Regulators are starting to make real data available to organizations in order to make proofs of concept more realistic.

There is much debate around whether proofs of concept should be paid for or not. Given the cost pressures they face, it's easy to see why investment banks might want these to be carried out as free of charge. Our view is that, without some sort of skin in the game, the proof of concept may not get the attention it deserves. And, while a paid proof of concept is a good demonstration of commitment, endless free proofs of concept will soon exhaust the resources of even well-funded FinTechs. As one interviewee told us: *“A quick ‘no’ is the second-best answer for us.”*

“As a company that has moved from startup to SME, there are many lessons learnt that are worth sharing. Of these, the key points would be to start with a structured sales pitch and a specific price point. You'll then hit the inevitable question about your existing clients. Our solution was to provide big-name clients with free analysis, which could then be referenced in meetings with clients.”

David Hesketh, COO, Trading Hub

Protect your “crown jewels”: intellectual property (IP)

A common concern in the FinTech community is the protection of IP. We are aware of many instances where ideas have been shared in confidence with investment banks, only for its in-house IT function to build something comparable.

FinTech firms have to strike a fine balance between sharing and protecting. Clearly, for a value proposition to be compelling, the core concept needs to be explained and justified.

While steps can be taken to protect IP through nondisclosure agreements, gaining recourse may prove challenging in practice. Therefore, it is vital to think hard about how much needs to be shared, and who really needs to see the recipe for the “secret sauce,” until the collaboration moves from point of concept to production.

Be prepared to build a robust business case

Building a credible business case is critical. In the current climate, ROI must be demonstrable, and payback periods short. The most common reasons why business cases fall short of what’s needed include:

- ▶ Assumptions that are unrealistic and lack credibility.

- ▶ Underestimation of integration costs – especially to legacy architectures.

- ▶ Failure to recognize the correct timing of benefits (e.g., when do headcount savings actually kick in?).

- ▶ Lack of supporting evidence for benefits relating to risk reduction.

- ▶ Failure to consider what bank resources are needed.

- ▶ Underestimation of the number of other dependencies, given the high volume of concurrent change within banks.

A critical component of the business case will be the pricing model. FinTech firms need to be crystal clear on their pricing strategy, including whether they are prepared to give equity as part of the deal. Pricing needs to reflect the value to both parties: for example, preferential pricing is commonly applied for an early adopter who is prepared to be a named user and whose presence will give credence to the offering.

Be prepared for procurement

Once business sponsorship has been secured, the final hurdles to adoption typically involve the procurement, vendor risk management and information security functions. For younger organizations, encounters with these functions can be tricky, for a number of reasons.

One is that the adoption process at each bank is different. Depending on the innovation and sourcing operation models, the timing of this part of the process can vary widely. Sometimes, these functions are involved early in an attempt to reduce surprises. Others only engage them once the business decision has been made.

A further challenge is that procurement and vendor risk management functions are still evolving with respect to FinTech onboarding. Some organizations are still applying a “one size fits all” approach, and seem surprised when a startup scores somewhat lower than a global system integrator. We discuss our recommendations with respect to this issue on page 69.

Our common-sense advice to FinTechs is as follows:

- ▶ Ask your business sponsor to support and guide you through this part of the process.

- ▶ Establish what certification you are likely to need (e.g., ISO 27001).

- ▶ Be prepared to answer lengthy questionnaires, and answer them as fully as you can.

- ▶ Prioritize responses to the most critical question – typically, in relation to information security, data privacy and business conduct.

- ▶ Offer a way forward on matters where a positive response cannot yet be provided.

- ▶ Keep your responses for future re-use.

- ▶ Suggest the adoption of a residual risk acceptance process for issues that cannot be resolved quickly.



How should investment banks position themselves to engage with FinTech?

Set the right “tone from the top”

Quite rightly, many of the innovation opportunities we’ve highlighted address the challenge of structural costs. Intuitively, sponsors within capital markets firms that generate major cost savings expect to be rewarded accordingly.

Yet, at the same time, performance measurement and compensation cycles are usually short. And innovation usually requires the acceptance of additional risk in the form of investment costs. In an uncertain economic environment, with reduced role security, there is understandably some apprehension about accepting additional risk.

Our point of view is that firms have no choice but to innovate, but they will need to define guidelines and parameters that nurture intelligent innovation. By this, we mean:

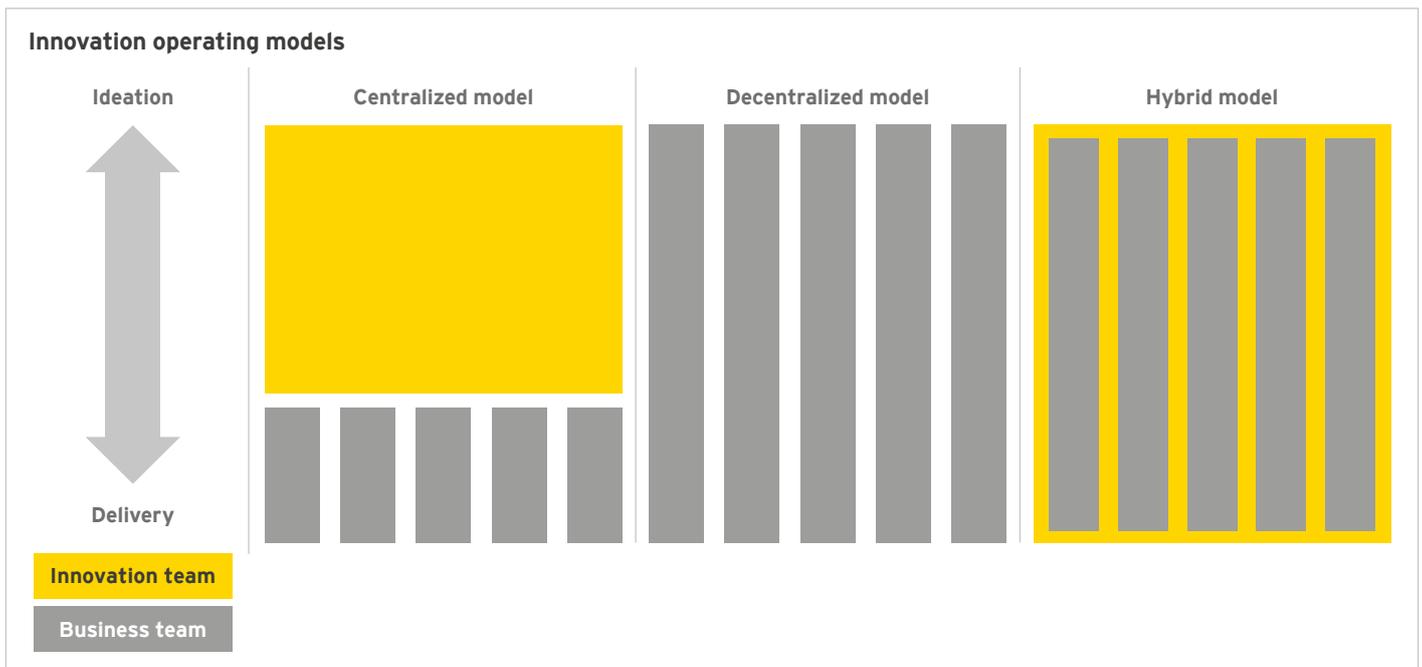
- ▶ A tone from the top that unequivocally states that innovation is expected – and indeed required – of leaders within the organization.
- ▶ A governance framework that supports efficient innovation, with clear accountabilities, decision-making frameworks, tollgates and success criteria.
- ▶ A way of working that allows initiatives to “fail fast” and encourages lessons learned to be built into future cycles.
- ▶ Incentive and performance measurement frameworks that recognize that not all innovation initiatives will be successful; a leader that risks innovation and operates within the defined parameters should not be penalized for failure. Consider taking a portfolio-led view of investment and risk decisions that measures value derived from technology innovation at portfolio level, rather than for individual initiatives.
- ▶ Zero tolerance for anti-innovative behaviors – for example, dismissing new ideas because of the potential impact on one’s personal role.
- ▶ Recognition that the composition of talent will need to change. The stars of the future might very well be the internal entrepreneurs who successfully engage external ecosystem partners, as opposed to those who excel at in-house development. This has implications for talent acquisition strategies at all levels of the organization.
- ▶ Development of partnerships with FinTechs that are built on collaboration and trust. This includes learning to provision technology “outside the firewall” (not all technology needs to be owned) and becoming comfortable with not knowing everything – the rapid proliferation of technology does not support this.

Select the right operating model

We see a variety of different innovation operating models being used today, but we recognize that most of these are evolving as the innovation agenda matures.

We would characterize the three main types of model as:

1. **Centralized model**
2. **Decentralized model**
3. **Hybrid model**



“Our approach to FinTech collaboration is to be as agile as possible. We have initial discussions with a large number of startups to understand how their solutions might support our business needs. Where there is promise we ideate a business-use case with them to develop a tangible value proposition. Only when that proposition makes sense do we move to joint proof of concept – short in duration with clear objectives – to determine whether we move forward with the collaboration. Not every initiative will succeed, and if one is going to fail, our objective is to fail early, as soon as we identify that there is not a case for further time investment which has obvious benefits for both parties.”

Michael Schneider, Head of Advisory & Business Development, Innovation in Group Risk Management, Commerzbank

Centralized model

In the centralized model, a central innovation team is set up, usually overseen by a chief innovation (or digital) officer. The team is responsible for all market scans – whether carried out internally or through third parties – and for bringing solutions to business problems to business owners.

The main advantages of this model are that it recognizes the specific need for innovation, and exposes the organization to ideas and concepts that it may not otherwise encounter if its remit was purely solving known problems. The centralized model can also foster better coordination with the chief technology officer, and enable better coordination of procurement and vendor risk management activities, although how well this works depends on the downstream models within those functions.

The biggest challenges to this model tend to arise when the central team is too remote from the business units to understand their needs fully. There can also be people implications. Depending on the resourcing profiles involved, those at the center are often perceived as having fun roles but no real jobs, and can be resented by the business lines who are dealing with issues day to day.

For FinTechs, the centralized model can be a double-edged sword. When this model works well, they can benefit from the support and structure it provides. Conversely, decision cycles may end up taking longer, with more time being spent before a business sponsor is found.

Decentralized model

In the decentralized model, which is more commonly seen in smaller and regional investment banks, responsibility for innovation is devolved to the lines of business. Each business unit faces off to the external FinTech marketplace and runs its own set of governance processes for acquiring innovation.

The primary advantage of this model is that it tends to enable sponsors with real problems to identify innovators with real solutions much more quickly. Less time is spent on horizon scanning, and more is spent by those familiar with the business and its processes on focused searches for market-ready solutions.

The disadvantages of this model are that it tends to involve duplication of effort, proliferation of local processes and a lack of consistency.

For the FinTechs, this model can play out either way. Those that have great relationships and are good navigators of investment banks may find they engage more quickly with their business sponsor. However, without the support and direction of a central team, others may find they get lost or bounced around the organization.

The hybrid model

In our view, the hybrid model can bring the best of both worlds.

We think that a defined, distinct innovation team helps to set the right tone and message, and that innovation needs clear leadership. However, we recommend that the distance between pure innovators and business units needs to be compressed as much as possible.

So the ideal solution – as seen in the hybrid model – might be a very light central team, with representatives (selected for having innovation in their DNA) seconded in from business units.

There are second order benefits as well. The secondees can be rotated to give more of the organization direct exposure to innovation. They will also return to the business units as champions of innovation and, therefore, drive a more entrepreneurial approach down through the line.



Whatever the model adopted, an aspect we have learned is that the end-to-end innovation adoption process is rarely written down and communicated.

We think transparency around this would be helpful to everyone. Few parties involved in the acquisition of innovation on the bank side profess to know how the end-to-end process works – so just imagine how confused FinTechs must be.

Our recommendation is for investment banks to define their own innovation framework and process clearly, then share relevant aspects of it with the firms they seek to engage with.

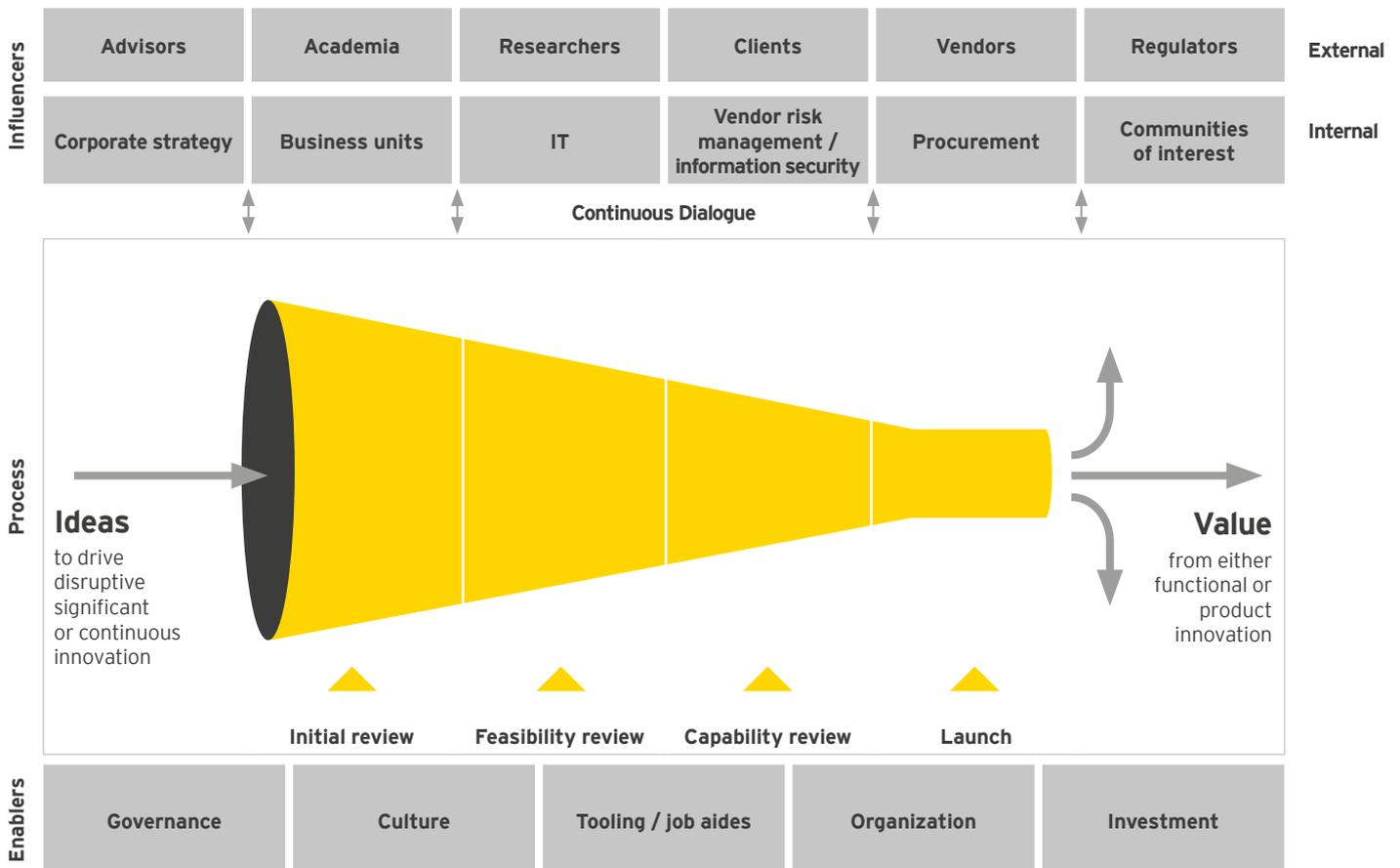
Below, we set out an illustrative framework based on our experiences and research. We recommend that firms define:

- ▶ Their sources of external and internal influence.

- ▶ The end-to-end process, including tollgates, decision-makers and acceptance criteria.

- ▶ The enablers that will support the two elements above.

Innovation adoption framework





Don't expect a risk-free bet

A one-size-fits-all procurement and vendor risk management process makes little sense. It is unreasonable to try to apply the same set of tests to a FinTech as to a globally established system integrator; particularly because vendor risk management questionnaires tend to have grown organically over the years as additional risks have surfaced. They are onerous, and often unhelpful in that they obscure the real risks that require mitigation.

To get the procurement and vendor risk management process right, it's vital to understand that innovation is not a risk-free bet. Proofs of concept will fail. Some innovation that reaches production will fail. The smartest organizations are those that zero in on the fundamental risks, where there is no room for compromise, and that have a process for the business to accept residual risks.

One bank we spoke to has onboarded a FinTech into its sandbox within three days of first making contact. Another accelerated the process for the FinTech simply by getting all the relevant decision-makers into a room at the same time and working through the acceptance process together in real time. So the process need not take many weeks and involve 50-page questionnaires.

Other approaches are also emerging. We are aware of one bank that invites potential collaborators effectively to join their firm for a period of time, with access to people and systems.

Establish a "roots and branches" culture of innovation

Based on the investment banks that we engage with, we observe a range of attitudes toward innovation. Some individuals naturally feel threatened by it. RPA and the externalization of processes and services will inevitably lead to headcount reductions. But they may also present opportunities to redeploy humans into more value-added roles.

We believe that the sooner innovation is embraced at all levels of the organization, the faster sustainable change will happen.

India's ICICI Bank's Trinity initiative promotes innovation and entrepreneurship in the banking and finance sector among up-and-coming engineering and management students. The program rewards an idea at every stage – from ideation to prototyping, to the facilitation of qualified teams toward entrepreneurship. ICICI provides support in mentoring and nurturing students as they formulate their ideas, creates opportunities to interact with industry veterans, and offers financial support for prototype development and facilitation toward commercialization.

Many organizations also run innovation initiatives via their own physical and virtual communities. Innovation suggestions are welcomed via internal social media. Hackathons are also a great way to encourage staff to develop and articulate innovative ideas.

Consider how to transition to the architecture of the future

There are clearly substantial opportunities for collaboration. And, while we have had a number of interesting theoretical discussions about the merits of a green field rebuild, in practice, incremental change is more likely.

Transformational architectural change requires bravery and a commitment to a multi-year program of work. Some of the collaboration ideas we have discussed in this paper could potentially be seen as diverging from a longer-term strategic vision. Some might also argue that RPA is a tactical fix response to broken processes. Others may agree with these views, but recognize that the efficiencies and learnings from RPA can be used to inform and fund a strategic rebuild.

Whatever process is used to formulate the strategy, the fact is that the application, technical and data architecture of the future is likely to look very different from today's. We expect leading organizations to seek internal simplification aggressively and to look to increase their use of external utilities, platforms and services where possible. We believe that a component-based architecture, resembling a set of interoperable building blocks, makes good sense. This will require the industry and its regulators to agree on standards and protocols. The industry is learning to collaborate better, but the speed at which standards are emerging could be quicker.

“Innovation opportunities need to be properly assessed and a powerful way to do that is combining expertise from the innovation labs with experience of existing infrastructure. Architects with a deep understanding of the legacy environment, current business processes and market practices need to be central to the evaluation process.”

Lee Braine, Investment Bank CTO Office, Barclays

Motivate the retained organization

Many of the ideas and themes discussed could potentially be seen as threatening to the retained organization. Will software robots eliminate my role? Will my experience and skillset be relevant and cherished in the new world?

Our expectation is that, while there will be widespread change, the opportunities are as numerous as the threats. Perspectives to consider include:

- ▶ The automation of commoditized tasks will free up human beings to perform more value-added tasks.
- ▶ New capabilities will be required in the future – but that doesn't mean that existing skillsets cannot be converted, in turn presenting development opportunities for people in the retained organization. For example, people who can program software robots are in short supply, yet there are a number of people with strong business process skillsets who could be trained to use intuitive RPA packages.
- ▶ The ecosystem itself will change – roles that previously existed within investment banks may exist in the future within ecosystem partners. We expect to see some migration of people from banks to technology firms and service providers.

Our strong advice is to bring the retained organization along on the journey. Regular communication and invitations to participate in innovation will foster and help to drive collaboration. Silence and a “them and us” mentality will result in a demotivated workplace and a struggle to retain top talent.

For all parties, dialogue with regulators is essential

Regulators and consortia will also play vital roles

When it comes to fostering collaboration between FinTechs and capital markets firms, regulators play an important role. This is because they set the framework, including limitations for services and products, and, ultimately, for collaborations.

Therefore, when regulators demand innovation within the financial markets, they also need to provide an environment within which it can be fostered without fear.

Regulators are beginning to set a very positive example in this respect through the introduction of regulatory sandboxes, allowing financial organizations to test new ideas for a limited period with live consumers and loosened regulatory restrictions. This mechanism also offers the opportunity for partnerships to form between incumbent financial institutions and FinTechs.

The UK provides a good example of the Government Office for Science and the regulator (FCA) working together to support industry adoption. The FCA recently launched a dedicated working group to discuss the development and adoption of new technologies that facilitate regulatory adherence. With the authorities actively engaging the FinTech community to automate regulation and compliance, the UK has emerged as a global RegTech leader, hosting a range of startups. The FCA's Project Innovate offers support to new FinTechs. The FCA is also understood to be considering the creation of a robotic regulatory handbook, intended to accelerate the speed with which regulated entities can find answers to specific questions.

In Asia, while regulators are expressing enthusiasm for RegTech solutions, they also recognize the need to increase their own technology awareness in order to assess fully these next-generation approaches and their implications for regulation. We see more progressive authorities holding regular industry dialogues with market participants (financial institutions, RegTechs, training academies and universities) to understand technology innovation and assess whether existing rules, policies and guidance are restricting innovation and the adoption of RegTech solutions.

The Australian Government has established the FinTech Advisory Group to complement the Innovation Collaboration Committee and promote its FinTech industry. As the advisory group identifies areas of potential future reform and ensures that specific FinTech priorities are considered in the implementation of government policies, it is paying special attention to RegTech.

Meanwhile, to encourage RegTech development in Singapore, the MAS has announced plans to make its data available through open-source API architecture. This is seen as a way to increase efficiency in submitting data on applications and transactions for financial stability assessments. The MAS is also collaborating with the Association of Banks in Singapore (ABS) to host the inaugural Singapore FinTech Festival in November 2016. The event includes a specific forum focusing on RegTech developments, use cases and compliance areas with the greatest need for transformative solutions.

In the US, however, there has been less proactive support to date, which is somewhat surprising given the maturity of the financial markets and the innovation culture on the west coast. The Office of the Comptroller of the Currency (OCC) is looking at a framework to allow startups to submit new business ideas. "What we're talking about is understanding these different models, rather than saying 'no' right off the bat," said Amy Friend, Chief Counsel for the OCC, in an interview with *The Wall Street Journal*.

Over time, it is inevitable that regulation of FinTech firms will increase. While arguably necessary to protect the financial markets and the end users of finance, our hope is that the approach adopted will be a pragmatic one and proportionate to the risks involved.

For capital markets firms, FinTech firms and solutions – embraced and adopted intelligently – offer a path back toward higher ROE. The last thing the industry needs to do is to hamstring them before they really get going.

"In commercial banking, we view FinTech more as an enabler than a threat. There are times when we have to ask ourselves why we would solve things internally when someone else has already cracked the problem. We are actively collaborating with FinTech organizations to generate efficiencies in operations and to address regulatory challenges."

Birendra Agarwal, CMB Chief Information Officer,
Lloyds Banking Group

Conclusion: building the investment bank of the future

Imagine you were given the opportunity – and the luxury – of building the investment bank of the future from scratch.

Wherever and however you start, it's unlikely that you would begin from the operating model of the established capital markets players. And it's even more certain that you'd end up with something very different from today's investment banks.

Instead, you would improve agility and reduce cost by assembling the organization from various components that now exist in the marketplace: using collaboration to bring together and integrate a best-of-breed trading platform with a largely externalized Blockchain-enabled back office, procured smartly on an "as-a-service" basis.

To service clients, you'd put your smart brains in the front office, supported by all the AI and analytics they'd need, again sourced flexibly from specialist third parties. Where your new infrastructure is best in class, you might consider white labeling it to others. Certain corporate clients, for example, major B2B platforms may also present an opportunity for investment banks to embed products and services such as cash and liquidity management.

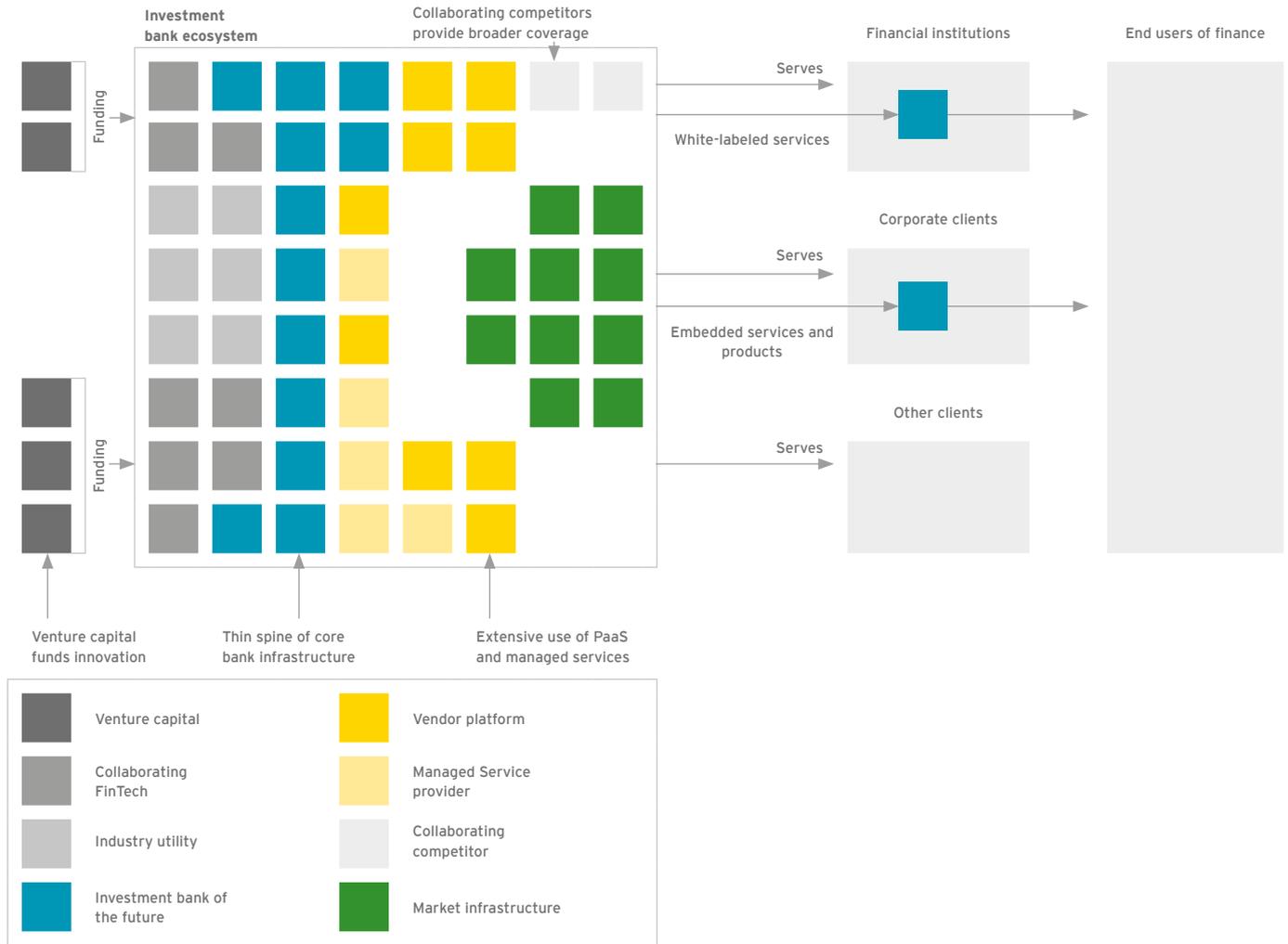
Clearly, today's investment banks can't adapt to this model overnight. But they need to be able to compete with businesses that can. That's one reason why – as we pointed out at the start of this paper: game-changing innovation in investment banking is no longer optional, but imperative.

However, this new world of capital markets doesn't only offer competitive threats, but also new opportunities. These opportunities need to be approached and addressed in the right way, methodically researched and smartly activated – all with a recognition that this type of change is very different from any that investment banks have undertaken in the past.

And what type of entity will this change produce? Essentially, an organization with a much thinner spine than investment banks have today, making extensive use of industry utilities and a diverse range of partners from across and beyond the FinTech ecosystem.

The investment bank of the future is taking shape today. For capital markets firms, now is the time to evolve, or risk facing a struggle to catch up in the years to come.

The investment banking ecosystem of the future



5. Who?

A directory of organizations offering FinTech innovation services to capital markets

As part of our research, we identified a number of organizations that support innovation in capital markets; they are listed in the following pages.

This directory is not exhaustive and, given the size of the FinTech market and the pace at which it evolves, it is impossible to identify every firm. It is inevitable that there will be omissions from this list at the time of publishing. Inclusion on this list is not intended as an endorsement of any of these firms or their services.

For consistency, we have attempted to categorize firms by their primary purpose, using a similar structure to “The what?” section of this report. A number of firms operate across multiple areas; they are therefore categorized as such.

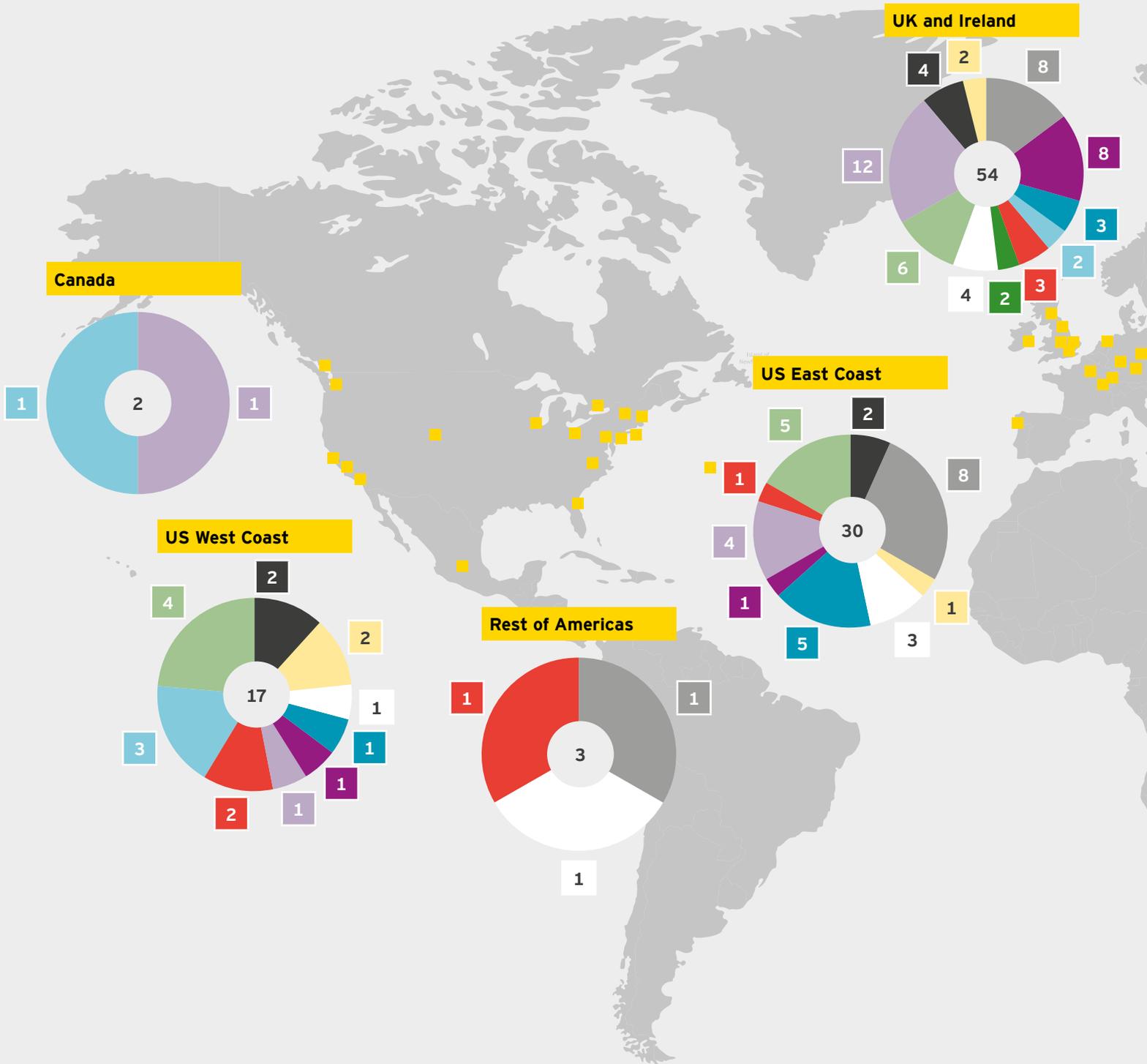
We have not generally listed incumbent technology vendors. We have, however, included a small number of organizations that may not typically be identified as FinTechs, but nonetheless contribute to the innovation agenda.

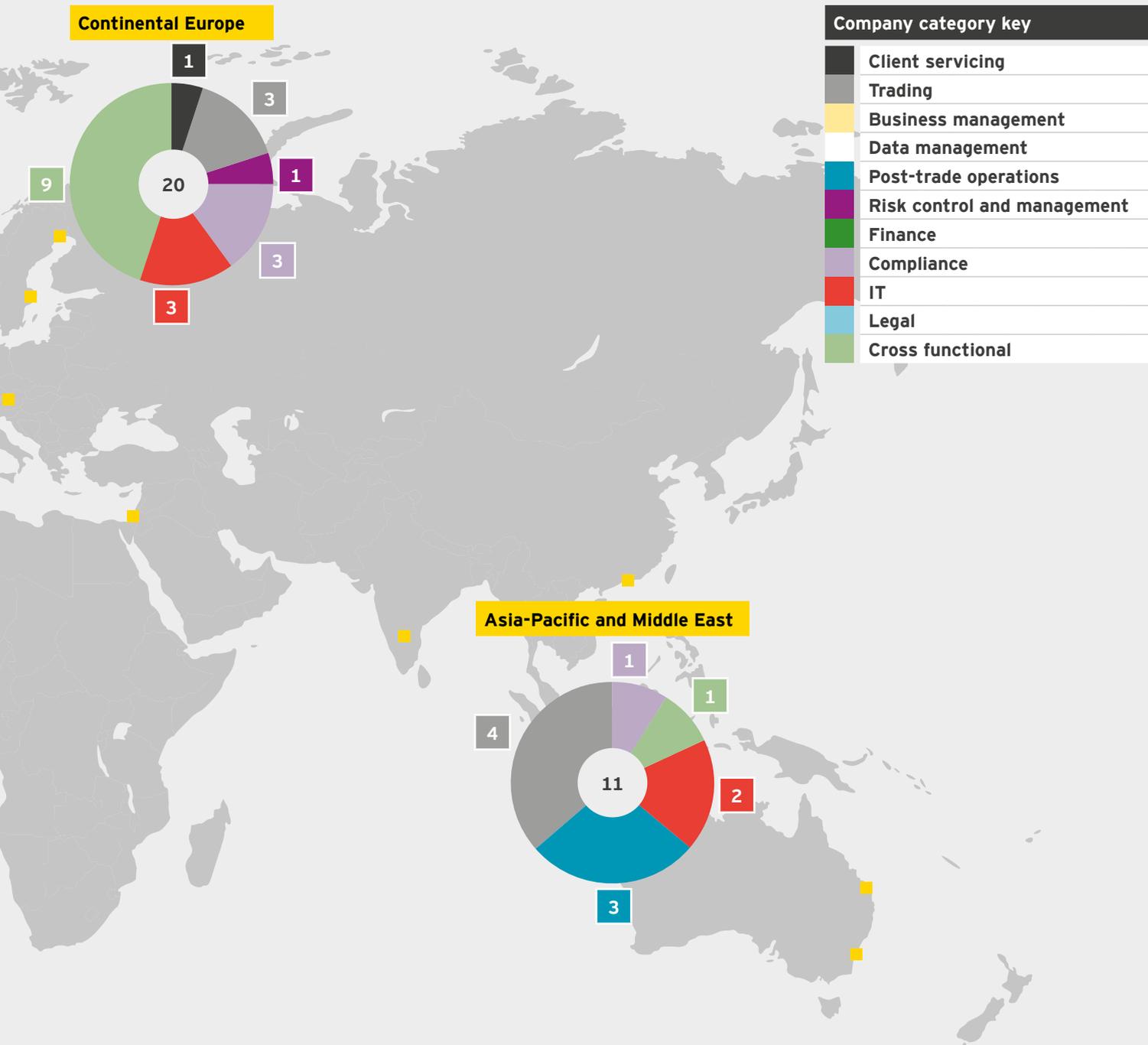
Category	Name	Headquarters
Client servicing <i>Client onboarding, insight/analytics</i> <i>Research</i> <i>Client relationship management</i> <i>Issuance, mergers and acquisitions</i>	AlphaSense	San Francisco, US
	CityFALCON	London, UK
	Dataminr	New York, US
	DealMatrix	Wöllersdorf, Austria
	DueDil	London, UK
	Krzana Finance	London, UK
	Origin	London, UK
	StockViews	London, UK
	Symphony	Palo Alto, US
	Trefis	Boston, US
Trading <i>Pre-trade analytics</i> <i>Trade execution</i> <i>Post-trade analytics</i>	Algomi	London, UK
	BestX	London, UK
	ChartIQ	Charlottesville, US
	Chartmill	Brussels, Belgium
	Cloud9 Technologies	New York, US
	Cloudmargin	London, UK
	Essentia Analytics	London, UK
	I Know First	Tel Aviv, Israel
	InvestLab	Hong Kong
	Itiviti	Stockholm, Sweden
	Knowsis	London, UK
	Lattice	Hong Kong
	LMRKTS LLC	New York, US
	Nivaura	London, UK
	OpenFin	New York, US
	Qubitia	Pontevedra, Spain
	Social Alpha	New York, US
	TechFinancials	Israel
	Tera Group	Summit, US
	LMAX Exchange	London, UK
	Tradetools Technology	Chicago, US
	TradingHub	London, UK
	TradingScreen	New York, US
trueEX Group LLC	New York, US	
Business management <i>Cost transparency</i> <i>Business continuity management</i>	Apptio	Bellevue, US
	Cutover	London, UK
	Evolgen	Jersey City, US
	HotDocs	Edinburgh, UK
	NetDocuments	Lehi, US
Data management <i>Market news and data</i> <i>Reference data</i>	Finsight	New York, US
	Kensho	Cambridge, US
	Market IQ	New York, US
	Morningstar	Chicago, US
	Privitar	London, UK
	Prophis Technologies	London, UK
	Red Deer	London, UK
	Stream Financial	London, UK
	Trunomi	Hamilton, Bermuda

Category	Name	Headquarters
Post-trade operations	Clearmatics	London, UK
<i>Collateral and margin management</i>	Digital Assets Holdings	New York, US
<i>Clearing and settlement</i>	Duco	London, UK
<i>Custody and asset servicing</i>	Epiphyte	San Francisco, US
<i>Reconciliations</i>	Fintellix	Bangalore, India
<i>Tax operations</i>	GBST	Brisbane, Australia
<i>Treasury operations</i>	ItBit	New York, US
<i>Fees and invoicing</i>	R3	New York, US
<i>Transaction reporting</i>	Serisys	Hong Kong
	SETL	London, UK
	SmartStream	London, UK
	Shadow Financial Systems	Piscataway, US
Risk control and management	Ayasdi	Menlo Park, US
<i>Credit, market and liquidity risk</i>	CrowdProcess	New York, US
<i>Enterprise risk management</i>	Onfido	London, UK
	OpenGamma	London, UK
	OpusDatum	London, UK
	PassFort	London, UK
	Percentile	London, UK
	Riskopy	London, UK
	RiskSave Technologies	London, UK
	Scaled Risk	Paris, France
	World-Check	London, UK
Finance	FinPoint	London, UK
<i>Capital management</i>	Tallysticks	London, UK
<i>Independent price verification</i>		
<i>Product control</i>		
<i>Financial / regulatory reporting</i>		
Compliance	Advise Technologies	New York, US
<i>Regulatory horizon scanning and compliance</i>	AMfine Services & Software	Paris, France
<i>AML and surveillance</i>	Ancoa	London, UK
<i>KYC</i>	AQMetrics	Kildare, Ireland
<i>Anti-bribery and corruption</i>	Behavox	London, UK
<i>Employee surveillance, market abuse and conduct</i>	Caspian	Newcastle upon Tyne, UK
<i>Policy setting, monitoring and testing</i>	ComplyAdvantage	London, UK
	ComplySci	New York, US
	Contego	London, UK
	Corlytics	Dublin, Ireland
	CoVi Analytics	London, UK
	Droit	New York, US
	Fenergo	Dublin, Ireland
	IdentityMind Global	Palo Alto, US
	KYC Exchange Net	Zurich, Switzerland
	KYC3	Luxembourg
	RedOwl	Baltimore, US
	Suade	London, UK
	Sybenetix	London, UK
	Trulioo	Vancouver, Canada
	VIX Verify	Sydney, Australia
	Worksmart	Milton Keynes, UK

Category	Name	Headquarters
IT <i>Cybersecurity</i> <i>Identity and access management</i> <i>IT service operations</i>	Anchor ID	New York, US
	ArmorVox	Sydney, Australia
	BehavioSec	Luleå, Sweden
	Cambridge Blockchain	Cambridge, US
	Crypta Labs	London, UK
	Darktrace	Cambridge, UK
	Digital Cash	Napoles, Mexico
	KELA Group	Tel Aviv, Israel
	Minebox	Gablitz, Austria
	splone	Berlin, Germany
	VBiometrics	Boulder, US
	WiActs	Sunnyvale, US
Legal	ClauseMatch	London, UK
	Kira Systems	Toronto, Canada
	Lex Machina	Stanford, US
	ROSS Intelligence	Palo Alto, US
	Salladore	Los Angeles, US
	ThoughtRiver	London, UK
Cross functional	BigchainDB	Berlin, Germany
	Blue Prism	London, UK
	Brighterion	San Francisco, US
	Broadridge Financial Solutions	New York, US
	Chain	San Francisco, US
	Crossing-Tech	Lausanne, Switzerland
	Crowd Valley	San Francisco, US
	Eigen Technologies	London, UK
	FinGenius	London, UK
	IBM Watson	New York, US
	Markit	London, UK
	Misys	London, UK
	Modular Financial Technologies	London, UK
	Murex	Paris, France
	Quantoz	Rotterdam, NL
	Qumram	Zurich, Switzerland
	Quotip	Zurich, Switzerland
	SAS	Cary, US
	Slock.it	Sachsen, Germany
	Stampery	California, US
	Stratumn	Paris, France
	SunGard	Jacksonville, US
	Veezoo	Zurich, Switzerland
	WIP Solutions	Hong Kong
	WorkFusion	New York, US

World map of organizations offering FinTech innovation services to capital markets





6.

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As part of our research, we met with individuals from a number of organizations who were kind enough to share their professional and personal perspectives.

We would therefore like to thank the following people, and acknowledge their time and contribution.

In addition, we would like to extend our thanks and acknowledgment to representatives from other organizations who preferred not to be named.

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Dan O'Prey	CMO	Digital Asset Holdings
Clare Finn Levy	Founder and CEO	Essentia Analytics
FCA	FCA RegTech Team	FCA
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Nick Clarke	Head of Capital Markets Solutions	GBST
Keith Bear	VP, Global Financial Markets	IBM
Yaron Golgher	CEO and Co-founder	I Know First
Mark Beeston	Managing Partner and Founder	Illuminate Financial
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Birendra Agarwal	CMB CIO	Lloyds Banking Group
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Raja Palaniappan	CEO	Origin
Charles Cascarilla	CEO	Paxos (formerly itBit Technologies)
Charles Pardue	CEO	Prophis Technologies
Dorothee Fuhrmann	COO	Prophis Technologies
David Rutter	Founder and CEO	R3 CEV
Vincent Kilcoyne	Capital Markets and FinTech Industry Lead	SAS
Tim Marsh	Chairman	Serisys
Anthony Woolley	UK CIO	Société Générale
Sean Hanifan	European Head, Global Corporate Client Coverage	Standard Chartered Bank
J.R. Lowry	Head of EMEA for State Street Global Exchange	State Street
Gavin Slater	Head of Product Development	Stream Financial
Diana Paredes	CEO and Co-founder	Suade
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