

The New Physics of Financial Services

Understanding how artificial intelligence is transforming the financial ecosystem

Foreword

Consistent with the World Economic Forum's mission of applying a multistakeholder approach to address issues of global impact, creating this report involved extensive outreach and dialogue with numerous organizations and individuals. They included the Forum's Financial Services, Innovation and Technology communities, and professionals from academia and the public sector. The outreach involved over 200 interviews and six international workshop sessions, encouraging collaborative dialogue to discuss insights and opportunities concerning the impact of artificial intelligence within the financial services industry.

The holistic and global content of this report would not be as rich without the support of, and contributions from, the subject matter experts who assisted in shaping our thoughts about the future of the impact of AI on the future of the financial services industry. In particular, we thank this project's Steering Committee and Working Group, who played an invaluable role with their expertise and patient mentorship. Also critical has been the ongoing institutional support for this initiative from the World Economic Forum and the leadership of our chairman, whose vision of the Fourth Industrial Revolution has been inspirational to this work.

Finally, we are grateful to Deloitte Consulting LLP in the United States, an entity within the Deloitte¹ network, for its generous commitment and support in its capacity as the official professional services adviser to the World Economic Forum for this project.

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Editors' note

Artificial intelligence is a critical aspect of the Fourth Industrial Revolution and has emerged as a clear focus of discussions at the World Economic Forum's Annual Meeting over the past few years. Financial institutions around the world are making large-scale investments in AI, while governments and regulators seek to grapple with the significant uncertainties and growing public trepidation as AI becomes central to the fabric of institutions and markets.

The World Economic Forum has a successful track record of providing detailed multistakeholder analysis of the changing landscape of the financial ecosystem, particularly through our *Future of Financial Services* series. It was clear that a similar approach could cut through the sensationalism surrounding AI to provide valuable insights for the private sector and policy-makers alike.

Over the past year, we have engaged in what may be the largest study of its kind into AI in financial services, and through this process we have discovered that the long-term impacts of AI may be even more radical and transformative than we first imagined. Indeed, the central thrust of the document that follows is that the very fabric of the financial services ecosystem has entered a period of reorganization, catalysed in large part by the capabilities and requirements of AI.

Our hope is that this document helps you and your institution make informed decisions about how to interpret the evolving role of AI in financial services and navigate the turbulent changes on the horizon.

With regards,

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Additional thanks

The project team expresses gratitude to the following individuals for their contributions and support:

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Next steps for the financial services ecosystem

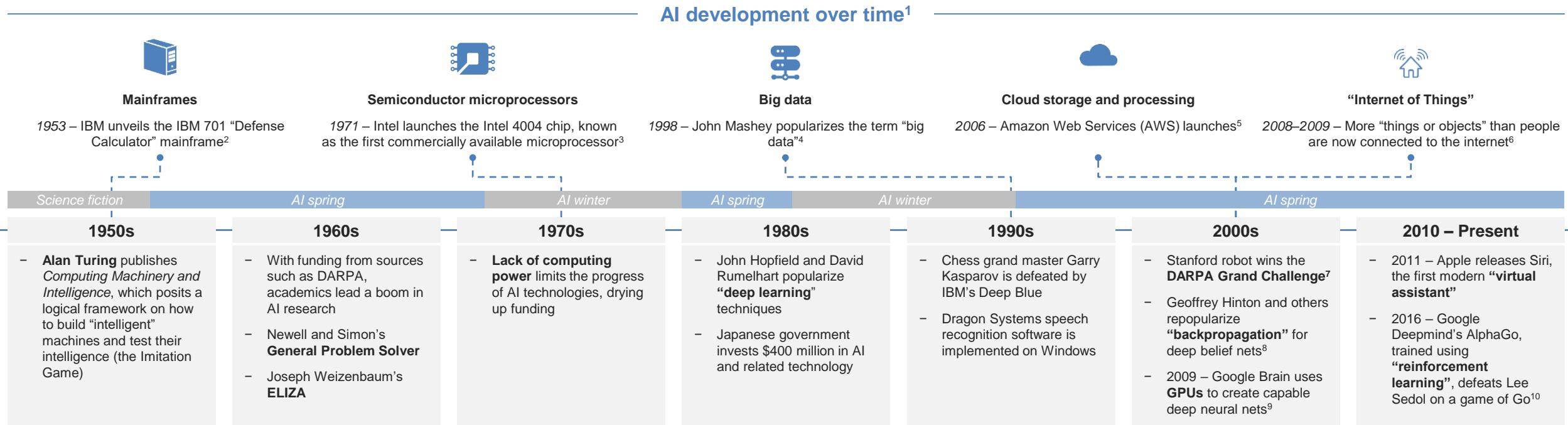
- 155** **Additional Reading**

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Context and approach

Unlike past ‘AI Springs’, the science and practice of AI appears poised to continue an unprecedented multi-decade run of advancement



What is different now?

- Technology advancement:** Enabling technologies have provided both the data and the access to cheap processing power that was lacking in past AI winters
- Talent and focus:** AI development today is being led by technologists rather than academics. Beyond just proofs of concept or trials, software engineers are building real apps for the real world, leading to myriad successful-use cases across the economy
- Leadership and investment:** Big technology firms, with immediate-term profitability requirements, are betting heavily on AI, demonstrating the belief that these technologies will improve profitability

What’s next on the horizon?

- Transfer learning:** Current AI technologies lack the ability of “abstraction”, which is the ability to take lessons from one area and apply them to another
- Efficient deep learning:** Deep learning shows promise in reducing the effort required to train models by automating feature extraction. However, heavy data requirements make these techniques impractical for common uses. New developments will increase the efficiency of these algorithms
- Unstructured learning:** In the pursuit of general intelligence, advancements in reinforcement learning and other simulation-based modelling techniques are opening up new areas in which AI can be used

The public discourse on AI in financial services is highly sensationalized, creating an excess of both exuberance and fear

Tremendous excitement is driving today's "*artificial intelligence moment*"

Significant cross-industry investment

~\$58 billion

Global AI investment by 2021¹¹

Sustained and strong investment growth

48% CAGR

Global cross-sector growth in AI investment through 2021¹¹

Tepid but significant investment from financial institutions

~\$10 billion

Investment in AI by financial institutions by 2020¹²

A top priority for financial service executives

76%

of banking CXOs agree that adopting AI will be critical to their organization's ability to differentiate in the market¹³

However, this excitement is also coupled with *significant uncertainty*

AI investing could be the next crisis

IS THIS THE END?

Artificial Intelligence Poses Risks to Insurers, Banks

Banks excited by AI, but uncertainty remains

Is technology contributing to increased inequality?

AI in Banking:
Nothing to be afraid of... yet

Robots Could Steal 40% of Jobs¹⁴

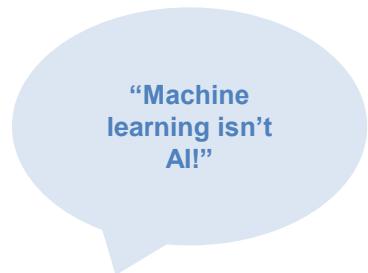
Sensationalism risks dampening the benefits that AI could bring to financial services, while exacerbating the harms

Conversations with global experts and business leaders reveal a lack of common definitions for AI – this is an example of the ‘AI effect’

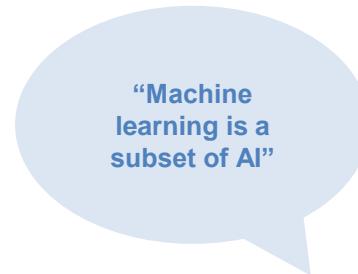
No one can agree on what “artificial intelligence” is or isn’t

There is a marked lack of clarity around the definition of AI, which frequently leads to confusion and outright disagreement. In our interviews with stakeholders we found slight – and sometimes not-so-slight – variations in experts’ definitions of AI, irrespective of their technical background or formal education in computer science and computer engineering.

Selected quotes from interviews



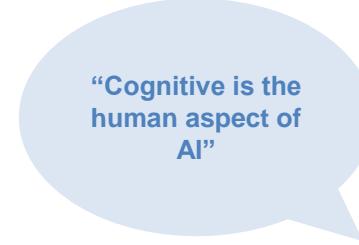
“Machine learning isn’t AI!”



“Machine learning is a subset of AI”



“AI is really about augmented intelligence”



“Cognitive is the human aspect of AI”



“What we’re talking about is deep learning – no one has achieved AI”

The AI effect

This lack of definitional clarity is illustrative of a well-documented phenomenon called the “AI effect”. Essentially, this means the inability of observers to agree on what is, and isn’t, intelligence and a tendency to conclude that the existing capabilities of computer programs are not “real” intelligence. Author Pamela McCorduck illustrates this phenomenon particularly eloquently, saying: “It’s part of the history of the field of artificial intelligence that every time somebody figured out how to make a computer do something – play good checkers, solve simple but relatively informal problems – there was a chorus of critics to say, ‘that’s not thinking’.”¹⁴

“Intelligence is whatever machines haven’t done yet”

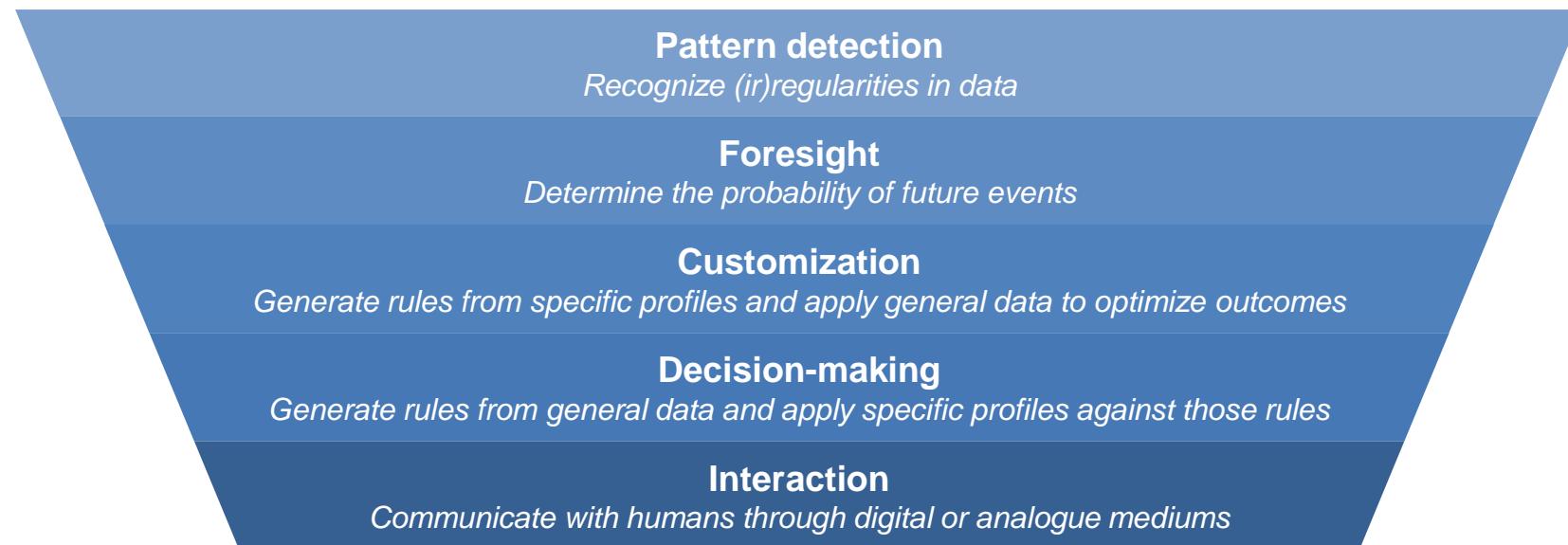
– Larry Tesler, 1970¹⁵

So what do people *really* mean when they say ‘artificial intelligence’?

While no one can agree on what AI is, they clearly mean something when they use the term

When business people talk about AI, they typically are **not talking about a particular technical approach** or a well-defined school of computer science, rather they are talking about a set of capabilities that allows them to run their business in a new way. At their core, these capabilities are almost always:

A suite of technologies, enabled by adaptive predictive power and exhibiting some degree of autonomous learning, that have made dramatic advances in our ability to use machines to automate and enhance:



Many applications of AI-driven technology use a combination of the above automations and enhancements

It is important to understand that AI does not exist in a vacuum – its capabilities will be intertwined with the development of all other technological innovations

Emerging technologies are mutually reinforcing, and the abilities of any one new technology are influenced by its interactions with other technologies

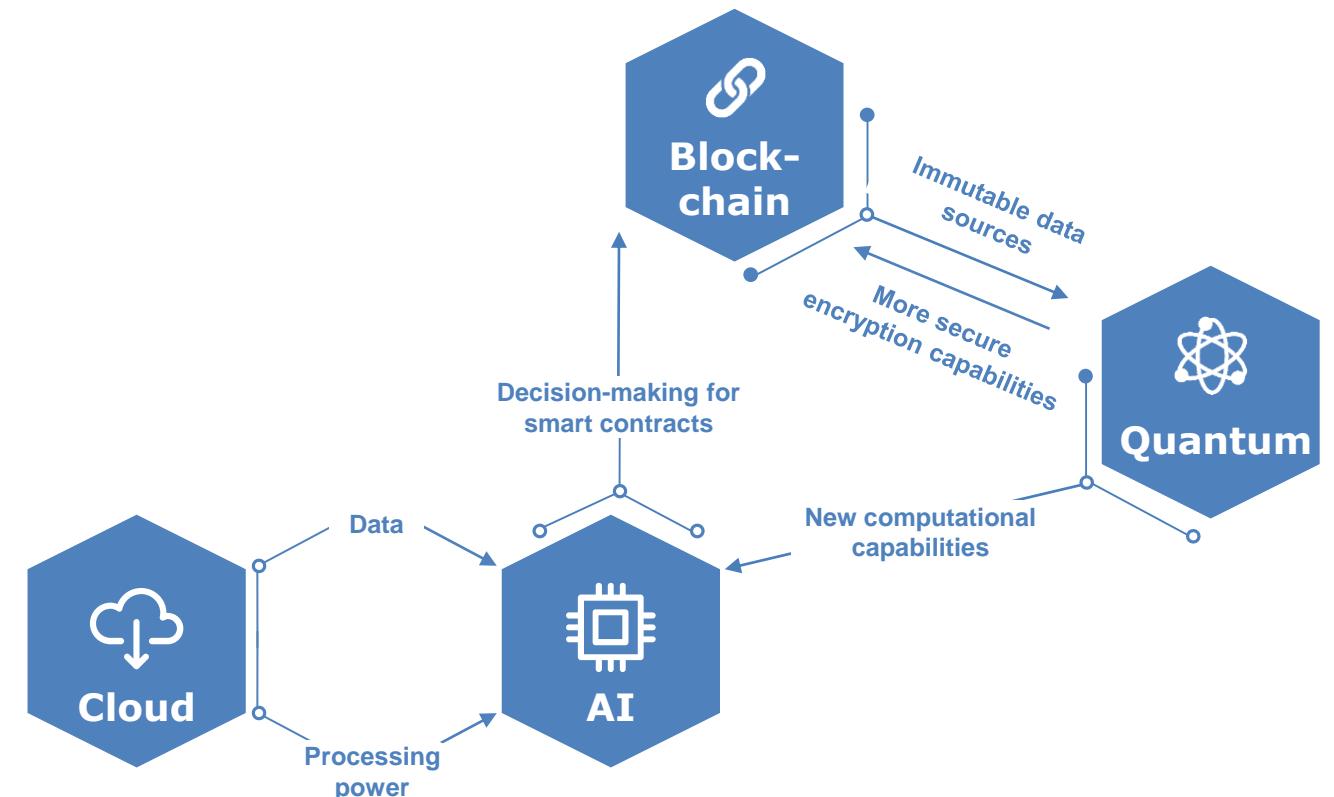
Focus on AI alone is not sufficient to understand the myriad ways in which it could be used within financial institutions. Much like other disruptive technologies, AI is not a panacea, and must be understood within the context of all other technologies that will affect how businesses operate.

Advances in any one technology will increase the capabilities of all other technologies that interact with it. For example:

- Blockchain offers a source of immutable data that does not require centralized verification, which could be critical for identity management
- While quantum computing holds the potential to break many encryption methods today, it may also bring new and even stronger techniques that will make blockchain more secure
- Advanced and different computation methods provided by quantum computing will allow AI to tackle new problems that were previously incalculable
- AI will enable increasingly complex and automated smart contracts to be executed, allowing more blockchain use-cases to enter the mainstream
- Cloud computing will provide both the data storage and the processing power necessary to train new AI models, in turn making cloud infrastructure a critical part of organizations

The potential list of interactions is endless, and will continue to develop and grow as these technologies mature and new disruptive technologies come to fruition.

Several examples of mutually reinforcing interactions



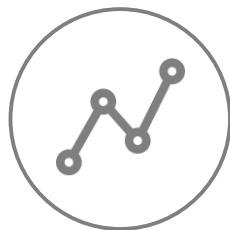
Initial conversations confirmed there is an acute need to improve our understanding of the strategic implications of the suite of technologies we call AI

Our identification of a gap in research on the strategic implications of the future of AI in financial services

While there is a huge volume of work investigating the role of AI in financial services, this work has focused mostly on observing and reporting near-term trends, or detailing technical requirements.

Explored by numerous white papers and research efforts

Trend reporting



There are a vast number of reports tracking the emergence and development of AI and reporting on emerging-use cases

Covered by a wealth of technical and operation research

Technical foundations



Computer science literature and research by leading institutions have produced a wealth of material on how to implement and optimize AI solutions

Strategic implications



There is a lack of content that explores changes to the shape and structure of financial institutions and the competitive nature of financial markets resulting from the increased use of AI

The World Economic Forum, with support from Deloitte, has conducted one of the world's largest studies into the impact of AI in financial services

- ✓ **200+ subject matter expert interviews** with leaders across incumbents and innovators*
- ✓ **Seven global workshops** that brought together stakeholders from different backgrounds
- ✓ **Ten months** of extensive research

Working with leading incumbents...



...and with leading innovators & academics



Hosting interactive discussions in financial capitals around the world



San Francisco, USA



London, UK



Zurich, Switzerland



New York, USA



Hong Kong, SAR



Sydney, Australia



Davos, Switzerland



*See page 155 for full list of contributors

This report will provide executives, regulators and policy-makers with a view of AI's impact on operating models and competitive dynamics in financial services



This report will...

- Describe how existing AI capabilities are changing the **operating models of financial institutions**
- Explore how AI is shifting the strategic priorities and **competitive dynamics of financial services**
- Raise near- and longer-term challenges that create **regulatory and public policy uncertainties**

This report will NOT...

- Delve into the technical details of **how the capabilities of any particular AI technology works**
- Provide **recommendations for how any one institution** should optimize their competitive positioning by using AI
- **Detail implementation strategies** for pursuing potential new opportunities

This report will help...

- **Strategic decision-makers** chart the direction for their institutions, based on a heightened awareness of how the basis of competition is changing
- **Regulators** understand the challenges they face and what responses are necessary to protect consumers and institutions alike
- **Policy-makers** weigh the benefits and threats of new technologies in financial services and craft responses

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The new physics of financial services

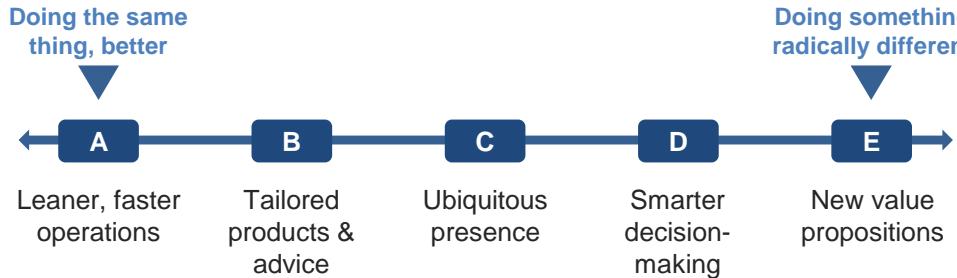
Executive summary

AI is enabling financial institutions of every kind to drive new efficiencies and deliver new kinds of value...

Key financial services opportunities enabled by AI

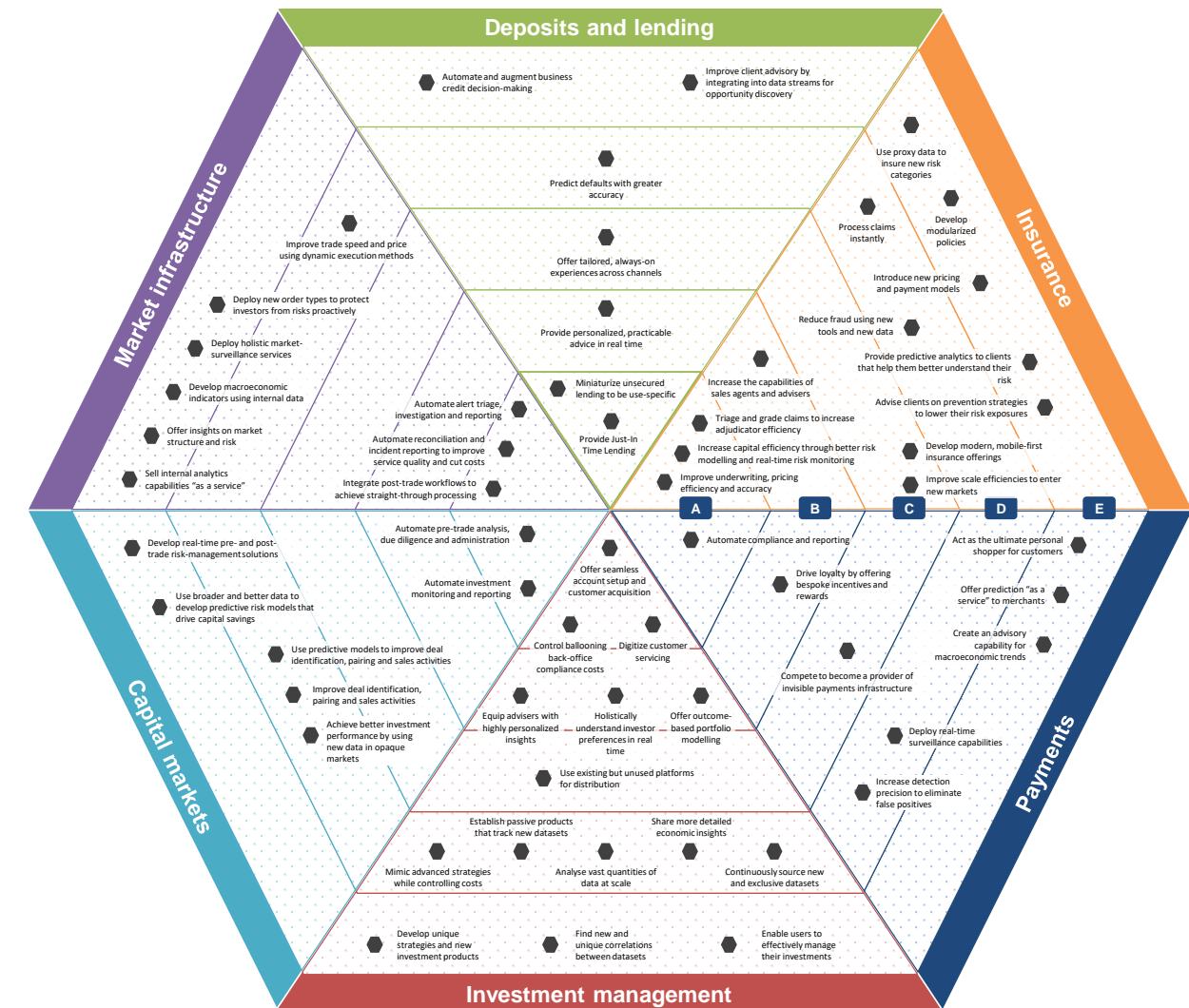
The diagram on the right illustrates a wide array of sector-specific opportunities that could be enabled by the deployment of AI in financial institutions. These opportunities (and the way institutions choose to pursue them) are the foundation that drives the key findings of this report.

In this diagram we have arranged these opportunities along a spectrum of five classes of strategies. Moving from the centre of the diagram to the periphery, the five strategy types range from conservative improvements to bold bets on new capabilities, highlighted below.



For convenience, we divide the financial system into six sectors that together encompass (more or less) the entirety of financial services. These are:

- Deposits and lending
- Insurance
- Payments
- Investment management
- Capital markets
- Market infrastructure

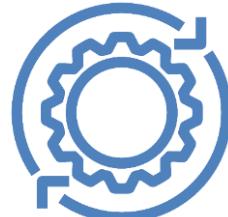


...but focusing exclusively on the capabilities that AI offers risks missing the fundamental shift that is occurring in the physics of financial services



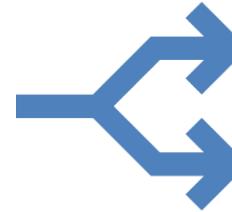
The bonds that have historically held together financial institutions are weakening

Creating new centres of gravity where emerging and established capabilities are being combined in unexpected ways



The operating models of financial institutions are being fundamentally reshaped

Making financial institutions more specialized, leaner, highly networked and dependent on the capabilities of a variety of technology players



The competitive dynamics of the financial ecosystem are being upended

Driving the formation of bifurcated markets where scale and agility win at the expense of mid-scale players



The first-movers in the deployment of AI are able to compound their lead

Accelerating early data advantages to the benefit of both front and back offices, deeply influences firms' strategic approach to alliances, infrastructure and talent

Yet shared prosperity in this future is not guaranteed, and requires deeper cross-ecosystem collaboration than that which prevails today



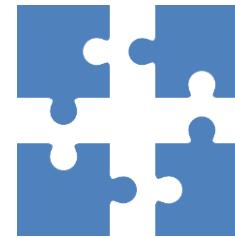
Workforce engagement is critical to the large-scale deployment of AI in financial institutions

While AI is often seen as a substitute for human talent, establishing a workforce that views the implementation of AI as an opportunity will be critical for anything but the most marginal business transformations. Achieving this will require an honest and collaborative relationship between an institution's workforce and leadership



Institutions must balance their competitive impulses against collaborative opportunities

AI offers financial institutions the ability to fundamentally solve a host of shared problems that plague the industry and its customers – but only if they can come together to build shared solutions



Time, energy and resources must be committed to resolve outstanding regulatory uncertainties

The deployment of AI across financial services raises challenging questions about the protection of both consumer interests and the stability of the financial system – addressing these challenges will demand public-private engagement across regulators, financial institutions and beyond

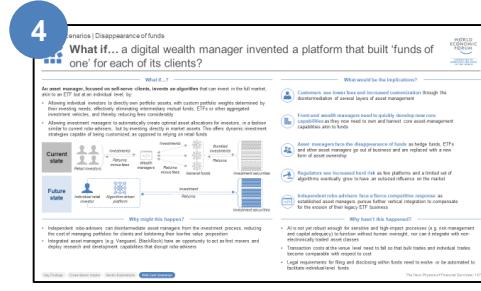
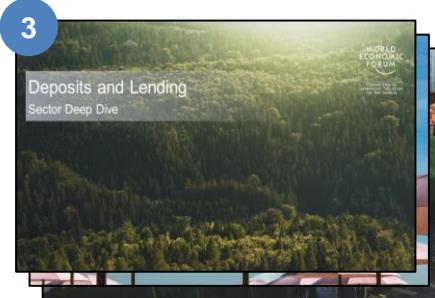


AI development must serve the needs of customers and remain in the best interest of society

The deployment of AI should enable a fairer, more accessible and more stable financial system. Maintaining a human-centric approach to the deployment of AI will be critical to ensuring it serves the interests of both individuals and society at large

What is in this report?

This report is split into four sections that will address the following questions:



How will AI reshape financial services?

Key findings

Page 22

What are the opportunities and challenges for implementing AI in financial services today?

Opportunities, challenges and broader societal implications

Page 55

Our predictions for the evolution of financial services as a result of institutions pursuing AI-enabled strategies

Our perspective of the near-term impact of AI on customers, financial institutions, regulators and society at large

How is AI being deployed by sectors of financial services?

Sector explorations

Page 85

Our understanding of AI applications across sectors in financial services, highlighting key AI-enabled strategies for institutions

How might the continued evolution of AI affect the future of financial services?

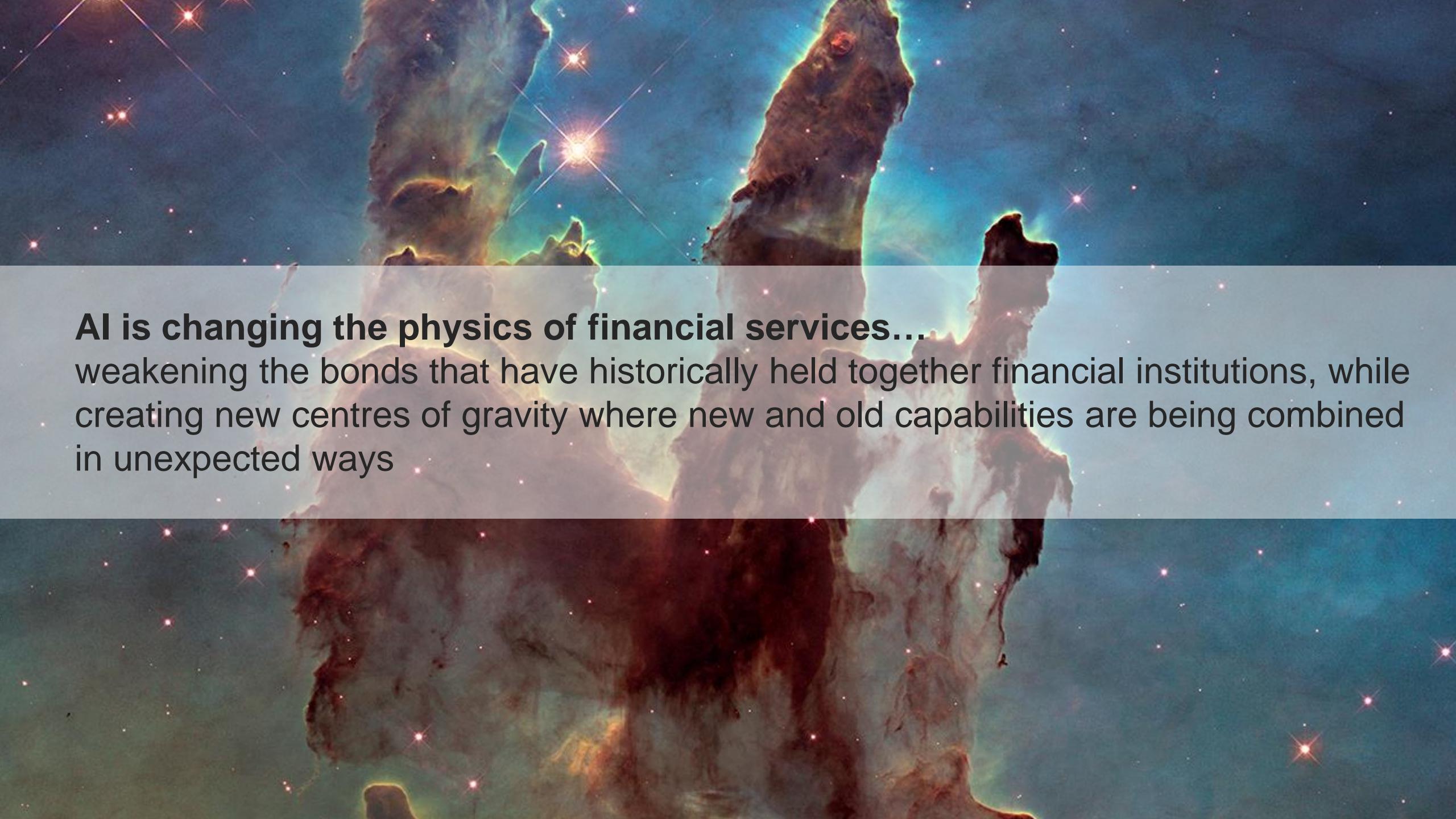
Selected "what if?" scenarios for the long-term implications of AI for financial services

Page 142

Our exploration of several potential disruptive scenarios that may proliferate in the longer term

How will AI reshape financial services?

Key findings

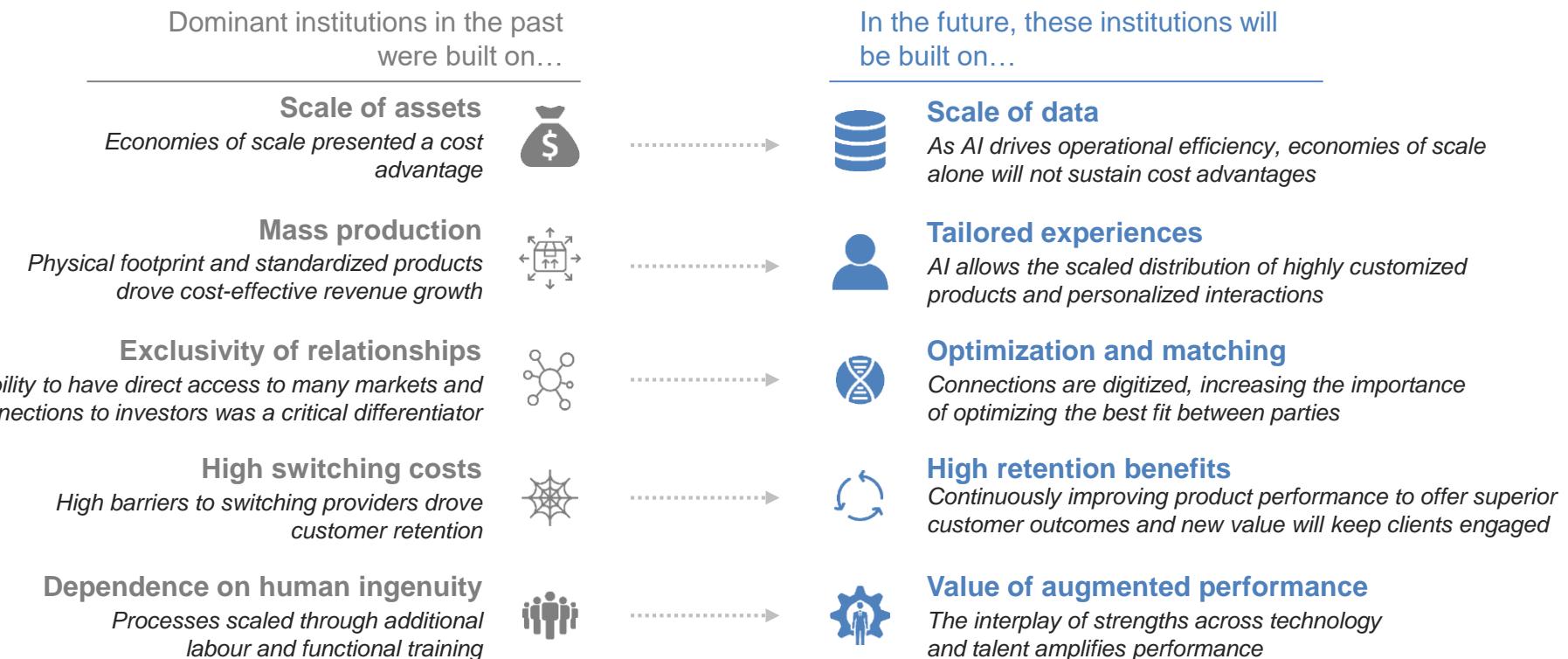


AI is changing the physics of financial services...

weakening the bonds that have historically held together financial institutions, while creating new centres of gravity where new and old capabilities are being combined in unexpected ways

AI is altering the attributes necessary to build a successful business in financial services

The resolution of previous trade-offs will create a new wave of transformation across the global financial services industry...



This shift will have far-reaching consequences for the make-up of financial services, placing legacy business models under pressure from those whose businesses are built around these new attributes

The changing physics of financial services will transform the financial ecosystem in the following ways

Key findings: AI in financial services will...

Make front- and back-office operations look radically different



From cost centre to profit centre

1

Institutions will turn AI-enabled operations into external services, both accelerating the rate at which these capabilities improve and compelling others to become consumers of those capabilities to avoid falling behind



A new battlefield for customer loyalty

2

As past methods of differentiation erode, AI presents an opportunity for institutions to escape a “race to the bottom” in price competition by introducing new ways to distinguish themselves to customers



Self-driving finance

3

Future customer experiences will be centred on AI, which automates much of customers’ financial lives and improves their financial outcomes



Collective solutions for shared problems

4

Collaborative solutions built on shared datasets will radically increase the accuracy, timeliness and performance of non-competitive functions, creating mutual efficiencies in operations and improving the safety of the financial system

Create major shifts in the structure and regulation of financial markets



Bifurcation of market structure

5

As AI reduces search and comparison costs for customers, firm structures will be pushed to market extremes, amplifying the returns for large-scale players and creating new opportunities for niche and agile innovators



Uneasy data alliances

6

In an ecosystem where every institution is vying for diversity of data, managing partnerships with competitors and potential competitors will be critical, but fraught with strategic and operational risks



The power of data regulators

7

Regulations governing the privacy and portability of data will shape the relative ability of financial and non-financial institutions to deploy AI, thus becoming as important as traditional regulations to the competitive positioning of firms

Raise critical challenges for society to resolve



Finding a balanced approach to talent

8

Talent transformation will be the most challenging speed limit on institutions’ implementations of AI, putting at risk the competitive positioning of firms and geographical areas that fail to effectively transition talent alongside technology



New ethical dilemmas

9

AI will necessitate a collaborative re-examination of principles and supervisory techniques to address the ethical grey areas and regulatory uncertainties that reduce institutions’ willingness to adopt more transformative AI capabilities

This section of the report will examine each key finding, exploring the impacts and implications of the new physics of financial services

The following slides will explore each “key finding” in three parts

These findings describe what the landscape of financial services may look like in the future, providing early signs that point to the realization of this future, and detailing how different stakeholders might be affected



The diagram illustrates the shift from a traditional model to a back-office-as-a-service model. On the left, the 'Traditional Model' shows a central box labeled 'Back-Office' connected to four boxes representing business units: 'Retail', 'Manufacturing', 'Finance', and 'Data'. An arrow points from 'Retail' to 'Data'. The 'Retail' box contains a sub-diagram showing 'Customer', 'Order', and 'Inventory' flows. A legend at the bottom indicates 'Line of Business' (Retail, Manufacturing, Finance) and 'Data' (Data). On the right, the 'Back-Office-as-a-Service Model' shows a central box labeled 'Back-Office-as-a-Service' connected to the same four business units. An arrow points from 'Retail' to 'Data'. This model includes a 'Cloud' icon above the central box and a legend indicating 'External Partner' (Retail, Manufacturing, Finance) and 'Data' (Data).

2 **Strategic Focus 1: From Cost Centre to Profit Centre**

Increasing examples of software-as-a-service offerings provide a blueprint upon which a majority of AI-based services in financial institutions could be explored

We observe that large-scale service offerings, like those from BlackRock and Ping An, have demonstrated the success of this model.

Webinar announcement: [The Amazon Web Services \(AWS\) and Microsoft Azure](#)

Aladdin 

BlackRock 

Ping An 

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Ping An <img alt="Ping An logo" data

The diagram features a central blue circle containing the text: "The transformation of the office-back will shift the competitive basis of firms towards the front office, and transform the distribution of talent in the industry". To the left of this central circle is a blue circle with the number "3" and the text "Findings 1: From Cost Centres to Profit Centre". To the right is a blue circle with the text "WORLD EDITIONS". Below the central circle, there are three horizontal lines with text above them: "IMPLICATIONS", "UNCERTAINTIES", and "CONCERNES". Each line has a corresponding icon: a person icon for implications, a bar chart icon for uncertainties, and a gear icon for concerns.

IMPLICATIONS

- Operational efficiency is removed as a competitive differentiator**
- Back-office processes become increasingly automated, standardised as most institutions will compete on cost-efficiency, forcing institutions to look for new areas of differentiation**
- Market power shifts to service providers**
- As service providers become increasingly dominant, they will insist that those services face high costs, forcing service providers to charge higher fees for marginally improved services**
- Reduced redundancies and increased concentration**
- As financial institutions become increasingly concentrated, the number of capital systems, fees and margins will have a significant impact on the financial system**
- Talent will shift from financial institutions to service providers**
- As institutions become primarily concerned with profit rather than cost, the flow of capital from financial institutions to non-financial service providers; consequently, the roles may be considerably different**

UNCERTAINTIES

- How will incumbents respond, which have been successful in maintaining a market and development lead centers of excellence that are attractive service offerings?**
- How will institutions protect the value of their intellectual capital in a world where data must be shared with competitors to access minimum requirements of efficiency?**
- As institutions begin to rely on back-office automation that is distributed outside of the organization, how will data protection regulations impact the globalization of financial services?**
- How will regulatory and prudential concern about data security and cloud architecture be resolved?**

Description

Overview of the intricacies of each finding in terms of how it will shape the future of the industry

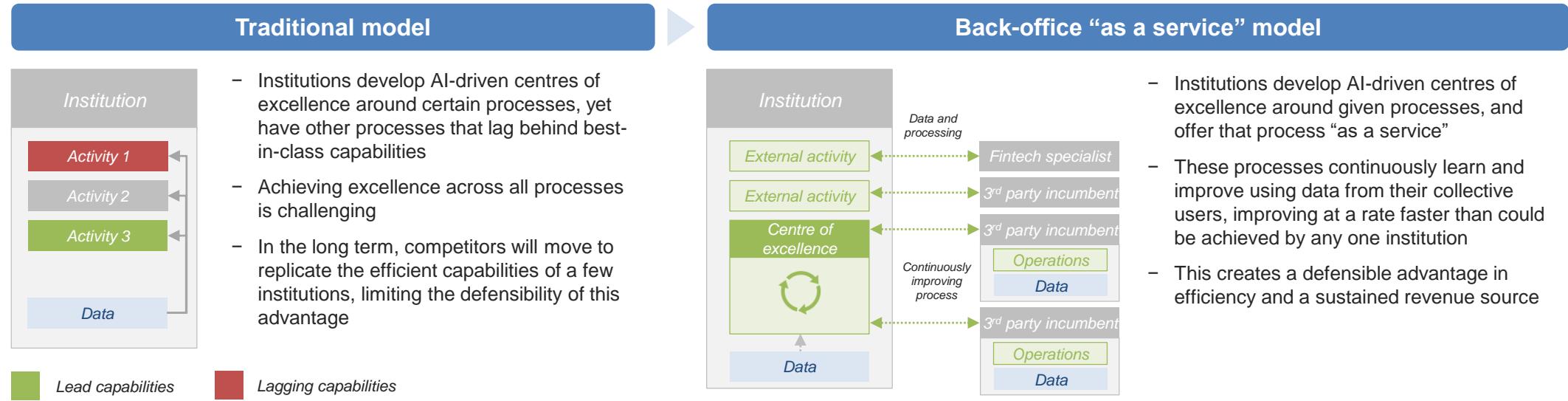
Evidence and examples

Early indicators that point to the realization of this finding

Implications and uncertainties

Showcase of how the incentive structures affect different stakeholders and what uncertainties remain to be determined

AI-enabled back-office processes can be improved more rapidly by offering them ‘as a service’ to competitors



The proliferation of externalized services across back-office processes is a result of both the rise in modularized operations and the data dynamics of AI

Operations are modularizing as institutions look to commoditize their costs

Cost commoditization is pushing institutions to modernize their operations to make them more interoperable

- Investments in modernized operations can improve the immediate efficiency of those processes, as well as lay the groundwork to turn those processes into service offerings
- These operations, particularly AI-based processes, are increasingly built on modular and cloud-based architecture, meaning they are easy to scale to new users

Turning operations into service offerings provides a defensible economic advantage

Beyond creating revenue streams, these services bring in more data, which ensures AI models continuously improve

- As more institutions become users of a service and integrate their data flows, underlying algorithms learn from their data – continuously increasing the efficiency of the overall process
- This ensures institutions that move quickly to modernize operations have the potential to develop a sustained operational advantage

As external services continue to improve, other institutions are pushed to become consumers

Individual institutions will not be able to compete independently with the efficiency of collective services

- Institutions become increasingly locked into mutualized services built on collective data. Individual institutions would need significant innovation to develop algorithms that overcome their comparative data deficit
- Data advantages are more sustainable than algorithmic advantages, as AI research is open source and new innovations can be mimicked by competitors

Existing examples of software ‘as a service’ offerings provide a blueprint upon which a majority of AI-based services in financial institutions could be built

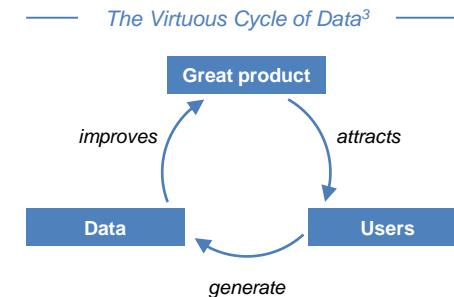
We observe that large-scale service offerings, such as those from BlackRock and Ping An, have demonstrated the success of this model

Modular microservice architecture at the heart of future banking technology



Across financial services, both new applications and legacy technology are moving to the cloud and microservice architectures. IDC estimates that by 2021, hyper-agile architectures will be mainstream, with 80% of application development done on cloud platforms using microservices and cloud functions.¹ At the back end, cloud infrastructure makes up a third of all IT spending in financial services and is growing at over 20% CAGR as institutions push to migrate legacy technology onto modern platforms.²

Development of products with explicit virtuous data cycles



The virtuous cycle of data is a conceptual framework proposed by the Stanford academic and former Baidu chief scientist Andrew Ng,³ and others. It describes how institutions can set up continuously improving services using AI, in effect creating a defensible offering with high switching costs. **Google Translate**, **Spotify's** Discover Weekly and **Facebook's** timeline algorithm are examples of services built on AI that have been progressively improving over time as users interact with those services. **Google Adwords** exhibits similar virtuous data cycles for corporate customers. Competitors that start from scratch with the goal of competing with these services will face a steep uphill battle.



Externalization of best-in-class processes by incumbents



BlackRock and **Ping An** are two examples of incumbent financial institutions that internally developed world-class services, and decided to externalize those services to develop new revenue streams. BlackRock Chief Executive Larry Fink has stated that he wants Aladdin to make up 30% of BlackRock's revenues.⁴ Ping An's OneConnect is its internal advanced technology infrastructure, covering everything from core banking technology to advanced AI capabilities. They have transformed this technology into a service offering used by nearly 500 banks across China.⁵

The transformation of the back office will shift the competitive basis of firms towards the front office, and change the distribution of talent in the industry

Implications



Operational efficiency is removed as a competitive differentiator

Back-office processes become increasingly uniform across financial services as most institutions will consume similar capabilities, forcing institutions to look for new areas of differentiation



Market power shifts to service providers

As service provider offerings become increasingly efficient, institutions that consume those services face high switching costs, allowing service providers to charge high margins



Reduced redundancies and increased concentration

As financial institutions become collectively reliant on a diminishing number of critical systems, flaws within those systems have a magnified impact on the financial system



Talent will shift from financial institutions to service providers

As institutions become primarily consumers of capabilities, jobs will flow out of financial institutions but be recreated in service providers. Consequently, roles may look considerably different

Uncertainties

How will incumbent institutions, which traditionally have not invested heavily in research and development, build centres of excellence that are attractive service offerings?

How will institutions protect the competitive value of their proprietary data in a world where that data must be shared with competitors to access minimum requirements of efficiency?

Given that the move to third-party services is expensive and operationally burdensome for most firms, which types of service offerings will succeed and which will fail?

Which aspects of third-party services will regulators approve of and champion, and how will outstanding regulatory and prudential concerns be resolved?

Historically important differentiators for attracting and retaining customers are eroding, while AI is enabling new ways to differentiate offerings and win clients

Historic differentiators for attracting customers

The factors that were important to financial institutions in remaining competitive are reaching equilibrium, reducing institutions' ability to differentiate using these factors

Price

Platforms are making price discovery much easier, placing pressure on margins and creating a "winner-takes-all" environment for the institution able to provide the lowest price



Speed

As AI and other technologies enable more and more products and services to become instant and real-time, fast services will cease to be a differentiating factor (and instead become table-stakes functionality)



Access

As the move to digital distribution and servicing of financial services accelerates, extensive branch and broker networks are no longer needed; allowing digital connections (e.g. via app) to become the norm



AI is driving a dramatic shift in how financial institutions should attract and retain active customers



The old methods of differentiation are becoming a race to the bottom as AI commoditizes these methods



At the same time, AI is creating new differentiators, driven by access to unique datasets and virtuous cycles of data; institutions must use emerging technologies and secular trends to remain competitive

Emerging differentiators for attracting customers

As it frees financial institutions from the need to make trade-offs between better service and cost, AI is giving rise to a new set of competitive factors on which financial institutions can differentiate



Customization

The ability of institutions to optimize financial outcomes by tailoring, recommending and advising customers better will allow them to compete on value offered



Capturing attention

The ability of financial institutions to engage users and access data through ongoing and integrated interactions beyond financial services (e.g. offering forecasting services to merchants, booking repairs for vehicle damage, etc.) will allow them to better retain customers



Developing ecosystems

Financial institutions' ability to bring together data from multidimensional networks that include their consumers, corporate clients and third parties will allow them to offer differentiated advice and improve performance

Financial institutions are seeking to differentiate themselves by using AI to build new products and data ecosystems

We observe that AI is shifting the basis for competition within financial services to mimic competition within the technology sector

Financial institutions are offering integrated services beyond financial products



RBC's investments in diversifying its digital platform have allowed it to incorporate a broader ecosystem of services. For example, RBC is piloting a forecasting tool for car dealers to predict demand for vehicle purchases based on customer data. By offering this tool alongside its lending solutions, RBC gives an incentive to car dealers to offer RBC lending products more frequently. Other examples, among many, include software that helps register start-ups or facilitate rentals on Airbnb. This allows them to better compete in the race to own customers' data and attention.^{6,7}

Institutions are shifting their role to become ecosystem curators



Financial institutions in the UK are revisiting their core value propositions now that open banking has come into effect. **Lloyds Banking Group's** transformation investment of \$4.1 billion a year is positioning the company to combine banking and insurance services, along with new API-enabled propositions, to compete in the digital world. This is supplemented with a major focus on AI capabilities to transform the customer proposition and business operations. The aim is to be an ecosystem provider and a "trusted guardian of data" in the age of many providers.⁸

Institutions with strong multidimensional ecosystems access massive scale of data and insight



Ping An has aggressively invested in building a suite of ecosystem partners, services and products to achieve a massive scale of data beyond just financial services. Through a suite of apps in finance, medicine, cars and housing, it is able to take advantage of data from over 880 million users, 70 million businesses and 300 partners to power its core business.⁹ For example, by offering apps that cover insurance, payment and telemedicine, Ping An is able to see the gaps in service and address them to improve diagnosis efficiency and accuracy – dramatically improving the overall quality of its offerings.

Competition between technology companies foreshadows how financial institutions will compete for customers



In what **Google** calls "Gen C", people crave engagement over exposure, and prefer brands that create experiences that are relevant and valuable. Companies such as Google and Amazon harness this behaviour by developing products and experiences that cross sector boundaries – with the intention of using their technological advantage and scale of data to provide differentiated and higher-quality experiences that will further attract and retain customers.¹⁰

Incumbents will need to radically alter the way they work and the types of products they develop in order to compete for customers

Implications



Institutions need detailed insight into customer behaviour both inside and outside financial services

Institutions will need to be highly focused on delivering what customers actually want. This means getting to know customers beyond just their finances and looking for opportunities to improve their day-to-day lives



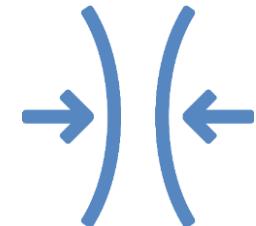
Product development and a willingness to experiment will be critical skills for institutions

To succeed, incumbents will need to harvest new resources and ways of working, including technical AI skills, product development capabilities, new datasets and cultures of innovation and experimentation



Large tech firms have distinct advantages in attracting new customers

The core strategies of tech companies have been highly focused on capturing user attention (and data) by offering free products and services. Financial services offered by these players will benefit from the existing service shelf



Margins will be squeezed for institutions that do not develop new differentiators

Institutions that are slow to implement new ways of differentiating their products face an uphill battle maintaining margins, especially after traditional metrics such as price and speed are normalized due to technology

Uncertainties

Will incumbents be successful in offering value-added services that compete with existing offerings in different industries?

What is the natural equilibrium of price in a platform economy and what margins can institutions expect to earn without differentiation?

How will regulators manage the complexity (e.g. in assessing suitability) created by customized product attributes?

As financial institutions build datasets that stretch to new industries, what are the boundaries and principles that should be obeyed regarding customer privacy?

AI can deliver a radically reimagined customer experience by allowing customers' finances to run themselves, and acting as a trusted adviser in moments of need

Financial advice, part of every product, is flawed



Most financial advice is generic and delivered impersonally (e.g. calculator-based, with average assumptions)

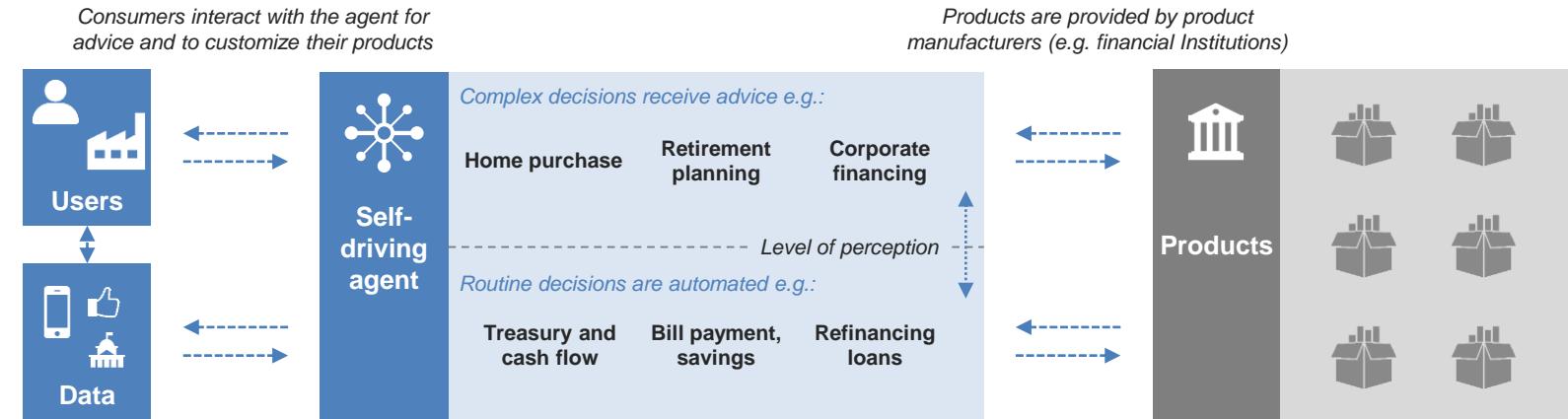


Reliance on subjective advice from different customer service agents leads to suboptimal financial outcomes



Advice is based on limited information as sharing of product and customer information is ineffectual within and across institutions

A “self-driving” vision of finance could transform the delivery of financial advice



AI enables self-driving finance in three key ways

Empowered platforms

The ability to compare and switch between products and providers is critical to managing financial decisions

- AI can unlock the potential of emerging multi-provider platforms by defining customer experiences
- Institution- and product-agnostic algorithms are critical in matching customers with products based on price and fit as determined by data
- Platforms can dominate the race for customers by providing the best financial outcomes

Mass advice and customization

Advice will be increasingly personalized and products will increasingly be bespoke thanks to the use of data

- Advanced recommendation engines can be used to customize the features and price for each financial product, using data from a variety of sources, including customers, groups and third-party sources
- Automated, sophisticated advice allows for a frequent, proactive and personalized service that is not economical under traditional human-based customer service models

Continuous optimization

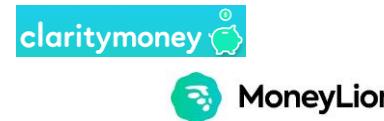
Algorithms operating below the level of perception will automate most routine customer decisions

- Day-to-day financial management will be automated as always-on algorithms and advisory platforms emerge
- For example, algorithms can optimize cash flows (e.g. savings rates), avoid fees, monitor for better deals and switch providers when necessary
- This will result in better customer experiences around price and product

A growing number of financial institutions are applying AI to customer advice and interactions, laying the groundwork for self-driving finance

We observe that the necessary components for self-driving finance are being developed and implemented by fintechs and incumbents alike

Next-generation personal financial management



In the past, personal financial management apps were restricted to describing a customer's financial situation; they were unable to provide actionable insights and recommendations. The next generation of these services (e.g. **Clarity Money**, **MoneyLion** and others) are using AI to offer mass advice and customization to help improve customers' financial positions (e.g. refinance a loan, consolidate credit card debt or cancel certain recurring payments). Similar tools are being built for corporate clients (e.g., institutional investor dashboards.)

Tools to consolidate customers' financial lives



Citi recently launched a mobile app that allows customers to link their accounts across providers to deliver a 360-degree view of their financial lives across all banks and providers.¹¹ Chat platforms such as **WeChat** have emerged to enable continuous optimization of financial positions, and are offering interoperability across different financial services verticals.

Automation of savings and bill payment



Myriad new apps have emerged that are automating routine savings and bill-payment activities. On the savings side, several apps, such as **Acorns**, round up payments to the nearest dollar and transfer the balance to a savings account. For bill payments, start-ups such as **Tally** can aggregate all of a customer's cards into one account and pay each individual bill through a single line of credit.

Primacy of customization in future banking infrastructure



New core banking infrastructure offerings are embedding all products into a single cloud system, allowing institutions to treat their entire product portfolio as a single balance sheet and to enable dynamic customization and pricing. For example, **Thought Machine's** core infrastructure treats products as "smart contracts", allowing new products to be quickly customized and deployed through a wizard or direct code.

Multi-provider platforms becoming financial managers



Multi-provider platforms are increasingly looking to empower their offerings through personalized recommendations for which products and features are best suited to customers. **Credit Karma**, which has found success as a lead generator for loans, raised \$500 million in March 2018 to build financial adviser tools and extend their control of customer experiences.¹²

Self-driving finance will upend existing competitive dynamics, pushing returns to the customer experience owner while commoditizing all other providers

Implications



Owners of customer experiences will earn the largest margins

Ownership of customers will be sticky as self-driving agents become more accurate as they learn and collect more data. This will allow owners of customer experiences to exert market power and accrue the lion's share of profits available



The frequency of customer interaction will be greatly reduced

There will be far fewer interactions between providers and customers as the customer experience is largely automated. However, the interaction points that persist will become increasingly important and advice-centric



Product manufacturers will shape themselves around the algorithms

Product manufacturers will lose direct access to customers. Competition will increasingly revolve around optimizing the algorithms of self-driving agents rather than targeting customers directly



Conduct risk will be transformed

There will be a large reduction in conduct risk as sales activities will be performed through self-driving agents as opposed to sales staff. However, when misconduct does occur, it will be on a much larger scale due to the connectivity of AI

Uncertainties

Will it be incumbents, new entrants or large technology companies that deliver the self-driving agent?

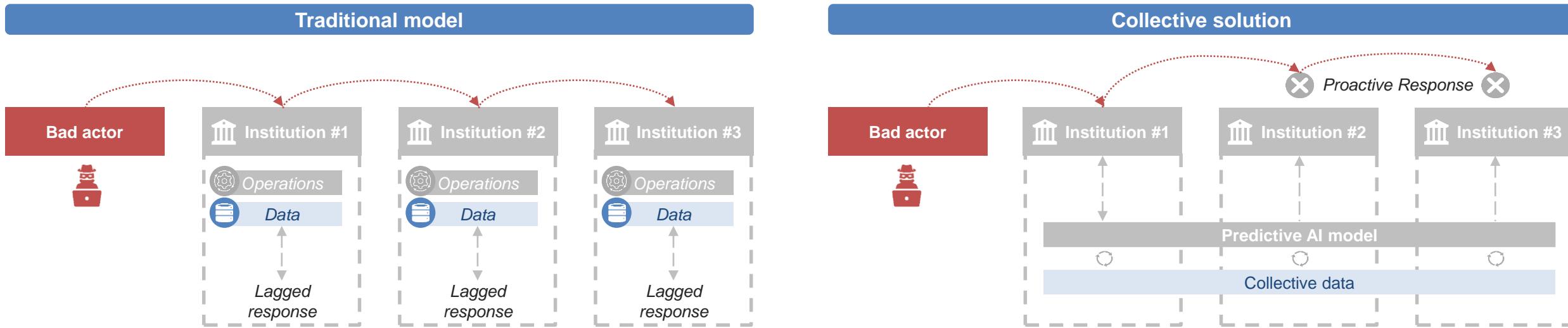
What monetization models are necessary to ensure that the incentives for product manufacturers are aligned to the interests of consumers and self-driving agents?

During what situations will human advisers need to remain involved to meet customers' needs? Will this need diminish over time?

How do we ensure that algorithm-driven decision-making can be trusted and held accountable?

Collaborative AI-driven tools, built on shared datasets, can enable a radically safer and more efficient financial system

Example Collective Fraud Prevention Model



Our research suggests that AI-based collective solutions present a significant opportunity to address core challenges of the financial system

Processes such as fraud prevention and anti-money-laundering controls are run suboptimally

Due to data asymmetries, many activities today are run inefficiently and ineffectively

- Many of these systematic inefficiencies are highly correlated; the suboptimal process at one institution has knock-on effects on other institutions and across the ecosystem
- If unchecked, there is a threat of a system-wide contagion
- Timely response is critical to the resolution of these threats

There is strong potential for cross-institutional collaboration on these issues

- These inefficient processes are rarely key differentiating capabilities, giving institutions flexibility over execution
- Since they would not be sacrificing strategic factors critical for their differentiation, institutions would be more likely to collaborate and mutualize these processes
 - Many of these processes are sector agnostic, being run at institutions at different levels in the value chain across different product categories

AI presents a strong mechanism to collaborate as the value of shared datasets is tremendous

AI benefits from scale in data to deliver performance that is greater than the sum of its individual parts

- Processes that often involve large datasets and flows of data are prime targets for AI implementations
- AI can recognize patterns and develop insights on threats that cross institutional boundaries
- As institutions move to create common utilities, new frameworks that address talent, governance and technology standards will emerge

AI-based solutions are emerging that could address the numerous shared pain points of the financial sector

We observe that both private institutions and collectives are moving to use AI to address shared problems

Increasing regulatory focus is straining institutions' budgets

\$342 billion
cumulative financial penalties for non-compliance between 2009 and 2017¹³

Cumulative financial penalties for non-compliance between 2009 and 2017 totalled \$342 billion globally, with 89% of industry executives around the world expecting continued increases in compliance costs from 2017–2019.¹⁴ Regulatory priorities stretch beyond leverage and capital-adequacy requirements, and there is also increased focus on collective issues such as financial crime, privacy and data security. New regulatory requirements that emerge to address these areas will place pressure on operating budgets for institutions.

Early-stage collective utilities are emerging, backed by key service providers



Collective institutions such as **SWIFT** and **EarlyWarning** have started developing service offerings that will leverage AI and the collective power of data to address some of the biggest threats. SWIFT is launching a new intelligent in-network solution for fraud control that combines real-time monitoring, and alerting and blocking of sent payments, with daily reporting. The solution gets “smarter” over time and is part of SWIFT’s commitment to develop leading-edge technology solutions, including AI and ML, to help its customers address their regulatory, fraud prevention and risk mitigation requirements. **EarlyWarning** is a fraud and risk-management technology company, started by a collective of the largest US banks, that employs AI.

AI-based transaction monitoring models have a demonstrated advantage over the status quo



Companies such as **ComplyAdvantage** and **Shift Technology** have demonstrated significant benefits in using AI-based algorithms to monitor transactions. ComplyAdvantage claims to have achieved an 84% reduction in false positive alerts for AML risk data, while Shift Technology is helping insurers fight claims fraud using AI.¹⁷

Real-time and digitized transactions are presenting new collective risks



Many have speculated that real-time payment brings with it “real-time fraud”. There is evidence to support this contention: the UK experienced a 132% increase in fraud in the year after it implemented the **Faster Payments** scheme¹⁵ and, thanks to automation, insurance fraud cases are expected to double.¹⁶ Furthermore, experts have warned that the proliferation of AI technologies could enable new forms of cybercrime and other threats across different industries.

New frameworks must emerge to enable shared accountability if collective solutions are to succeed

Implications



The safety of the financial system will be radically improved

If collective solutions succeed, real-time scanning using full market data has the potential to dramatically increase institutions' ability to react proactively to threats and catch malicious activities with improved accuracy



Efficient compliance will become a commodity

As institutions collectivize their shared compliance services, they will participate on the same competitive plane – removing efficiency of compliance as a competitive differentiator



Accountability and control must be renegotiated

As certain processes are shifted to shared utilities, institutions will seek to offload accountability to these central utilities as well, while regulators will push to hold the institutions accountable



Growing cyber-risks present increasing operational challenges

Institutions must develop strategies to mitigate the increasing risk of abuse and leakage of highly confidential information at a customer and transaction level, as well as the increased risk-sharing of sensitive competitive information

Uncertainties

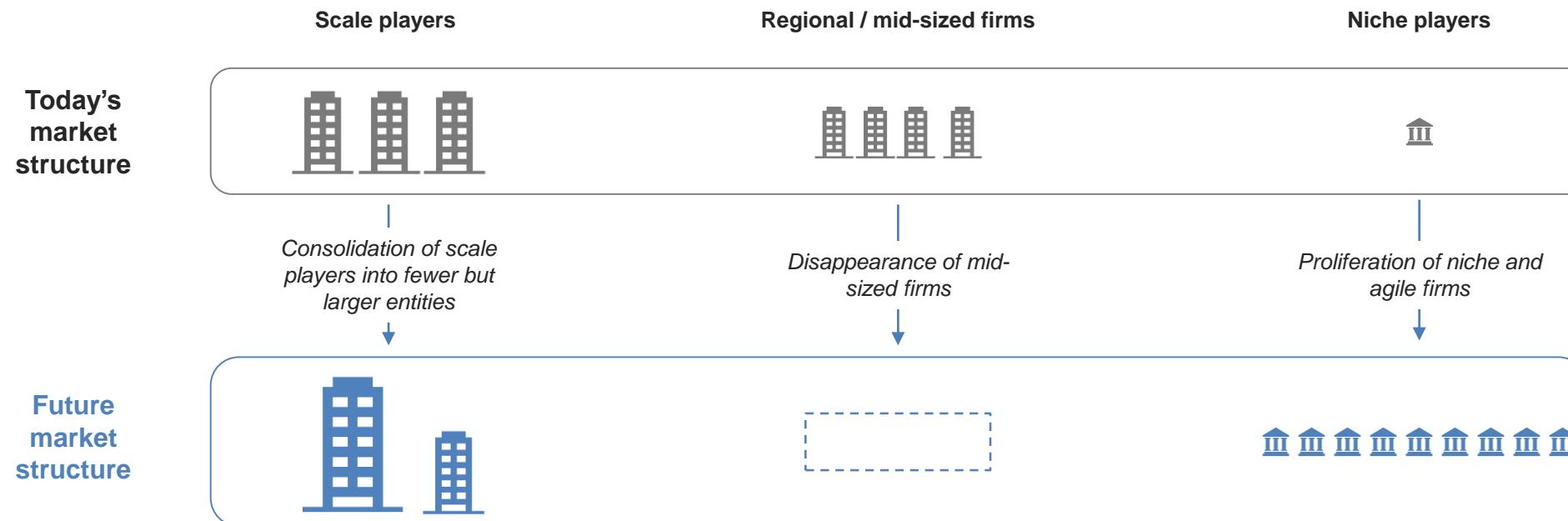
What is the right ownership framework for collective utilities to ensure their interests are aligned with their stakeholders?

How will liability for errors and compliance failures be shared between utilities, collectives and individual institutions?

Can cross-border solutions be developed given a growing divergence in financial and data regulations?

How will the industry ensure leadership and investment across the financial system to overcome the barriers to collaboration?

The economics of AI will push market structures to extremes, favouring scale players and agile innovators at the expense of mid-sized firms



Cause: AI will drive shifts in customer behaviour and operating economics

- Platforms will push customers more aggressively to switch to lower-cost products, as price is the primary decision factor for most commoditized financial
- Optimization algorithms will help customers find niche products that best fit their unique needs, in cases where this behaviour dominates price
- AI will allow new offerings to be built and scaled much more efficiently. Firms can use AI services to establish full back offices (e.g. meeting regulatory requirements without massive investment or the need to hire large workforces)

Effect: This shift will simultaneously favour scale players and agile innovators

- Scale-based players have a natural cost advantage, allowing them to capture customers from mid-sized players, especially given increased price transparency in the industry
- Agile and niche players can capture under-served customers by optimizing their offerings to the decision-making of algorithms and targeting unique, unmet needs (e.g. niche insurance, unique investments). This could present an opportunity for non-bank new entrants (e.g. tech companies)
- Mid-sized firms will struggle to make the investment necessary in AI to remain competitive; as incumbent firms increasingly become AI service providers, firms that do not have the capacity to build similar offerings will struggle

Economic theory and market observations suggest that, as AI becomes more important, firms will be pushed to market extremes

Evidence from economic theory

Economists have documented the power of information technology to drive firm structures to market extremes. Erik Brynjolfsson defined this phenomenon as being the result of the simultaneous creation of long tails in product availability, combined with a winner-takes-all superstar structure.¹⁸ AI accelerates this phenomenon by magnifying the impact of several key drivers:

- **Search and database technology:** AI-based search algorithms can better match users with what they are looking for, making more qualitative aspects of financial services easier to search and compare
- **Personalization:** By enabling continuous customization, AI helps products better meet the unique needs of customers who were previously under-served
- **Making niche products cheaper to build:** As AI automates back-office processes, new products and offerings have a low marginal cost, improving the economics of offering niche products
- **Improving returns to scale:** As search costs are minimized, scale players have inherent advantages in offering the cheapest products (e.g. the lowest-rate loans or cheapest insurance premiums)

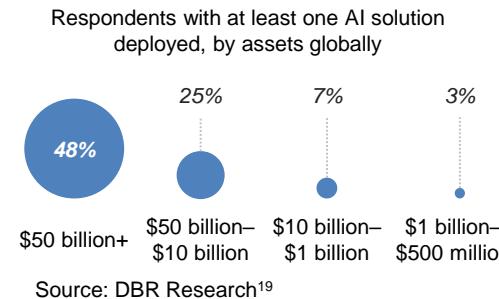
Evidence from observations

Market extremes are already developing in asset management



Scale players such as **Vanguard** have aggressively pursued a low-fee offering by taking advantage of economies of scale. In the ETF market, automated platforms (e.g. robo-advisers) have increased the ability to seamlessly optimize investments and fees, helping the scale players to win customers. At the other end of the spectrum, a new class of funds has emerged. These are led by innovative entrepreneurs who use AI and quantitative investing to deliver differentiated return profiles that can be scaled rapidly without substantially increasing their costs or human capital footprint.

Mid-tier firms are lagging in technology investment



Firms with fewer assets are lagging behind larger investment firms in both AI and digital transformation. A survey by DBR Research found that 48% of banks with more than \$50 billion in assets have deployed an AI solution, compared to 7% for banks with between \$1 billion and \$10 billion in assets. One reason for this is that mid-tier firms have tighter investment budgets and rely on technology vendors, resulting in limited internal capacity for innovation and a reduced ability to move quickly.

As institutions get pushed to market extremes, firm structures and core competencies at either end of the spectrum will begin to look radically different

Implications



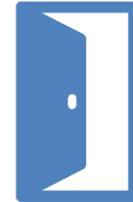
Aggressive competition will lead to consolidation among scale players

In order to retain the favour of recommendation algorithms, scale players will maximize their economies of scale, focus on key products and divest from non-core activities in order to improve price and performance metrics



Consolidation of mid-tier players

As mid-tier financial institutions become less profitable, they will become acquisition targets for scale players to increase the size of their books



Reduced costs of entry enable a new generation of product manufacturers

New firms will be formed by innovative entrepreneurs and will be able to scale rapidly. The shape of these new firms will be radically different from traditional financial institutions



Product shelves widen and diversify

As more niche players enter the market and try to fill unique and under-serviced needs, consumers will have access to new and different products that better fit their financial requirements

Uncertainties

How will regulators react to the increased consolidation of assets and the risk of creating new “too big to fail” entities?

As operational barriers to entry are reduced, will regulatory barriers similarly adapt to enable new entrants?

To what degree will consolidation of scale players become a cross-border phenomenon?

How will emerging markets react to aggressive expansion of international firms into their domestic systems?

Data partnerships emerging out of necessity will have winners and losers as some firms are pushed to the periphery and others emerge as ecosystem hubs

In order to access the full benefits of AI, institutions will be pushed to enter into data partnerships for *short-term opportunities*

Depth of data

Machine learning is very data hungry



Enables more accurate models

Breadth of data

Diverse datasets are critical for most AI applications



Enables more complex-use cases

Access to end users

Institutions collect more data by being closer to users



Enables virtuous data cycles

However, these partnerships exhibit *long-term risks*, with the potential to create winners and losers



Winner-takes-all experience

Customer experience is winner-takes-all, especially in platform and self-driving ecosystems



Imbalance of market power

Owners of customer experiences have strong market power and can pit providers against each other



Security and privacy risks

Increased data connectivity poses security and privacy risks that could break apart critical partnerships



Data imbalances

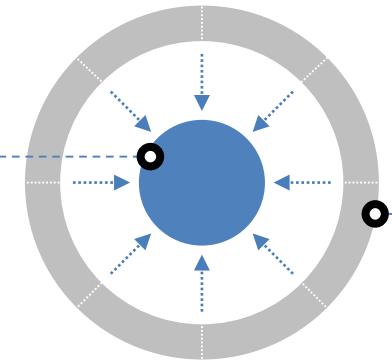
The gap in data between large techs and incumbents will continue to grow, diminishing the power of asset scale



Partnership lock-in

Institutions that become reliant on data flows from partnerships may become locked in unfavourable relationships

Alliance “winners” will be those who can successfully turn themselves into ecosystem hubs



Alliance “losers” will be those relegated to the periphery of the ecosystem, becoming interchangeable with other data and capital sources

Partnerships are proliferating across the financial services ecosystem, but only time will tell if these relationships drive sustained value

We observe that data partnerships are currently in the early stages of being formed, but are not yet at the stage where tensions have major impacts

Growth in partnerships between financial institutions and technology companies



The recent partnership between **JPMorgan Chase, Amazon and Berkshire Hathaway** to build a health insurance alliance for their own employees demonstrates the power that can be unleashed through collaboration.²⁰ The alliance will use big data and technology to align incentives, increase customer engagement and improve targeted health plans (e.g. specialized medicine, smoking cessation and obesity programmes). However, many news outlets have speculated that Amazon is a challenger to incumbent institutions and could potentially be a significant disruptive force in financial services.

New entrants are expanding more quickly as a result of open banking



As the UK Open Banking Standard and PSD2 go into effect, a number of new niche providers have emerged. Challenger banks such as **N26** and third-party providers – for instance, **Squirrel** and **Klarna** – are rapidly expanding across Europe. These players are able to extract, from incumbents, the data necessary to power their operations without giving incumbent institutions reciprocal access – essentially eroding incumbents' data=exclusivity advantage.

Technology companies are building products to access and generate financial data



Apple Pay, Google Pay and Uber's credit card are all examples of nominally profitable but data-generating entries into financial services by technology companies. However, such affinity agreements are misaligned to shifts in the industry: data is an increasingly important input to differentiation, while the ability to generate meaningful profits from transaction revenue is declining. As a result, competitive tensions between technology companies and financial institutions are likely to grow.

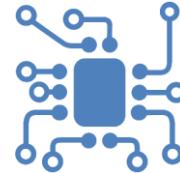
Emerging Chinese financial ecosystems centre on data-sharing platforms



New financial services ecosystems are emerging in Asian countries, building apps on top of existing technology platforms such as **WeChat** (e.g. **Taikang Life**). WeChat acts as the interoperability layer, connecting customer data with financial institutions, as well as institutions to each other. As they grow in size, these platforms become critical elements at the centre of these ecosystems, while the financial services providers are interchangeable based on customer preferences.

Incumbents are placed in a double bind: they cannot resist entering data partnerships but these partnerships may threaten their competitive positioning

Implications



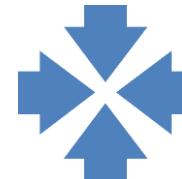
Partnership development is becoming a critical competitive competency

Effectively developing the right data partnerships while mitigating potential tensions in those relationships will allow firms to sustainably develop unique and differentiated products, insights and experiences



Large technology companies will become critical sources of data and customer experience

Due to their data advantage, large technology firms will be critical components of the financial value proposition. In the short term, incumbents will feel pressure to partner with these firms to access customers and data



Emerging tensions could threaten alliance longevity

By positioning themselves as the critical link across the ecosystem, firms can turn other participants into commoditized service providers. Tensions arising from this may limit the longevity of emerging alliances



Unilateral restrictions on data-sharing make forming partnerships difficult

Firms that move to prevent data-sharing by their customers will struggle to form the data partnerships necessary to develop AI capabilities, which risks leaving them uncompetitive

Uncertainties

How will new data regulations affect large tech companies, and will they be held to similar data-sharing standards as financial institutions?

Who will retain control of the customer experience in partnerships between technology companies and financial services firms?

How will smaller and regional banks negotiate effectively with large technology companies, particularly if those technology companies already have major financial services partners?

How will regulator-mandated data-sharing (e.g. open banking) affect the relative negotiating power of institutions in forming partnerships?

Data regulations will have transformative impacts on the shape and structure of financial markets, particularly where they require increased data portability

Recent critical data regulations

The ability to use cloud-based services

The ability to use public and private cloud infrastructure, and to use the kinds of data that can be hosted on the cloud, is critical to the development of AI applications

Impact on competitive dynamics

- Regulations on cloud usage by financial institutions vary globally, with stricter restrictions in Europe
- Technology players in regions with more relaxed rules have an advantage in developing new capabilities

Data privacy and security

Privacy and data-protection regulations (e.g. GDPR) are placing new limitations and requirements on the collection, transmission and storage of personal data

Impact on competitive dynamics

- Data partnerships become increasingly difficult to manage as parties are held to stricter requirements
- Consumers gain increasing control over their data, including control over who can access that data and "the right to be forgotten"

Data portability and open banking

Regulations in Europe (e.g. PSD2, UK Open Banking) require that incumbent institutions share customers' financial data with third parties (at the request of the customer)

Impact on competitive dynamics

- Large technology firms can access financial data and use it alongside a wealth of other personal data, giving them a head start in developing new AI applications for customers' finances
- Financial institutions do not have the reciprocal ability to access non-financial data from third parties (e.g. technology companies)

Influence of data regulations on market structures

A

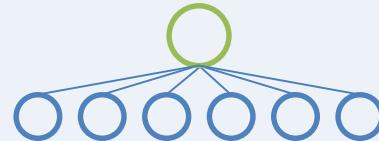
Walled gardens



If large financial institutions maintain control over data-sharing (e.g. over the terms of how they share customer data), they may prefer to strike bilateral partnerships with tech companies to access third-party data and AI capabilities. This would allow incumbents to sustain their market position while taking advantage of differentiated AI capabilities

B

Platform-led



If personal financial data became hyper-portable, third parties would be able to access incumbent-held customer data and build platforms, and customer data would cease to be a source of competitive differentiation. In this case, incumbents would likely compete on platform-based ecosystems, providing commoditized products and competing against many manufacturers

Global data regulations are undergoing a period of unprecedented change as governments move to adopt new rules to protect and empower citizens

New data regulations cover a range of issues from privacy to data protection and portability

GDPR and PSD2 are dramatically reshaping the European data economy



The revised Payment Services Directive (PSD2) of the European Union came into force in January 2018, with the aim of enabling more innovative payments across Europe. In conjunction with the General Data Protection Regulation (GDPR), this means institutions have to carefully balance requirements to share data with third parties against the risk of substantial penalties in cases where data is mishandled.²¹

The UK open banking standard has the potential for major shifts in domestic financial services



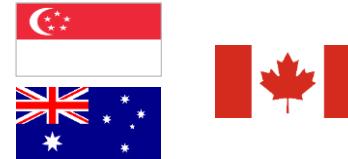
The UK has been one of the first jurisdictions to adopt open banking as a mandate across financial services. This push started in 2016, with a report by the Competition and Markets Authority that found “older and larger banks do not have to compete hard enough for customers’ business, and smaller and newer banks find it difficult to grow”.²²

Emerging Chinese ecosystems centre on data platforms



While China does not have an open banking framework, the existing regulatory regime has been very conducive to fintechs and third-party providers. Proliferation of APIs (both public and private) between technology companies and incumbent institutions (e.g. WeChat and Alipay) have allowed these platforms to become interoperability layers to facilitate the flow of data across institutions.²³

Globally, other countries are considering new regulations



Across different parts of the world, governments are considering radical changes to their data-openness regimes. Australia, Singapore, Canada and Iran, among others, are actively considering some form of the open banking regulatory model, often mirroring the steps taken by the EU and the UK.^{24,25} These data regulations often extend beyond financial services and affect many different industries collectively. For example, the G20’s Anti-Corruption Working Group has identified cross-sector open data as a priority to advance public-sector transparency and integrity.²⁶

US regulators are largely silent on data regulations



In the United States, data-sharing alliances are more ad hoc than mandated, with individual banks building bilateral relationships with data aggregators. Regulators have not signalled an intention to implement frameworks similar to the UK and the EU.²⁷ However, the US Congress has been listening to testimony from large technology companies such as Facebook, Google and Twitter on the topic of privacy and data security, which could lead to the emergence of new rules.²⁸

The evolution of data regulations will be the critical driver in determining the roles and relative positioning of different players in financial services

Implications



Incumbents must play an active role in shaping data regulation if they are to remain competitive

Wide-reaching, cross-sector data regulations affecting entire economies will determine whether incumbents can access the necessary external data to continue to own the customer experience



Data regulations formulated in the coming years will have long-lasting effects on financial markets

In many jurisdictions, data regulations are still being developed. In the coming years, these regulations will solidify and financial markets will be shaped by those regulations for the foreseeable future



Fintechs can thrive by using AI to develop unique offerings and by using open banking to access data

Increased requirements for data portability will erode incumbents' data advantage, allowing fintechs to compete more effectively for scale of data



Digital identity systems will be critical to managing personal data flows

As consumers gain increased control over how their data is used, they will need a consolidated point of control to easily manage consent and authorization; this is likely to be a digital ID system

Uncertainties

What form will new open banking and data privacy rules take in Canada, Australia and other countries, and how will financial institutions be affected?

What norms will develop regarding international data flows, and how will divergent domestic rules affect cross-border data flows?

How will recent consumer concerns regarding improper data usage and sharing by large tech firms in Western countries be resolved?

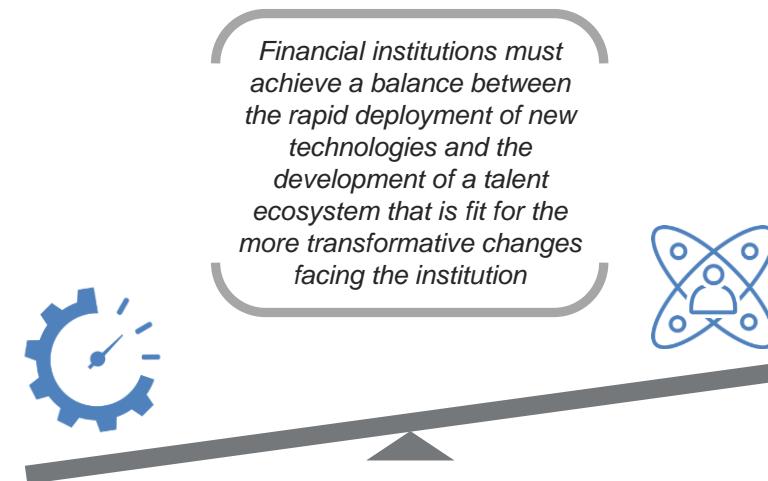
Will it be possible to effectively translocate AI models developed in more permissive data regimes to less permissive ones, and what impact with this have on competitive dynamics?

The near-term priorities of financial institutions are mismatched with the talent required to deliver on a longer-term vision for business transformation

Transforming talent is critical to unlocking the most impactful applications of AI, making investments in talent strategy critical to long-term competitiveness

An outsized near-term focus on optimizing current environments

- Using AI to optimize current activities (e.g. contact centres and compliance functions) offers institutions immediate benefits from small-scale investments and does not require a clear vision of the future of the institution
- However, these optimization projects drive value primarily through headcount reduction – reducing jobs faster than new opportunities are created
- If talent erodes without a clear vision of the institution's future it risks creating unnecessary stumbling blocks for financial institutions as they strive to transform



An insufficient long-term focus on accelerating business transformation

- Net new opportunities for talent will be created by shifts to new business models and competitive dynamics
- Success in tomorrow's business environment will be predicated on talent strategies and capabilities that are distinctly different from those that exist today (e.g. roles, culture, rewards)
- Financial institutions that fail to evolve talent strategies alongside business transformation risk creating hard-to-fill gaps in their talent profiles, due to an inability to attract, train and retain people with the skills and capabilities that are complementary to machines

An imbalanced focus on talent and technology is creating significant roadblocks to the transformational agendas of firms:

Leadership is not aligned to the potential and pace of innovation

- Uncertainty about the future of financial services is confounding views on what talent will be required, and how different capabilities can be secured
- Financial executives know they need to change, but are not aligned on the areas, impacts or timing of when that change will take place

Organization structures remain rooted in traditional ways of working

- Incumbent environments of financial institutions remain hierarchical, with expansive spans and layers
- Attempts at structural change have weeded out duplication, but have yet to reshape the operations of financial institutions
- A vision for structural change needs to lead the articulation of new ways of working, and subsequent roles that are required

Incentives continue to reward a focus on near-term results

- Methods of reward and recognition are competing forces that are working against longer-term work efforts
- Traditional structures of employment, including work arrangements, compensation structures and retention strategies, are hindering financial institutions' ability to change their businesses by diverting forces to near-term performance metrics

Financial institutions need help to conceptualize the union of talent and technology as they aspire to move forward and achieve AI-driven growth

Evidence from economic theory

Economic historian **Robert C. Allen** observes that the current wave of transformation – often dubbed the Fourth Industrial Revolution – bears a strong resemblance to the Industrial Revolution of the 19th century. In particular, the reaction of talent to increased use of AI is reminiscent of “Engel’s Pause”, a phenomenon where a new technology results in a worsening of circumstance followed by increased prosperity.²⁹ This is highlighted in a number of examples and reinforces the need for institutions to re-evaluate their understanding of, and strategies for, both talent and technology transformations:

- **In the immediate term, there is risk that unemployment rates rise:** As AI digitizes and automates routine roles, there will be a net displacement of talent unable to rejoin the workforce with their existing skills; the initial rise in unemployment will create the perception that AI is worsening society rather than improving it
- **In the near term, a shift in talent will drive growth:** For society to overcome these harms and embrace AI, the technology must be developed to a level where it is pervasive. Although this may be technologically feasible, there will need to be a shift in priorities to encourage innovation and longer-term thinking, within and outside formal institutions
- **Over the longer term, relationships between society and business will be redesigned:** The benefits of AI will be maximized only if societal structures and processes adapt to support new ways of working. By aligning with and enabling AI innovations, while working to address challenges, institutions and social structures will likely see prosperity that justifies AI-driven growth²⁹

We observe that the current situation in financial services highlights historic under-investment in a longer-term vision for talent and technology

Product improvements have been the core focus of financial institutions



In an effort to optimize processes, many institutions have started in the back office, where there are often thousands of people processing customer requests or tackling reporting needs. At one European bank, where 70% of applications were paper-based, the time spent by staff on processing forms was reduced by 70% through digitization and automation.³⁰

Institutions such as Mizuho Financial Group are developing AI tools to increase efficiency across both the front and back office, which they say could replace 19,000 staff (around a third of their staff) and close 30 branches.³¹ Contact centres are an area of focus. These are becoming disrupted by new services such as Amazon Connect, which provides cloud-based, AI-driven solutions that replace the contact centre and the sizeable real estate, FTE and management associated with it.³²

As an industry, financial services is playing “catch-up” to create a talent pool and culture that are ready for change



There is wide-ranging agreement that, due to under-investment and lack of foresight on technological change, financial institutions face a serious mismatch between the skills and capabilities of their current workforce and those that will be required to remain competitive in coming years. Though incumbents have begun prioritizing efforts to reskill, these efforts appear broad in their approach, though foundational steps are underway (e.g. Scotiabank, BNP Paribas, BlackRock).^{33, 34, 35}

Beyond reskilling, financial institutions must further reshape the internal culture of their organizations to attract and retain people with sought-after skills and capabilities. This means moving away from the command-and-control cultures that trap individuals in narrow roles, with little autonomy, and towards employee-centred environments that embrace the future of work.

AI is giving rise to a new discipline with regard to how financial institutions plan for their future talent and technology needs

Implications



Institutions face a prolonged skills deficit

Efforts to reskill are lacking a clear view on the roles and responsibilities that institutions need today, and how demand for skills will change over the longer term. The lack of vision and coordinated strategy puts institutions at risk of a prolonged skills deficit



Investment in talent is a critical enabler of AI

Talent strategies need to be developed within the context of a defined strategy and target operating model, allowing the evolution of talent to be viewed as a strategic enabler – from enacting change and dependency to earning a return on other investments



Resistance to change will lead to a number of false starts

The most significant roadblock to change will be created by people due to insufficient “runway” (time, effort and investment) being prioritized at the onset of transformations to establish understanding, buy-in and continued motivation for commitment



People management will become a competitive advantage

Financial institutions that are able to proactively create new talent experiences through the execution of evolved policies, processes and structures will lead in their ability to effectively execute, and accelerate, business transformations

Uncertainties

What are the specific talent profiles that financial services will need to evolve and perform within new business models?

How can institutions balance the domain expertise they need today with the quintessentially human capabilities they will need over the longer term?

How can financial institutions accelerate transformations when training, learning and adapting takes place at human speed?

What should the role of government be during this period of uncertainty and as new talent economies unfold?

Mitigating the social and economic risks of AI in financial services will require multistakeholder collaboration

Global communities have a joint interest in mitigating the risks and harms of rapid technological development



Safety of the financial system

AI creates new opportunities to more efficiently and effectively combat bad actors through collective action...



Global and regional economic growth

AI enables the dramatic simplification of processes, improving the speed, quality and cost of commerce...



Consumer protection and the public interest

AI expands the reach of effective decision-making through the democratization of financial advice...



Employment and human capital

AI provides new opportunities to augment performance by improving the productivity of workers within redesigned roles...



Experience of other industries

AI makes data-driven connections across industries and borders to deliver value in differentiated ways...

but....

opens up the industry to broader risks of contagion as AI demands an increasing interconnectedness across domestic and cross-border systems

but...

has the potential to polarize global communities as competition around AI development becomes a point of regional conflict

but...

might continue to subject segments of the population to unfair and inequitable exclusions from certain products or services

but...

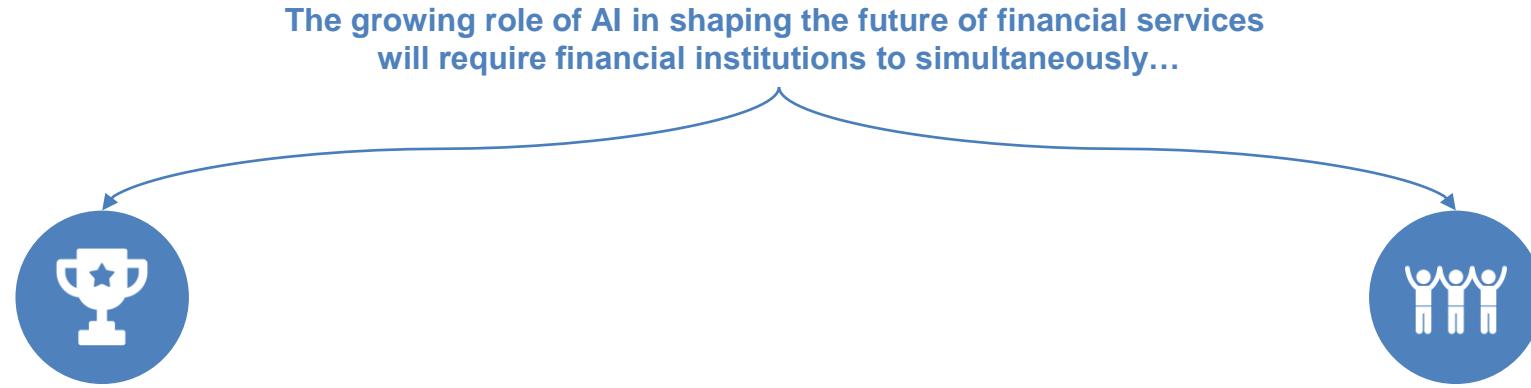
will reduce the need for labour across routine tasks, leaving some workers "lost", without the required skills and capabilities for new roles

but...

is susceptible to creating excessive concentrations of market power and driving income inequality

While the potential benefits of AI will be striking, its potential risks to societal and economic well-being are too great to be left unaddressed

Responding to the new physics of financial services will require institutions to maintain a challenging balance between competition and collaboration



Be first and best in the deployment of AI

Because those institutions that are able to establish an early lead in using AI as a competitive differentiator will be rewarded by virtuous feedback cycles that compound their advantages and leave second movers struggling to catch up



Collaborate with many stakeholders

Because unlocking the full potential of AI requires an extensive network of partnerships and only collective efforts by financial institutions, alongside regulators and the broader public sector, can ensure that the expanded use of AI in finance benefits society as a whole

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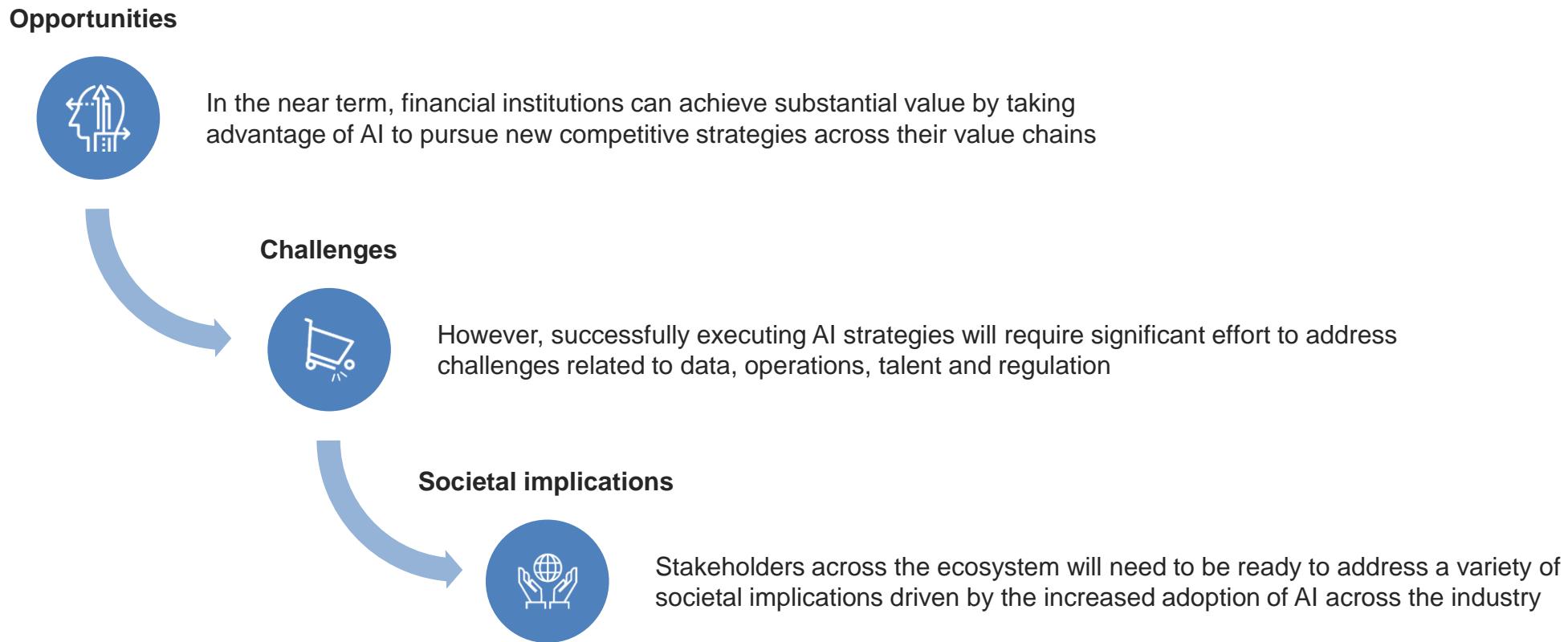
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What are the opportunities and challenges for implementing AI in financial services today?

Opportunities, challenges and broader societal implications

AI presents significant opportunities for financial institutions, but only if internal challenges can be overcome and societal implications effectively managed

— Path to AI implementation



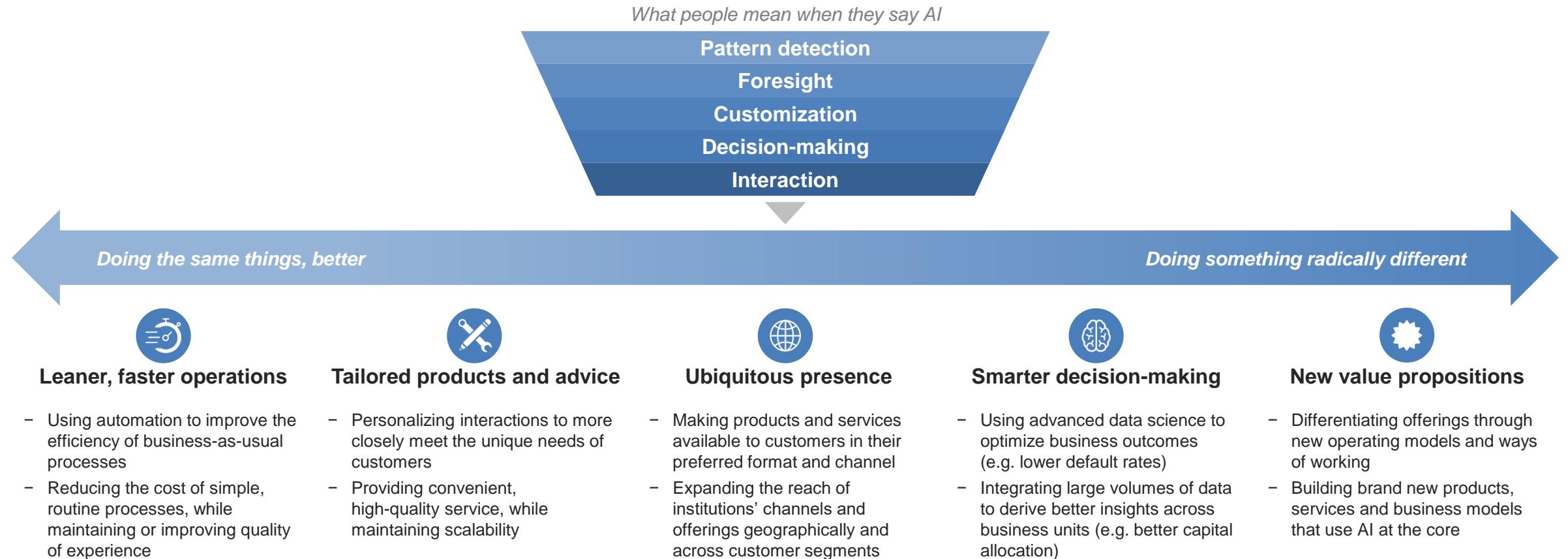
The following three sections will explore each of these topics in detail

AI opportunities across financial services

AI presents institutions with the opportunity to change their businesses in a multitude of ways ranging from incremental improvement to complete reinvention

— Overview of AI-driven cross-sector strategies

AI investments by financial institutions are being made across a broad spectrum, from relatively conservative efforts to improve existing processes to bold bets on new capabilities and business models



AI allows an ever-expanding set of processes to be streamlined, improving efficiency, decreasing costs and freeing up capacity

— Why it matters

Historically damped returns

Sustained periods of low interest rates, combined with pressure from new entrants (e.g. aggregators), have damped returns, increasing the need for cost cutting to drive bottom-line growth

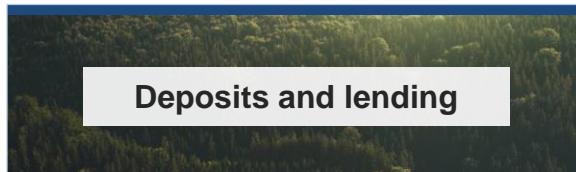
Increased regulatory burden

Expanded regulatory requirements have increased operating costs, and will likely continue to do so as new regulations come into effect (e.g. GDPR)

Suboptimal customer experiences

Due to the presence of labour-intensive processes that are disconnected across the value chain, customers are provided with a suboptimal experience (e.g. slow payments)

— Examples of leaner, faster operations



Deposits and lending

› Provide “just-in-time” lending

AI allows for analysis and decisions (e.g. credit adjudication) to be made instantaneously, allowing credit to be offered in real time

Example



Automated personal and business loans

Detail on Slide 91



Insurance

› Improve underwriting, pricing efficiency and accuracy

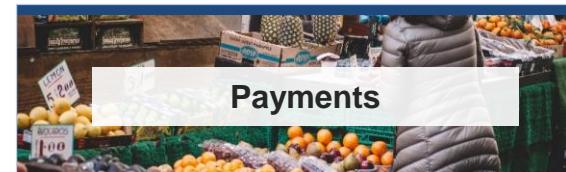
AI can increase the efficiency of underwriting by reducing error rates, incorporating new datasets and automating risk modelling

Example



AI-powered risk modelling

Detail on Slide 98



Payments

› Automate compliance and reporting

AI allows for the truncation of routine tasks, reducing the friction across systems and increasing the speed of payments processing and compliance reporting

Example



Intelligent data cataloguing for compliance

Detail on Slide 109



Investment management

› Offer seamless account setup and customer acquisition

AI can contextualize data from multiple institutions to automate portfolio construction, speeding up key components of customer onboarding

Example



ID verification through image recognition

Detail on Slide 120



Streamlined operations alone will not be sufficient for most institutions, requiring these techniques to be combined with other AI applications

— Key beneficiaries of *leaner, faster operations* include



Institutions offering low-margin, highly commoditized products

In the short and medium term, providers of commoditized products (e.g. car insurance) can use AI to develop competitive advantages in a market characterized by thin margins and cost-based competition



Institutions with a high volume of accounts and low per-account value

AI can reduce the cost of customer onboarding as well as customer service, allowing institutions with a large volume of customers (e.g. retail banks) to improve service quality and expand reach, while controlling costs



Institutions facing high compliance requirements

Institutions with sizeable middle- and back-office operations in relation to their overall size (e.g. payment providers, trading desks) stand to benefit greatly from leaner operations, allowing them to refocus operational expenses on core competitive strengths

— Implications

Short-term cost cutting may spark a “race to the bottom” on price. While institutions can improve their operating efficiency and profit margins in the short term, competitors can easily replicate improvements, making the long-term sustainability of this strategy uncertain

Customers will experience faster and elevated levels of service as AI will increase the digitization of processes, creating more intuitive and self-service processes, alongside human interaction when and where needed

The role of human labour will need to change as AI takes on a greater share of work, requiring enterprise-wide change management to transform talent models alongside technology, as well as a societal response to workforce disruption



AI resolves the traditional trade-off between cost and customization, allowing institutions to offer tailored products at near-zero marginal cost

— Why it matters —

Influence of adjacent industries

Players in other industries (e.g. large tech) are able to offer highly personalized experiences, leading customers to expect similar levels of tailored service from their financial institutions

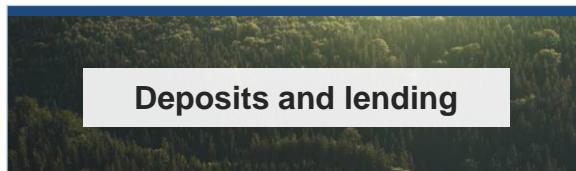
Increased commoditization

Advice and personalization will become key differentiators as platforms and competitive forces drive products to become increasingly homogenized

Heightened conduct risk

Since the financial crisis, trust in traditional institutions has been low, increasing the need to offer high-quality, and impartial, advice to grow and maintain customers' confidence

— Examples of tailored products and advice —



Deposits and lending

› Provide detailed advice directly to customers in real time

AI can analyse data across disparate sources, unlocking insights for real-time delivery to customers, creating a high-quality, self-serve experience

Example



AI financial advice for retail customers

Detail on Slide 90



Insurance

› Increase the capabilities of sales agents and advisers

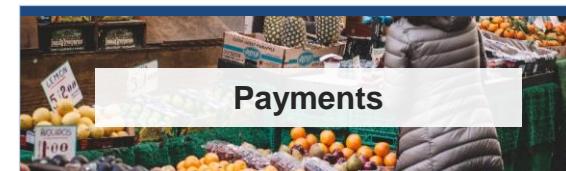
AI can be used to support complex decision-making (e.g. quotes for commercial clients), supplementing sales teams' capabilities

Example



Chatbot-support for sales agents

Detail on Slide 100



Payments

› Drive loyalty by offering bespoke incentives and rewards

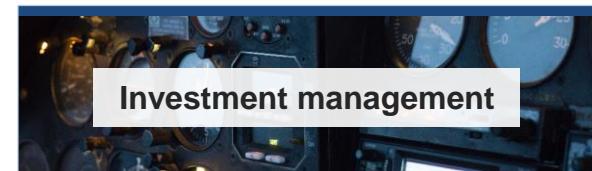
AI can be used to tailor rewards programmes to individual customer behaviour, helping to maximize customer engagement

Example



Automated rewards programme manager

Detail on Slide 111



Investment management

› Equip advisers with highly personalized insights

AI can automate the generation of very detailed, specific insights (e.g. personal wealth report generation) to support advisers' interactions with their clients

Example



Simple, ad hoc analysis for advisers

Detail on Slide 117



Institutions with large and varied customer bases will likely be the primary beneficiaries of an increased capacity to tailor products at scale

— Key beneficiaries of *tailored products and advice* include



Institutions with large and diverse product shelves

AI is effective in breaking down barriers between sets of data, creating an opportunity for institutions with a broad suite of offerings (e.g. insurers, full service banks) to unlock insights across products and business units, improving the quality of advice and creating opportunities to deepen relationships



Institutions that serve a large volume of customers

High-net-worth individuals have historically had access to highly personalized products and services. AI allows for similar customization to be offered at a significantly lower cost, making such products and advice available to mass market customers (e.g. retail banking clients)



Institutions offering complex financial products and services

Complex financial offerings (e.g. mortgages) generally require a higher degree of human involvement; AI has the potential to reduce the burden on human capital, allowing talent to focus on higher-value activities (e.g. building personal relationships with clients) to improve the quality of service

— Implications

Customers will be offered more relevant advice and products, helping individuals achieve their financial objectives and improve their financial well-being as a private banking-like experience is extended to mass-market consumers

Advisory will be a critical competency in securing customer loyalty, allowing institutions to set up virtuous cycles of data that deepen relationships with their customers by offering continuously improving advice

Third-party data will become a critical resource, and the ability to set up and manage data partnerships with financial and non-financial stakeholders will be a core area of expertise for institutions seeking to power their tailored advisory and product offerings



AI can help institutions expand their reach by enabling better self-serve applications that allow more services to be delivered digitally

— Why it matters —

Disconnect from underlying experience

Financial services are often a means to an end; a ubiquitous presence allows institutions to tie directly with customers' ongoing experiences without distracting from their end goals

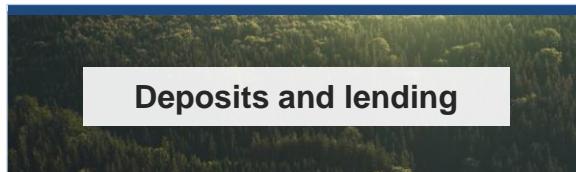
Shifting channel preferences

As customers' expectations change over time, institutions need to ensure they are able to engage customers through their preferred modes of interaction (e.g. digital direct channels)

Traction in new markets

There is significant value that can be unlocked by engaging new segments of customers within untapped markets, across demographics and countries, through digital channels

— Examples of ubiquitous presence —



Deposits and lending

› Offer always-on personalized experiences across channels

AI can be used to power always-on virtual agents that interact with customers autonomously, providing support for basic questions and simple tasks

Example



Conversational AI agents

Detail on Slide 90



Insurance

› Develop modern, mobile-first insurance offerings

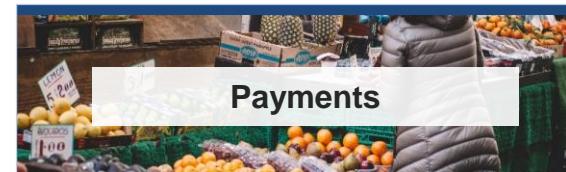
AI can use a variety of data sources (e.g. images, location data, sensor data) to enable real-time provisioning of insurance policies and instant claims handling

Example

Cover

Insurance app using image recognition

Detail on Slide 100



Payments

› Compete to become a provider of invisible payments infrastructure

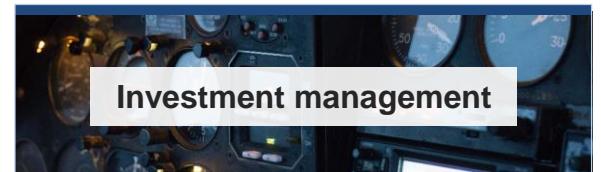
Institutions can expand their suite of offerings and capture new market share by using AI to offer a seamless experience that automates the purchasing process

Example

amazon go

Cashier-less brick-and-mortar store

Detail on Slide 111



Investment management

› Use existing but unused platforms for distribution

By integrating experiences into existing digital activities (e.g. third-party interfaces), institutions can improve their reach and level of service to customers

Example

B余额宝
金 增 镜 的 支 付 宝

Wealth platform integrated into Alipay

Detail on Slide 120

AI allows institutions to support customers when and where they make decisions, but may also increase competition for customer engagement

— Key beneficiaries of *ubiquitous presence* include



Institutions offering highly self-serve products and services

In product categories where customer engagement is self-directed (e.g. digital banks), ensuring that customers are able to manage their finances through their preferred channel will be critical to maximizing customer satisfaction and retention



Institutions whose products are used to execute transactions

Physical cards (e.g. credit, debit) are a means to an end (i.e. acquiring a good or service); integrating directly into third-party channels (e.g. retailers) will allow new opportunities to become the card of choice, maximizing the share of customers' spend



Institutions where volume is a key driver of profitability

Companies seeking to establish economies of scale (e.g. ETF, life insurance and mortgage providers) can use AI to expand the reach of their distribution models, enabling them to access customer and assets traditionally beyond their reach

— Implications

Customers become more difficult to retain as financial interactions increasingly occur in third-party interfaces, diminishing the brand presence of financial institutions

Managing relationships with third parties will be critical to ensure that financial product manufacturers continue to have direct access to end users of products

Customers will have more seamless experiences with their finances, with decisions often being entirely integrated into third-party experiences (e.g. e-commerce)

Regulators will need to adapt to increasing channel complexity and blurring of industry lines to continue to effectively govern institutions and maintain the safety and stability of the financial system

AI can give institutions enhanced decision-making capabilities, unlocking novel insights that drive improved performance

— Why it matters —

The declining cost of comparison

An ability to provide differentiated products and performance is increasingly important as customers and investors defer a broader set of decisions to algorithms

Saturation of traditional investment strategies

It is becoming increasingly difficult to outperform the market and identify high-potential investment opportunities through common investment strategies

Need for more accurate risk management

The mounting cost of compliance and risk-management activities creates the need to develop increasingly customized risk profiles and allow earlier and more accurate risk estimation

— Examples of smarter decision-making:

Deposits and lending

- Predict defaults with greater accuracy

Inaccurate adjudication leads to higher losses on defaults and missed revenue from creditworthy individuals who were erroneously denied loans

Example



AI-powered credit modelling

Detail on Slide 91

Investment management

- Find new and unique correlations between datasets

Identify unexplored patterns to outperform markets where traditional active-investing strategies are less attractive for investors

Example



Macroeconomic trends identification through machine learning

Detail on Slide 121

Capital markets

- Improve deal identification, pairing and sales activities

Use large volumes of data to map, track and analyse companies to create market themes and identify buy/sell opportunities

Example



Machine intelligence for M&A analysis

Detail on Slide 128

Market infrastructure

- Improve trade speed and price using dynamic execution methods

Mitigate the impact of price movements and execute at the best price by using AI to optimize trade-execution strategies

Example



AI prediction of trade price impact and cost

Detail on Slide 138



Smarter decision-making can deliver new value through improved returns and more resilient product performance

— Key beneficiaries of *smarter decision-making* include



Institutions facing high risk of human error

AI and automation can help reduce human error (e.g. in problem detection, diagnosis, planning, execution) in sectors where the actions of a few individuals have an outsized impact (e.g. investment managers, market participants, trading venues), helping prevent losses



Institutions with commoditized offerings

For institutions that have increasingly commoditized products (e.g. lenders, insurers), AI can be used to drive better decision-making and ultimately create competitive advantages (e.g. lower price, higher returns)



Institutions that compete on performance

By using AI to make more abstract connections and test complex models, institutions (e.g. investment managers) can identify and execute new outperformance opportunities and distribute improved returns to customers

— Implications

Both retail and commercial customers will benefit as better, AI-driven, decisions improve financial outcomes

Institutions will be able to more effectively mitigate risks as decision-making algorithms improve the accuracy of their adjudication and underwriting activities

Talent strategies will become a source of competitive advantage as financial institutions fight to attract and retain highly sought-after AI talent



AI allows institutions to redefine their core offerings, unlocking untapped segments and revenue opportunities through new products and services

— Why it matters —

Value from new sources of differentiation

Institutions that can distinguish their product offerings beyond simple price competition will better position themselves for a future dominated by platforms and algorithms

Entrance of new competitors

The risk of entry by non-traditional competitors such as large technology firms is pushing institutions to bring new and innovative offerings to market to stay competitive

New boundaries of innovation

AI-based solutions break traditional business constraints on scalability and efficiency, allowing institutions to develop brand new offerings that were not previously possible

— Examples of new value propositions —



Insurance

➤ Use proxy data to insure new risk categories

Introduce insurance for new risk categories (e.g. cybersecurity, product-specific insurance) by moving past the exclusive use of historical data to price policies

Example

CYENCE

Quantify cyber-risk using AI

Detail on Slide 101



Investment management

➤ Develop unique strategies and new investment products

Expand product shelves to address new investment strategies or unique risk factors that were previously under-served

Example

Fidelity Investments **iShares**
by BLACKROCK[®]

Next-generation smart-beta ETFs

Detail on Slide 119



Capital markets

➤ Develop real-time pre- and post-trade risk-management solutions

Present profitability calculations for overall portfolio positions by factoring in the cost of risk capital and the impact of different trade scenarios

Example

DTCC

Securing Today. Shaping Tomorrow.[™]

Pre-trade impact analysis using AI

Detail on Slide 129



Market infrastructure

➤ Deploy new order types to protect investors from risks proactively

Offer products that anticipate and avoid adverse impacts from predatory strategies, price quote instability and illegal activities

Example

iex

New order types based on AI

Detail on Slide 138



By leveraging AI to drive business model innovation, institutions can better contend with non-traditional competitors and commoditized markets

— Key beneficiaries of *new value propositions* include



Institutions that lack proprietary ownership of customer data

As open banking increases the portability of financial data and the ability of new entrants to compete in financial services (e.g. fintechs and large techs), incumbent firms (e.g. online payment providers) must look to develop new value propositions to combat their eroding data advantage



Firms serving institutional clients

Firms underpinning capital markets, serving institutional clients and offering complex services (e.g. investment managers) often operate in areas with imperfect products and unmet customer needs. AI can accelerate product innovation, allowing these institutions to make major, transformational shifts in how these services are offered



Institutions offering simple, commoditized products

AI creates an opportunity for providers of commoditized products (e.g. retail banks, P&C insurance) to build offerings that deliver new value to customers, allowing institutions to break out of commoditized markets and offer differentiated products and services at a premium

— Implications

Underserved customers will have an improved experience as more traditional – and non-traditional – products and services become available

Incumbents may have to shift strategies to capture opportunities in AI as competitors introduce new products and services that may be complementary to or substitutes for existing offerings

Regulators will need to monitor innovation closely to ensure institutions remain compliant throughout the race to deliver more value through new services

Cross-sector challenges

While the potential benefits of AI to financial institutions are immense, execution challenges and the timeline to realizing value are often underestimated

In order to unlock the full value of AI, financial institutions will need to make significant changes to ready their organizations for the deployment of these new technologies

Our research has identified the following as the most significant challenges to the implementation of AI in financial institutions

Data		Institutions struggle to make available the large quantities of high-quality data required to successfully train AI across their owned and unowned datasets
Operations		Many valuable applications of AI require complex, deep and broad-reaching integration into the business, not just simple “bolt-on” implementations
Talent		AI fundamentally redefines the role of talent in financial institutions, and often requires human capital to change at a pace that exceeds any past transformation
Regulation		Current regulatory frameworks were built based on an increasingly outdated model of the financial ecosystem, creating significant uncertainties for institutions seeking to employ cutting-edge implementations of AI

The following slides will explore each area of investment, and highlight examples of key challenges across industries and examine their implications



Incumbent institutions possess extensive stocks of data, but often struggle to deploy it effectively in AI applications

Data is the single most important ingredient of AI; the predictive capabilities of AI models are defined by the breadth, depth and quality of input data, as the machine-learning methods (e.g. algorithms) themselves are relatively easy to access

— Notable data challenges



Persistent data-quality issues

"We must first deal with the extent of irregularities created by human error"

Incumbent institutions already own large sets of financial data, but much of it is not consistently formatted across the organization and may contain errors; this makes the data difficult for AI applications and increases the cost of implementing new AI capabilities across enterprise-use cases



Fragmented internal data storage

"Data is everywhere, but nowhere at the same time"

Incumbents' financial data is stored across a patchwork of disparate systems (e.g. the proliferation of product-specific systems) that ingest and display data in different ways, requiring significant and costly data-engineering work to create large, common data lakes that can serve as inputs to AI



Insufficient breadth and depth of data

"The value of AI will be seen when traditional and non-traditional financial services data are combined"

More mature AI applications depend on insights that span across datasets, necessitating a broader diversity of data than financial institutions have access to. To navigate this complexity, new data partnerships need to be established across traditional and non-traditional stakeholders



Inadequate partnerships and APIs

"The future of financial services requires seamless access to data from across the financial ecosystem"

AI is driving the need to build real-time data flows across institutions to access essential data, yet the lack of commonly agreed standards for data-sharing is a roadblock to implementation until new partnerships and integrations are formed



Lack of data digitalization

"It is about time that paper-based and batch processes were eliminated"

Many institutions remain reliant on analogue data-intake formats (e.g. paper) that require effort to be made machine-readable. Digitization of these inputs will improve data governance and increase speed, accuracy and consistency of processes



Incomplete understanding of customers

"We need a holistic view of customers' data if we are to use AI to optimize advice"

Advisers must be able to access customer information across institutions and accounts to build a complete understanding of customer needs. Currently, this data sits in various incompatible systems and formats, which prevents data analysis driven by AI from reaching its full potential



Financial institutions must make better use of customer data if they are to continue to own the customer experience

– Stakeholder-specific implications



Fintechs, and other new entrants (e.g., independent data providers), can carve out defensible positions by finding excludable datasets

- The increase in data flows that accompanies the adoption of AI will make many datasets increasingly commoditized and readily available. Fintechs can take advantage of their niche technological expertise to develop innovative and differentiated datasets that complement financial data, positioning themselves as critical members of the financial services ecosystem



Regulators will need to cope with the increasing complexity of data management, consider their role in protecting consumers while facilitating innovation

- As data-sharing becomes more interconnected, the monitoring and auditing process for regulators will also become more complicated. The increasing breadth and depth of data flows within and across organizations (e.g. through screen scrapers) increases the risk of improper use and data breaches, potentially leading to an increased need for regulatory oversight in data management and sharing



Large technology firms have diverse data and leading-edge infrastructure. As they continue to search for complementary financial data, they stand poised to seize the initiative in building AI-enabled financial service capabilities

- Large technology companies such as Google, Facebook and Alibaba have positioned their enterprise strategies to acquire and use as much data as possible. Given new regulations that make certain financial data more accessible (e.g. PSD2), these firms could move swiftly to obtain an expanded set of financial data and apply their technology advantage to inform the development of new capabilities



Legacy technology infrastructure and rigid operating models are additional hurdles to deploying AI within incumbent financial institutions

AI capabilities must be tightly integrated with core systems infrastructure in order to drive value, but many incumbent institutions remain reluctant to prioritize core technology enhancements that do not have immediate pay-offs

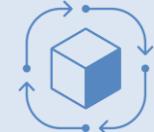
— Notable operations challenges



Legacy systems and technical debt

"Band-aid solutions will no longer be 'good enough' to remain competitive in a world powered by AI"

Legacy systems operated by incumbent institutions have accrued significant technical debt and require enormous overhauls to be ready for AI implementation (e.g. configuring APIs and adapting to real-time data flows)



Extent of process re-engineering

"The way things get done in financial services is built around people. AI-enabled processes will look radically different"

Existing process maps in financial services are based on the movement of information between people. As AI takes hold, new process maps need to take into account new steps and structures that support the interaction between machines and humans



Intermediaries resistant to change

"There need to be incentives for influential parties with strong networks and domain knowledge to form a new ecosystem to accommodate AI"

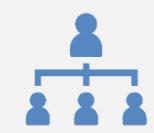
Transformation of processes across value chains requires cooperation from institutional intermediaries, who are themselves put at risk of disintermediation by this very technology. These intermediaries may resist change and attempt to direct how operations might change



Lack of agile, cloud-based architecture

"The full potential of AI can be unlocked only by building support platforms simultaneously and planning for change"

To use AI at its highest potential, institutions need to efficiently store data, access processing power and enable updates with ease – this is best enabled through core infrastructure built on agile, cloud-based microservice structures



Organizational structure redesign

"Institutions will require a clear view of the structure they need to capitalize on the benefits of AI"

AI will render aspects of the organization obsolete, requiring organizational structures to become more adaptable (e.g. leaner and more agile) as well as change the positioning of talent to adapt to new ways of working



AI is narrow and task-specific

"AI must be retrained for each small step it needs to take, making end-to-end transformation labour-intensive"

AI cannot yet be applied generally, and thus models must be customized for each discrete-use case. This increases the need for both technical experts and domain specialists, particularly as many financial services processes are highly complex and obscure



Prioritizing technology and operations investments that will not yield an immediate return is essential to unlocking longer-term value in AI

– Stakeholder-specific implications



Incumbent financial institutions must invest in costly and unglamorous core systems remediation to capitalize on the full benefits of AI

→ Although these upgrades seem daunting, incumbents must consider these investments before the transformational benefits of AI can be realized. Incumbents can consider wholesale replacements of core infrastructure or phoenix models (e.g. establishing a challenger bank), as well as future-proofing new infrastructure by building around microservice architectures



Successful implementation of AI will require purpose-built executions of AI capabilities

→ AI trained to perform in a certain context will not be effective or applicable to other similar environments; successful deployment of AI capabilities will require significant forethought to ensure they can derive meaningful insight. As a result, incumbents are likely to misjudge the effort needed to complete projects



Fintechs and large technology firms have a head start in AI capability development

→ Both small and large technology players can take advantage of their technical advantage to enter the financial services market with a strong value proposition. On the other hand, incumbents may find it more difficult to compete, especially given that they must first invest in upgrades to core infrastructure systems



Simplification of market infrastructure will require a collaborative effort to ensure stakeholder buy-in

→ Changes to current market infrastructure must be made to allow for effective integration of AI capabilities into financial institutions' operations. For example, data flows must be dynamic, uniform and easy to share across institutions. Collaboration between regulators and market participants is required to create a common model to be adopted across institutions so that the necessary developments can be undertaken



There is no playbook for how financial institutions should manage the talent transformation that AI will precipitate in the industry

Creating an AI advantage will require a fundamental shift in how institutions respond to the changing needs of talent. There is significant uncertainty as to how organizations should steward talent through the AI journey, and a significant risk that traditional policies, practices and cultures stand in the way of creating effective new ways of working

— Notable talent challenges include



Inflexible employment relationships

"The traditional constraints of employment no longer serve the aspirations of institutions and workers"

Extensive effort is required to construct a new employment contract: one that favours flexibility over rigidity, rewards productivity with protection, and structures skills and capabilities around solutions rather than functions or tasks



Mismatch of skills and capabilities

"Leaders are currently crippled by the talent they do and do not have"

Not only is there a severe lack of AI talent within the market, this scenario is worsened by internal structures that are inefficient in their ability to recruit, retain or transition the needs for talent across roles (i.e. deep domain expertise and complementary attributes to machines)



Uncertain vision for change

"AI transformation will require a new level of buy-in and commitment to see change through"

AI demands a scale of change across financial institutions that is difficult to define and will be even harder to maintain. Financial institutions do not appear to have a vision of how work will change, nor a clear vision of how to roll-out change across individual functions, teams and roles



Narrow capacity for training

"We know we need to train, but for what purpose, and to what end?"

Due to limited supply of "AI talent", there is an immediate need to invest resources in more proactive forms of enterprise-wide upskilling and awareness. These efforts are helpful in driving change, but inhibited by the shortage of 'trainers', pace of learning and natural limitations of individuals' capabilities



Incompatible corporate cultures

"It can't be seen, but you can feel it. Culture is a factor that builds you up or breaks you down"

Rules-based environments, predicated on narrow scopes of authority and routine work arrangements, have difficulty in transitioning to a future that demands agility to be a core competency. While culture is nebulous, it serves as an essential obstacle to effective transformation



III-equipped people leaders

"What got you here won't get you...anywhere"

Internal fiefdoms need to be broken down and replaced with strategies for engagement, characterized by fluid channels for communication and staunch standards for collaboration. The current capabilities of people managers to lead change are inadequate, and are putting at risk the performance of teams



Financial institutions often lag in recruiting and retaining people with the knowledge, skills and capabilities needed to create an AI-enabled workplace

— Stakeholder-specific implications



Fintechs have the opportunity to become suppliers of “in-demand” capabilities through strategic relationships with incumbents and/or regulators, as these institutions attempt to dramatically “upskill” their workforce for a new world of work

- Traditionally, high-skill technology talent has not been a priority for incumbent institutions, but they must adapt to be able to adopt AI skill sets. Fintechs that lead now have an opportunity to form service partnerships across the financial services ecosystem to help institutions manage the competing priorities of “running the bank” and “changing the bank”, while maximizing benefits and limiting pain



Large technology firms are taking aggressive measures to secure their talent positioning through generous compensation packages and strategies that target non-traditional roles

- With a limited talent pool that is fluent in AI, there is a “war for talent” as institutions across industries try to gain a competitive edge. Firms with the best compensation and culture will attract the best talent. Incumbent financial institutions have been slow to adapt their rigid compensation structures, while large technology firms have moved rapidly to attract top talent into entry-level roles



Regulators face a larger talent gap than private institutions, challenging their ability to take confident positions on the use of AI

- In order to shape future regulations and conduct their macro-prudential duties, regulators must acquire an in-depth knowledge of AI and automation to correctly gauge capabilities and predict areas of risk and impact. Slow movement in upskilling regulatory workforces will create a chilling effect for firms seeking to drive AI applications that are both innovative and compliant



Existing regulatory regimes often struggle to keep pace with emerging technologies, creating roadblocks in the deployment of AI capabilities

Prescriptive regulations are currently limiting the advancement of AI in financial services. Inflexible requirements and regulators' limited resources constrain their ability to keep up with the rapid pace of change, creating significant regulatory uncertainty for institutions seeking to use new technologies

— Notable regulation challenges include



Complexity of regulatory frameworks

"Institutions must consider how to develop AI while staying compliant, which is not the easiest path when implementing new offerings"

Interpreting regulatory requirements for AI-based solutions is complex, as these frameworks were not designed with AI applications in mind; this exposes institutions to making mistakes in the adoption of AI



Lack of standards for identity

"Increased flows of data are crucial to the enablement of AI, but are not without their costs"

Realizing the benefits of AI requires the continuous flow of personal data across institutions. Robust authentication and verification methods that are standardized across institutions are necessary to ensure security and privacy, and minimize the risk of fraud or other undue harms



An undefined liability model

"If AI-powered decisions result in amplified losses, who becomes liable?"

AI introduces ambiguity into responsibility in the event of loss or negative outcomes. Institutions are hesitant to use third-party services for AI systems as regulators will likely hold the primary institutions responsible if there are damages to recover



Fragmented data-sharing regulations

"The success or failure of firms' global ambitions will be determined by the regulatory environment of their local geographies"

The fragmented nature of regulation across nations segments the pace of AI innovation and the structure of financial services by region. Strategic national competition also makes regulatory coordination difficult, creating barriers for adoption and stalling investment



Auditability of new systems

"Algorithm-driven AI solutions are often complex black boxes even to the creator"

While regulators require audits of new processes (e.g. to verify independence), many AI processes are not easy to audit (e.g. traditional interim working steps are often skipped entirely), raising questions around when an audit is or isn't necessary



Tendency to avoid risk

"Uncategorized risks introduced by AI into the ecosystem are intimidating to tackle"

Regulators are continuously challenged to create the optimal balance between enabling innovation and mitigating risks. However, the complexity surrounding AI, combined with regulators' natural tendency to be cautious, suggests that regulatory frameworks are likely to lean in favour of risk mitigation



Unlocking the full potential of AI will require financial institutions and their regulators to co-create new approaches and solutions

— Stakeholder-specific implications



As institutions invest in AI, they will run into data-sharing, privacy and liability concerns; the fear of mis-steps will slow down the implementation of AI capabilities

→ Complex and fragmented regulations pertaining to data-sharing and privacy make it difficult for incumbents to pursue AI projects with confidence. Falling foul of emerging regulations comes at the cost of punitive measures and/or loss of customer trust. Regulators face increasing pressure to quickly understand developing trends and develop stringent policies that protect consumers, yet still leave room for innovation



While the principles underlying consumer financial protection and fairness continue to remain sound, they will need to be reinterpreted for a financial system built with AI at its core

→ The principles on which financial regulation was established remain relevant and apply to emerging AI technologies. However, the interpretation of these principles is not clearly defined, and regulators must adapt “black-letter” regulations to remove redundant requirements while adopting new rules to protect against new risks



Diverging regional data-sharing regulations make international coordination on macro-prudential oversight harder

→ Differences in data standards and regulation are apparent across regions. This challenges institutions that operate globally and necessitates international frameworks to manage common systemic issues that would have an impact across jurisdictions. Risks such as rogue trading, capital adequacy and cybersecurity require cross-border collaboration to reach a resolution

Societal implications

As AI transforms the financial system, it will create unintended consequences for society at large that require public-private cooperation to address fully

Emerging societal issues magnified by the use of AI in financial services



Workforce disruption

The onset of AI has created a fear of large-scale labour displacement; strategies must be developed to effectively manage the forthcoming talent shift and transition large portions of the workforce through the Fourth Industrial Revolution



Ethics and discrimination

The enigmatic nature of AI technology may seem like “magic” to outsiders, but understanding its behaviour is critical to detecting and preventing models that discriminate against or exclude marginalized groups and individuals



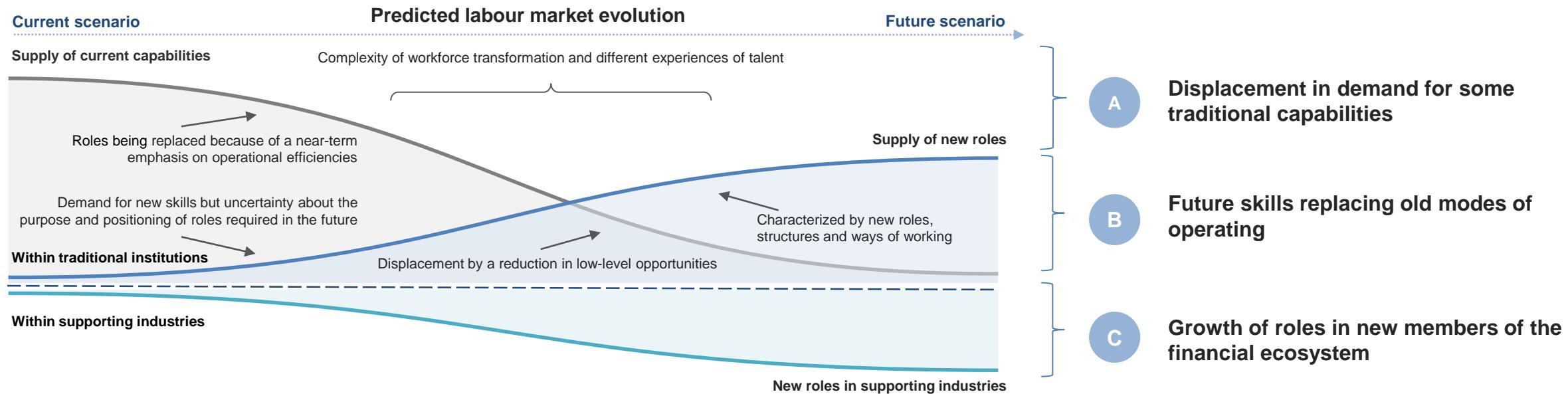
Systemic risk

As AI takes an increasingly critical role in the day-to-day operations of the financial system, it poses a new source of systemic risk that has the potential to disrupt national and global economies, necessitating new controls and responses

The following slides will explore the broader challenges faced by society as a result of AI innovation in the financial services industry

The effects of AI on the labour market are a significant concern globally, especially the implications for those in low- and middle-complexity roles

Discussions of AI's impact on the financial workforce often feature competing utopian and dystopian narratives. Neither of these visions is accurate – rather, understanding the true impact on labour requires a deeper examination of how the financial ecosystem is changing



A Displacement in demand for some traditional capabilities

As institutions pursue efficiency and cost-cutting strategies, routine low- and middle-complexity roles are likely to be displaced (e.g. back office). Since these roles constitute a significant portion of jobs in financial services, there is a risk of a net decline in overall roles available, especially in the nearer term

B Future skills replacing old modes of operating

Institutions need to source more technical skills to develop AI solutions, as well as more high-value abilities to complement them (e.g. creativity, ingenuity, insight). In order to unlock the full potential of this workforce, institutions must effectively re-task existing talent as well as source new external talent

C Growth of roles in new members of the financial ecosystem

The role of third-party providers outside the ecosystem (e.g. large technology firms, fintechs, new entrants) that supply services to financial institutions will grow, and these roles are likely to look radically different. They will require new skill sets (e.g. technical backgrounds), have different cultures and have different compensation models

The use of AI in financial services introduces new ethical pitfalls and risks unintended bias, requiring the industry to reflect on the ethics of new models

While the benefits of AI are clear, the potential unintended consequences are less easy to visualize. This demands proactive collaboration between institutions and regulators to identify and address potential sources of bias in machine decisions and other exclusionary effects

As AI introduces new decision-making methods, there is ***potential for discrimination*** that will test societies' moral obligations if decisions adversely affect disparate groups

Bias in input data

Bias present in input data, as well as incomplete or unrepresentative datasets, will limit AI's ability to be objective



Bias in development

Subconscious bias or lack of diversity among development teams may influence how AI is trained, carrying bias forward



Post-training drift towards discrimination

As AI systems self-improve and learn, they may acquire new behaviours that have unintended consequences



Furthermore, AI may make it harder to explain ***solutions***, compounding the impact of potential discrimination by making safeguards more difficult to establish

Uncertainty over input use

Some methods of AI training may obscure how data is used in decisions, creating the potential for discrimination (e.g. using race or gender data in credit decisions)

Unpredictability of models

As market conditions evolve, it may be difficult to predict how models will respond, with the resulting portfolio and macro implications

Auditability

Regulators often lack the technical expertise to inspect algorithms, especially if development is improperly documented or there are persistent, system-wide gaps in governance

Note: Despite these risks, most AI used today is not a "black box" and, depending on the use case, the ability to explain solutions is not always a critical factor. For the most complex AI applications, parallel models can also be run that either predict or create confidence in the behaviour of the AI model

Without proper oversight, AI innovation could introduce new systemic risks into the financial system and increase the threat of contagion

As AI models become a pervasive part of the financial ecosystem, they will transform the landscape of existing systemic risks while potentially adding new, unexpected risks. Areas of particular concern include the potential for herd behaviour among AI systems and the increased vulnerability of financial operations to cyberattacks



Herd risk and consolidation



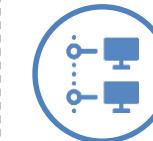
Risks of contagion, where losses from negative market events may be increased by a shared algorithm passing decisions across multiple institutions



Increased risk of errors as model miscalibration would impact on many institutions simultaneously (e.g. miscalculating credit risk)



Increased cyber-risk



Increased interconnectivity as AI demands increased digitization and linkages across institutions, creating more opportunities for cyberintrusion



Systemically important technology and third-party data providers are critical in developing AI systems, increasing the reliance on previously unregulated stakeholders

No one institution, government or regulatory body can address and prepare for these challenges alone, necessitating increased engagement and collaboration across all parties in the global financial system

AI is likely to have a transformative effect on the global financial system – the task of the ecosystem will be to maximize benefits while mitigating harms

Opportunities



Regardless of sector, AI presents opportunities for financial institutions across their value chains: from meaningful improvements to business-as-usual processes to radical, industry-changing plays

Challenges



Incumbent institutions face significant challenges, across their operating environments, to achieving the full value of AI. Overcoming these obstacles will require significant investment and discipline to deliver on the ambitions of AI-driven agendas

Societal implications



As the global financial system undergoes transformation, institutions, regulators and policy officials must be proactive to manage the large-scale displacement of labour, as well as develop modern tools to manage new ethical uncertainties created by automated decision-making

How is AI being deployed by sectors of financial services?

Sector explorations

Our views on emerging competitive dynamics are informed by a detailed examination of AI-enabled strategies across every sector of financial services

Over the following slides, we will explore the following six sectors in detail



Deposits and lending



Insurance



Payments



Investment management



Capital markets



Market infrastructure

Each sector will follow the four-section narrative below, which provides a detailed overview of high-potential AI strategies



Deposits and lending: Sector overview

Core banking margins are under significant pressure, caused by increased regulatory burdens, accommodative monetary policy and new competitors

Key findings

- Demand for banking services is on the decline as the cost of commercial banking, asset volatility and regulatory costs increase
- Banks are increasingly competing with fintechs and other non-bank institutions for customers and revenue
- AI can help banks to identify and mitigate risks more effectively

Strategic focus areas

- Standard operating procedures in retail banking continue to be replaced by AI-powered automation, such as AI-powered loan origination and AI-powered risk assessment
- AI can improve the efficiency and effectiveness of lending operations
- AI can help banks to identify and mitigate risks more effectively



Deposits and lending: Strategy summary

AI can improve banks' profitability through the delivery of personalized advice at scale and the transformation of lending operations

Key findings

- AI can help banks to identify and mitigate risks more effectively
- AI can improve the efficiency and scale of retail lending
- AI can help banks to identify and mitigate risks more effectively

Key anticipated changes in mobility and lending include

- Key finding 1: Personalized advice will become standard as AI becomes more accurate and more widespread
- Key finding 2: Increased efficiency and scale of retail lending
- Key finding 3: Improved working capital solutions for consumer loans

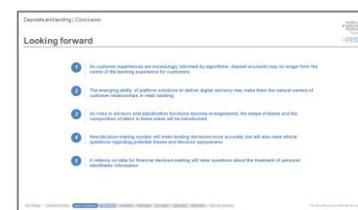


Why improved customer experiences matter

AI is allowing institutions to deliver advice at scale and at the moment of need, redefining the value proposition of the retail banking experience

Key findings

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Deposits and lending: Conclusion

Looking forward

- An customer experiences are increasingly informed by algorithms, deposit accounts may no longer form the core of the banking experience for customers
- The emerging ability of platform solutions to deliver digital advisory may make the retail arm of banking less relevant
- As new advisory and educational functions become more prominent, the shape of teams and the composition of roles in these areas will be reconsidered
- New technology making mobile and self-service banking more accessible, but also more efficient, questions regarding enhanced security and consumer protection
- A review is due for financial decisions making will view questions about the treatment of personal information

1. Sector overview

A high-level overview of the sector, its emerging trends and the key challenges that it faces

2. AI's anticipated impact on the sector

An overview of the impact AI is poised to have on the sector and an introduction to selected strategies that AI is poised to enable or accelerate

3. Selected strategies enabled and enhanced by AI

A detailed review of each high-potential AI strategy, including evidence of its importance as well as specific opportunities observed in the marketplace today

Note: Examples range from automation techniques (which may not meet some readers' bar for what constitutes "AI") through to advanced AI techniques. These examples are intended to highlight key industry and technological trends and should not necessarily be taken to represent the best or most advanced practices

4. Looking forward

A summary of key implications for various stakeholders (e.g. individuals, financial institutions and regulators)



COMMITTED TO
IMPROVING THE STATE
OF THE WORLD

Deposits and lending

Sector exploration

Core banking margins are under significant pressure, caused by increased regulatory burdens, accommodative monetary policy and new competitors

Overview of the sector

Sector description and chapter scope

Deposits and lending are the core offerings of the retail and commercial banking sector. Institutions receive deposits (by offering customers accounts) and use these deposits to finance both secured loans (e.g. mortgages) and unsecured loans (e.g. credit cards).

This chapter focuses on this banking value chain; transactions that facilitate these products are covered in the Payments and Capital markets chapters.

Chapter scope

Distribution	Financial advisory	Deposits	Lending	Risk-taking	Transactions
• Branch	• Savings	• Fixed-term	• Secured	• Balance sheet	• P2P
• Phone	• Spending	• Current	• Unsecured	• Securitization	• B2B, C2B, B2C
• Digital	• Borrowing				
Retail customers					
Small and medium-sized business customers					
Corporate customers					

Sector trends

- **Upward interest rate trajectory** as global economic confidence continues to recover and central banks begin to tighten monetary policy
- **Growth in low-principal financing** (e.g. microfinancing and SME lending) as the cost of servicing loans decreases, resulting in low-value credit products becoming more attractive
- **Focus on customers** as changing customer preferences for digital and personal advice results in changing revenue models for depository and lending institutions
- **Shift in financing to capital markets** (particularly in mortgages) as regulatory and supervisory bodies continue to emphasize the de-leveraging of depository institutions

Issues facing the sector

Increasing pressures on traditional players from new competitors

- **48% expected annual growth rate** of marketplace lending from 2016–2024¹
- **Two out of every three bank executives believe PSD2** will have a negative impact on profit margins because of new entrants²

Sustained low trust and consumer confidence

- **Only 54% of individuals globally “trust” financial institutions**, making it the lowest-rated sector in 2018³

Sustained cost pressures across banking operations

- **Major global markets (e.g. United States, European Union, China, Japan)** are all expected to increase interest rates to Q1 2019,⁴ resulting in pressure on balance sheets
- **75%–80% of bank IT spend** is on maintaining existing core banking systems, and is expected to continue to hinder profitability⁵
- **89% of industry executives** globally expect the cost of compliance to continue increasing from 2017–2019⁶

Significant global unbanked and underbanked populations

- **Almost 40% of adults globally** do not have a bank account, or access to a financial institution⁷
- **67% of bank regulators in 143 jurisdictions** have a mandate to promote financial inclusion⁸

High costs of misconduct

- **Regulators in the US and Europe have fined banks \$342 billion since 2009** for misconduct, and this is likely to top \$400 billion by 2020⁹

AI can improve banks' profitability through the delivery of personalized advice at scale and the transformation of lending operations

The rise of AI will initiate and accelerate the following changes in deposits and lending:

The line between deposits and lending will become blurred as cash-flow management will be delivered “as a service”

Lending products will become smaller and more agile as they are customized to specific uses

The cost of funds in lending will increase as deposits become more expensive to service, putting pressure on net interest margins

The range of potential customers will increase as non-traditional data makes it possible to serve new customers and operate in new regions

Key AI-enabled strategies in deposits and lending include:

Strategy A

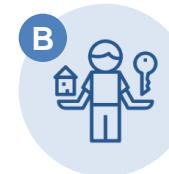
Focus retail banking on improving customer outcomes



→ E.g. use machine learning to predict cash-flow events and proactively advise customers on their spending and saving habits

Strategy B

Increase the efficiency and scale of retail lending



→ E.g. streamline the end-to-end onboarding process to more efficiently evaluate and issue new loans

Strategy C

Offer automated working-capital solutions for commercial clients



→ E.g. use advanced analytics to understand a broader set of data to better adjudicate commercial lending

The following slides will explore each strategy, detail the components and highlight key examples

A

AI is allowing institutions to deliver advice at scale and at the moment of need, redefining the value proposition of the retail banking experience

- Why improved customer outcomes matter

Increasing conduct risk is threatening credibility

As banking institutions lose the trust of customers,¹⁰ loyalty will decline, making it harder to retain deposit levels and fend off new entrants

New savings offerings threaten fee revenue

New entrants with new products are promising higher interest for on-demand deposits and eliminating fees to attract more volume

New entrants are providing differentiated offerings

The next generation of personal financial management apps are aligning their service and compensation with customers' financial outcomes, threatening ownership of the retail banking customer experience

- Observed opportunities

➤ Provide personalized, practicable advice in real time

Pain point

Customers lack access to timely, clear and relevant financial information

Current online and offline channels have limited ability to provide insights to customers on their financial habits, and the impact of those habits on their future financial needs. Lack of clear and readily accessible information through online and offline channels leads customers to make suboptimal decisions on the allocation of funds, resulting in worse financial health

New capabilities

- Insights generated from third-party data (e.g. social, mobile) connect advisory to the day-to-day reality of retail customers
- A true single-customer view can be achieved by intelligently scanning internal data held across silos

- Process automation improves connectivity and accuracy across business functions and accounts
- Continuous monitoring of accounts held across different institutions can raise proactive alerts

AI and/or Advanced Automation Examples



Albert's "genius" product compiles financial data within and across institutions to suggest next best actions (e.g. switching utility providers to more cost-effective options)



Clarity Money integrates account balances, bills and credit scoring to help customers understand their complete financial story and actively manage their accounts

➤ Offer tailored, always-on experiences across channels

Pain point

Often, financial advice is generic and delivered by generalist staff during limited interaction points

Generalist staff (e.g. branch employees, phone advisers) are limited by the hours when they are available and their limited personal interaction with customers. This limits the ability of these staff to deliver always-on personal advice to the mass market

New capabilities

- Intelligent employee dashboards can generate insights from past customer interactions (e.g. analysis of calls) and provide recommendations to front-line staff
- Automated interactions provided by "chat bot" solutions allow customers to access and receive always-on advice through the expanding network of digital channels

AI and/or Advanced Automation Examples



Personetics, **Fini by Clinc** and other conversational agents allow financial institutions to automate routine and common interactions, enabling them to provide personalized and responsive information and advice through digital channels



AI can deliver smarter and more nimble workflows that improve the productivity and reach of lending operations

- Why efficiency and scale matter

Agile innovators are rewarded with higher profitability

Margin positions, even in high-competition lending markets, are improving for institutions that effectively reduce manual efforts in the back office¹¹

Expectations for real-time access

Connected and agile workflows, as well as the removal of non-additive customer interactions, are reducing the time it takes to access credit

Pressures to improve inclusion

Institutions are expanding market share in mature and emerging markets by ingesting data to better predict the risk of default, improving confidence in lending decisions

- Observed opportunities

➤ Provide “just-in-time” lending

Pain point

Loan origination can take days or weeks due to fragmented data storage and manual entry

Data is stored across multiple internal and external systems, and is often manually entered. This increases the number of inaccuracies and creates delays in response time, resulting in slow, opaque and unresponsive processes

New capabilities

- **Natural language processing** allows faster and error-free document reading to support activities such as information verification, user identification and approvals

- **Dynamic sourcing of data** from disparate sources eliminates the need for manual data entry – opening the way for scalable digital onboarding and servicing channels

AI and/or Advanced Automation Examples



Kyckr cleanses, monitors and remediates data to meet KYC obligations, and increases onboarding efficiency



Upstart aims to streamline the entire loan-origination process by automating activities from data entry to verification tasks

➤ Miniaturize unsecured lending to be use-specific

Pain point

Unsecured lending is not adjudicated or priced based on the purpose of an intended-use case

Lending products (e.g. lines of credit) do not adapt to individual purchases (e.g. buying a coffee vs. purchasing a new computer); making loans use-specific would allow for dynamic pricing based on the risk profile of a given transaction

New capabilities

- **Third-party data analysis** (e.g. SKU level data) can aid understanding of how transactions affect the creditworthiness of an individual
- **Automated decision-making** can adjudicate customers in real time and at low cost, allowing tailored lending (e.g. custom repayment terms) at the point of purchase

AI and/or Advanced Automation Examples



Affirm provides businesses with financing solutions for their customers, offering credit at the point of purchase; Affirm settles the full amount with businesses and then customers pay Affirm back over time, with interest

➤ Predict defaults with greater accuracy

Pain point

Inaccurate adjudication results in increased default costs and missed revenue due to denials of creditworthy individuals

Adjudication is often based on a limited dataset (e.g. credit ratings), limiting the reliability of creditworthiness calculations, particularly for specific segments of the population such as non-residents and unbanked or underbanked groups

New capabilities

- **Advanced credit-decision models** that use machine learning can improve the confidence of lenders to extend credit, reducing defaults and expanding reach
- **Alternative data sources** can be used in place of traditional credit scores to assess creditworthiness in segments for which data is not readily available

AI and/or Advanced Automation Examples



Qudian makes personalized credit accessible online for mobile consumers who need access to small loans for discretionary spending



ZestFinance uses alternative data and machine learning to build credit models, allowing lenders to gain confidence in lending to new segments



AI is launching a commercial banking renaissance through improved data integration and analytics tools that unlock a vast underserved market

- Why better commercial lending matters

Threat of new entrants

Accounting and invoicing platforms are integrating lending into their business services platforms, encroaching on the traditional market share of incumbent institutions

Bloated commercial processes

The high cost of commercial lending operations has cut the profitability of incumbents and is pushing customers in some regions into capital markets for financing

Underfunded commercial lending markets

Commercial lending for small and medium-sized businesses is under-served,¹² particularly in emerging markets¹³

- Observed opportunities

➤ Improve client advisory by integrating into data streams for opportunity discovery

Pain point

Incumbents have no real-time visibility with regard to the financial situation of their clients

Lenders struggle to adopt sophisticated credit models that incorporate detailed considerations of growth, profitability and liquidity into calculations, because they lack access to the detailed, real-time and contextualized (e.g. industry-specific) data required. As a result, borrowers are left on their own to determine their own financing needs and navigate the lengthy, opaque process of commercial lending

New capabilities

- **Integration into client Enterprise Resource Planning (ERP) and data sources** to access real-time raw data, enabling lenders to get a deeper understanding of client fundamentals and offer more customized advisory services

- **Predictive algorithms** can assess and anticipate client borrowing needs in real time, allowing advisers to dynamically generate offers and extend funds seamlessly

AI and/or Advanced Automation Examples



Amazon Lending has made over \$3 billion in loans to small merchants globally,¹⁴ enabled by insight into the revenue flows of merchants that are part of its e-commerce platform



Tradeshift and HSBC are partnering on a platform solution to extend working capital to companies by viewing and analysing the entire supply chain of commercial clients¹⁵

➤ Automate and augment business credit decision-making

Pain point

Business credit decision-making is significantly more costly than retail credit decision-making due to the need for manual analysis of business financial documents

Commercial lending products are costly to originate as applications must be reviewed manually to determine creditworthiness. Financial information is reported in non-standard documents (e.g. income statements), making verification of these documents a manual and time-consuming process, especially for SMEs

New capabilities

- **Augmented analytics tools** allow underwriters to customize their credit analysis rapidly, using a variety of data sources to increase their certainty of creditworthiness and ultimately credit adjudication

- **Natural language processing and automated dashboards** can collate important statistics by deciphering complex and non-standard financial documents, extracting relevant information in summary form for underwriter review

AI and/or Advanced Automation Examples



OakNorth's "ACORN Machine" analyses alternative data to quickly originate bespoke loans for small and medium-sized businesses. It has grown its loan book to £800 million in just two years and is offering its cloud-based adjudication technology "as a service" to other lenders¹⁶

Looking forward

- 1 As customer experiences are increasingly informed by algorithms, deposit accounts may no longer form the centre of the banking experience for customers
- 2 The emerging ability of platform solutions to deliver digital advisory may make them the natural owners of customer relationships in retail banking
- 3 As roles in advisory and adjudication functions become re-engineered, the shape of teams and the composition of talent in these areas will be transformed
- 4 New decision-making models will make lending decisions more accurate, but will also raise ethical questions regarding potential biases and decision opaqueness
- 5 A reliance on data for financial decision-making will raise questions about the treatment of personal identifiable information

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Insurance Sector exploration

Insurance is highly sensitive to AI-driven transformation, particularly due to the rising influence of new entrants

Overview

Sector description and chapter scope

At its core, insurance is a means to protect the discretionary income of customers by spreading or externalizing risks. Insurance is one of the sectors that receives the most attention from both investors and disruptors looking to challenge the traditional order of business. Thus far, traditional insurers and carriers have maintained their positions of strength due to the complexity of products and advantages of scale, which allow them to better pool and hedge risk.

Chapter scope

Reinsurance	Life insurance	General / P&C insurance	Distribution	Retirement / annuities
• Life	• Whole life	• Retail and commercial	• Brokers	• Covered in Investment Management
• Non-life	• Term life	• Motor	• Digital platforms	
• Insurance-linked securities		• Health	• Comparison websites	
		• Home		
		• Marine		

Sector Trends

- **Autonomous vehicles** will change the automotive property and casualty insurance landscape, likely shifting risk-coverage responsibilities from drivers to automotive manufacturers
- **“Insurtech” disruptors** have been more successful than fintechs in other sectors, particularly within the distribution space, where new business models and platforms are scaling rapidly¹
- **Commoditization** of common personal lines, such as property, automotive and health, are pushing incumbents to look for volume in new types of insurance
- **Distribution networks** are becoming more complex to meet customer expectations for increasingly digital and omni-channel experiences

Issues facing the sector

Poor consumer perception of insurers

- **Insurers are less trusted** than banks, supermarkets, car manufacturers and online shopping sites²
- **Consumer reports outline negative practices** that highlight the perceived conflict of interest between consumers and insurance companies³

Customer expectation of increased interactions

- **57%** of global insurance consumers, across all product types, prefer to hear from their providers at least semi-annually; only 47% receive that level of contact currently²

Rising involvement from large technology players

- **Alibaba and Tencent** purchased stakes in Ping An Insurance in a \$4.7 billion deal in 2014⁴
- **Amazon** announced a health insurance joint venture with JPMorgan and Berkshire Hathaway⁵

Consolidation in property and casualty insurance markets

- **AXA** acquired XL Group for \$15.3 billion, March 2018⁶
- **AIG** acquired Validus for \$5.6 billion, January 2018⁷
- **Allianz** acquired significant stakes in Euler Hermes and LV's general insurance business, February 2018⁸

Growth potential concentrated in non-traditional markets

- **2x–3x** growth of South-East Asian life and non-life insurance markets compared to the global average⁹
- **80%** growth in gross written premiums in China between 2010 and 2015⁹
- **3.7%** average real growth of the global insurance industry from 2016–2018¹⁰

AI will help insurers predict risk with greater accuracy, customize products and use enhanced foresight to rapidly deploy new products

The rise of AI will initiate and accelerate the following changes in insurance:

Customers will get more for their money as policies will become cheaper and coverage will be more complete

Insurance will be more connected, more real-time and more accurate as new algorithms and new data take hold

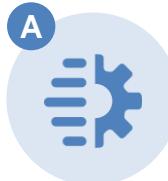
Distribution will permeate devices and geographies in order to cover the situational needs of customers

Brokers, back-office underwriters and adjusters will be at risk of disruption as operations across functions become streamlined

Key AI-enabled strategies in insurance include:

Strategy A

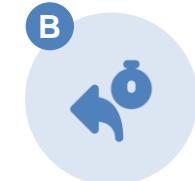
Streamline operations to win on price



→ E.g. use natural language processing and advanced decision trees to improve underwriting and capital efficiency

Strategy B

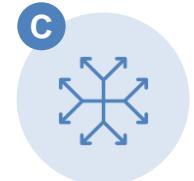
Develop a differentiated claims experience



→ E.g. use image recognition and fraud detection to speed up claims processing

Strategy C

Improve and expand distribution strategies



→ E.g. use predictive analytics and new data sources to improve sales efficiency and expand into new markets

Strategy D

Insure against new types of risk in new ways



→ E.g. use alternative data and dynamic behavioural pricing to develop unique insurance products that cover new risk categories

Strategy E

Offer add-on services that complement insurance



→ E.g. use real-time monitoring to advise clients on risk-exposure strategies to lower risk

The following slides will explore each strategy, detail the components and highlight key examples



AI is driving efficiencies in underwriting and risk monitoring to give insurers a competitive edge, particularly in commoditized markets

- Why winning on price matters

Low ratios for commercial insurance

The high cost and involved nature of commercial risk assessments are threatening the profitability of commercial P&C insurers

Commoditized retail P&C insurance

The rise of platforms and policy standardization has left price as the only differentiator for retail products such as car and home insurance

Rising interest rates create headwinds

Rising interest rates will depress bond portfolio yields, hurting P&C insurers and requiring better capital and portfolio management¹¹

- Observed Opportunities

➤ Improve underwriting, pricing efficiency and accuracy

Pain point

Even in digitized systems, underwriter workflows often require manual review or data entry for non-standard cases and exceptions

Even in modern underwriting engines, there are “complex” or slightly irregular cases that are not explicitly programmed. These require manual review, which is often rote but requires a high level of domain-specific knowledge on the part of increasingly costly talent

New capabilities

- **Optical character recognition (OCR)** can read, verify and standardize supporting documents, eliminating the need for manual review
- **Non-static and complex decision trees** can be built with machine learning by analysing past cases, allowing for automated underwriting and pricing of complex and irregular cases

AI and/or Advanced Automation Examples



Cytoria analyses unstructured datasets using AI to find new risk patterns. This helps insurers to improve loss and expense ratios, and to identify profitable segments for commercial insurance



Fukoku Mutual Life increased payout calculation efficiency by 30% using AI, breaking even on the cost of its investment in automation in less than two years¹²

➤ Increase capital efficiency through better risk modelling and real-time risk monitoring

Pain point

Back testing and model validation is a high-cost process whose outcome has significant impacts on balance sheets and overall insurer profitability

Risk modelling is an imperfect process as our nascent and evolving understanding of risk limits the productivity of data scientists, making this critical process highly labour-intensive. The costs for insurers are compounded by changing regulatory requirements for modelling

New capabilities

- **Automated modelling** using machine-learning systems allows institutions to run thousands or millions of trial models a day, reducing the cost of meeting regulatory requirements
- **New and unstructured data** can be used in risk analysis using machine learning, allowing for a wider variety of situational simulations. This results in more accurate levels of liquidity capital

AI and/or Advanced Automation Examples



Swiss Re is using IBM Watson to analyse the impact of broad market trends on its portfolio and better price risk¹³

Concirrus Quest Marine provides live marine weather, fleet and port data to insurers (e.g. warning when a vessel enters an exclusion zone)

OmniScience enables faster model runs for insurers – reducing the cost of risk management and improving overall risk metrics



AI is being used to evaluate claims, creating workflows that are more accurate and responsive to customer needs

- Why claims experience matters

Avoid poor claims experiences

Incumbents can address reputational concerns by offering differentiated claims-handling stories that result in positive customer outcomes

New entrants digitizing claims

Platforms and direct players are developing innovative claims channels, including online and interactive digital claims solutions, to gain market share

Claims fraud is a major cost centre

Some estimates put fraud at 10% of all claims filed.¹⁴ Given that the average profit margin is 6% (US),¹⁵ lowering fraud is a major profit opportunity

- Observed opportunities

➤ Triage and grade claims to increase adjudicator efficiency

Pain point

Claims processing often requires manual review of complex documents, which slows response time

Claims documents are long and time-consuming to read and interpret, requiring highly skilled underwriters to evaluate injury or damage and determine whether it is covered by a policy

New capabilities

- Rank claim severity using deep learning to read claims documents and score their urgency, severity and compliance to expedite triage
- Provide adjudicators with summaries and statistics that enhance their decision-making and can increase the efficiency of individual underwriters

AI and/or Advanced Automation Examples



Zurich Insurance is using AI to review paperwork (e.g. medical reports), speeding up processing times from hours to seconds¹⁶



Tractable uses image recognition to support triaging and validate repair-cost estimates automatically

➤ Process claims instantly

Pain point

Any wait time for claims adjudication results in a poor customer experience

Responding to claims is a lengthy process that involves numerous steps and approvals. Often this means customers must pay out of pocket and wait with uncertainty about timelines and outcomes

New capabilities

- Use of new data to verify damage (e.g. photographs, IoT sensors, weather data) the moment a claim is filed allows institutions to extend initial funds that can immediately address customer needs, while reducing the chance of fraud

AI and/or Advanced Automation Examples

中国平安 PING AN



Ping An's "Smart Fast Claim" uses image recognition and pricing algorithms to recognize automotive damage, improving claims efficiency by over 40%¹⁷



Axa's "Fizzy" uses self-executing parametric contracts to compensate customers for delayed flights, eliminating the need for a claims process¹⁸

➤ Reduce fraud using new tools and new data

Pain point

Fraud is a major avoidable cost for insurers

Since claim forms are self-attested, there is high potential for fraud. Fraud losses shrink insurers' profit margins and are sometimes passed on to customers in the form of higher overall premiums

New capabilities

- Analytical models using external data (e.g. news reports, social media) can more accurately flag cases of fraud, reducing losses while increasing throughput
- Analysing large quantities of data efficiently using machine learning allows for in-depth review of every submitted claim for fraud

AI and/or Advanced Automation Examples

Shift Technology

Shift Technology uses AI to find patterns of fraud in deep claims datasets, which can then be applied to incoming claims in order to flag potential instances of fraud



AI is augmenting the capabilities of new and existing distribution channels, allowing insurers to expand their reach and scale

- Why distribution matters

Importance of channel mix

By introducing better exploration and search tools into direct digital channels, institutions can reduce costs while interacting with customers through their preferred channel

Simplifying the complexities of insurance

Insurance products and clients are increasingly complex. Augmented tools allow agents to manage those customers' needs in a cost-effective way

Opportunities in emerging markets

Digital and scalable channels are best positioned to capture the high growth of insurance sales in developing markets

- Observed opportunities

➤ Increase the efficiency and capabilities of sales agents

Pain point

Lead generation and client acquisition is a labour-intensive process with a lot of tedious work

The best insurance salespeople spend a significant portion of their time generating leads, casting a big net with lots of churn and wasting time on cold leads

New capabilities

- **Predicting lead quality** using machine learning by analysing external data (e.g. sentiment analysis on social media) can improve sales efficiency
- **Correlating sentiment and usage patterns** with historic sales data can predict the likelihood of policy cancellations or renewals

AI and/or Advanced Automation Examples



Allstate is using its personal lines agent network to sell commercial lines products. It has developed an internal chatbot that agents can use to provide accurate quotes and valuable advice for complex commercial clients¹⁹

➤ Use mobile and experience-driven insurance delivery

Pain point

Insurance purchases are disconnected from the underlying assets and experiences they protect

Currently, insurance policies are largely purchased through a different channel from the asset or experience they are protecting, requiring customers to go through an unnecessary purchase cycle that is divorced from what is being insured

New capabilities

- **Automated decision-making** can provide instant pricing and underwriting to quote, bind and issue personalized policies in real time
- **Integrations with third-party apps** and points of sale can seamlessly integrate insurance purchases into the asset purchase at the point of sale

AI and/or Advanced Automation Examples



Cover uses image recognition to offer quotes on insurance policies based on a picture taken via the mobile app. It connects to a wide number of insurers for a broad set of insurable assets including cars, homes, phones and pets

➤ Improve scale efficiencies to enter new markets

Pain point

High upfront costs have stymied growth opportunities in traditionally under-served markets

For example, expanding into life insurance markets in countries such as India has traditionally been uneconomical due to the need to do an upfront health check with a doctor

New capabilities

- **Non-traditional data** can be used as a proxy in place of physical doctor check-ups, reducing the cost of verifying a life insurance application
- **Advanced visual recognition** can automatically validate official documents (e.g. medical forms and doctors' reports)

AI and/or Advanced Automation Examples



Baidu has launched a joint venture with Chinese insurers to use data and AI capabilities to develop an AI-powered underwriting engine. This can expand digital originations at low cost²⁰



AI allows institutions to be more agile, enabling them to deploy new products in response to emerging risks

- Why new risks matter

Prohibitive cost of specialty insurance

Unique, hard-to-insure cases have led to an expensive specialty insurance market that limits access to protection for customers

Evolution of motor risk

Self-driving cars will shift property and casualty markets to commercial insurance, leading to falling margins for insurers

Margin compression across traditional lines

Insurers seeking to maintain existing profit margins will need to find new risk areas where insurance products are less saturated and rates are at a premium

- Observed opportunities

➤ Use proxy data to insure new risk categories

Pain point

Insurers and actuaries rely on historical cases when assessing risk probabilities and pricing insurance

When there is a lack of historical data, or when the risk models are not robust enough, risk categories go uninsured (e.g. cybersecurity and product-specific insurance such as for laptops)

New capabilities

- **Alternative data sources** can be used as proxies for damage data (e.g. repair bills, sentiment analysis of news) in order to correlate risk with damage and build actuarial tables

AI and/or Advanced Automation Examples

CYENCE

Cyence uses AI to quantify the financial impact of cyber-risk by analysing technical and non-technical data sources to understand the cyber-risk of portfolio companies

➤ Develop modularized policies

Pain point

Insurance policies are predefined and rigid, and cannot be customized without significant cost

Insurers have difficulty bundling and unbundling their products as insurance policies are sold as rigid and fixed entities. This limits the level of customization and modification that can be offered over the life of the policy

New capabilities

- **Dynamic pricing and underwriting models** allow different components of a policy to be priced, bundled or sold separately (e.g. insurance on a per-use basis)
- **Automated underwriting** reduces the marginal cost of originating, allowing for dynamic underwriting at no additional cost (e.g. policies on an hourly basis)

AI and/or Advanced Automation Examples

trōv

Trov allows users to purchase miniature insurance policies for specific electronic devices, and allows them to turn that coverage on and off at will, offering users the ability to dynamically control their risk exposure

➤ Introduce new pricing and payment models

Pain point

Static payment models are not matched to customer needs

Traditional insurance policies restrict users and insurers to single upfront payments to cover risk terms and force a renewal period. Yet emerging insurtechs have demonstrated a market desire for more flexible pricing models (e.g. pay-per-mile car insurance)

New capabilities

- **Dynamic behavioural pricing** methods can correlate risk and damage data to a variety of data feeds (e.g. time-series) in real time, in order to correctly price and underwrite Insurance policies whose prices and coverage vary by usage patterns and behaviour

AI and/or Advanced Automation Examples

State Farm®

State Farm has run a “proof of concept” competition through Kaggle to develop a program that uses computer vision and photos to identify distracted drivers. This data can be used to micro-target safer drivers and offer lower premiums²¹



AI allows insurers to make use of their internal data and provide unique service offerings that complement their product shelves

- Why new services matter

Declining customer engagement

Customer engagement is becoming more difficult as traditional touchpoints (e.g. selling, claims) are increasingly automated and self-service

Large techs changing insurance value propositions

Technology players that integrate insurance into other service offerings are changing the core value of insurance and pushing incumbents to compete in unfamiliar areas

Digitization is lowering margins

As more activities in insurance are digitized and margins shrink, institutions will need to find new high-margin revenue pools if they are to maintain profitability

- Observed opportunities

➤ Provide predictive analytics to clients that help them better understand their risk

Pain point

Customers have limited ability to understand their own risk exposure, which affects their ability to plan for the future

Assessing risk exposures is a complex task for insurers, let alone for their customers. Yet insight into future risk is a core input into planning and forecasting, particularly for commercial clients that may need to adapt their business decisions or make major investments based on their changing risk profile

New capabilities

- **Detailed insight generation** using AI allows insurers to visualize risks in an intelligible way, allowing them to pass more information to their clients (e.g. the probability of flooding in various areas)
- **Real-time monitoring** provides insurers with individualized insights that can be sent to customers, enabling them to learn about their behaviours and how associated risk changes

AI and/or Advanced Automation Examples



FM Global has developed RiskMark, a service that analyses photos and notes to provide insights for real estate clients on the riskiness of various properties across their portfolios²²



Manulife Vitality is a unique service offering that uses health data from wearables to present customers with insights into their health risks and help them track activity²³

➤ Advise clients on prevention strategies to lower their risk exposures

Pain point

Customers' limited ability to analyse the effectiveness of risk-mitigation strategies increases risk exposures and associated insurance premiums

Risk-prevention measures, such as regular upkeep and behaviour adjustments, can reduce expense ratios for insurers while improving net outcomes for customers, but customers lack clarity about how proactive measures will impact their risks, costs and activities in the future

New capabilities

- **Ecosystem analytics** allow insurers to combine data from their customers, from suppliers and from the market to deliver targeted advice to customers faster and more efficiently
- **Personalization at scale** allows insurers to tailor advice on how to reduce risk exposure, in very specific circumstances, that provides actionable, non-generic insights

AI and/or Advanced Automation Examples



Zendrive measures driving behaviour and produces safety insights that coach drivers to improve behaviour



Roc Connect uses IoT data from customers' homes to enable insurers to offer solutions that make homes safer proactively, rather than by simply being reactive to events

Looking forward

- 1 As insurance becomes more personalized, customers will enjoy better prices and coverage. However, this raises challenges for those who are priced out or excluded by more individualized models
- 2 AI will push insurance to be more connected, more real-time and more accurate, but incumbents will start from a position of disadvantage on the data battlefield compared to large technology firms
- 3 Current regulatory frameworks will need to adapt to enable the issuance of dynamic policies and coverage
- 4 As AI reinvents processes across the insurance value chain, many roles will be displaced, necessitating a plan to transition those displaced into new functions
- 5 Dynamic insurance policies and real-time claims processing will necessitate new approaches to mitigating the potential for increased fraud

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Payments

Sector exploration

Payments service providers face sustained margin pressures that threaten their traditional business models

Overview

Sector description and chapter scope

The payments industry includes all institutions that facilitate the exchange of money between parties, across all channels (e.g. cheque versus card).

This chapter focuses on the end-to-end payments value chain, from payee to payer; this chapter also includes dialogue on the underlying payments infrastructure supporting the flow of money on a national and global level.

International payments networks

International funds transfer (e.g. correspondent banking)

Domestic payments networks



Method: Cash, cheque, credit card, debit card, prepaid, ACH, money transfer, other

Sector trends

- **Open data flows** are compressing the payments value chain and enabling unified mobile payments experiences
- **Increasing competition on rewards and benefits** has led to a focus on premium cards in developed markets¹
- **Increasing accessibility** via mobile channels has dramatically expanded the presence of digital payments in emerging markets
- **Innovation in blockchain-based payment systems** raises uncertainty about the future of centralized payment networks

Issues facing the sector

Shrinking margins due to increased competition and merchant pressure

- **10% decrease in debit card interchange fees** in the US from 2013–2017²

Growing complexity and difficulty in ensuring interoperability

- **The second-fastest-growing category of APIs** is for payments and financial services; APIs increase fragmentation and interoperability complexity³
- **271 mobile money solutions** existed across 93 countries as of 2015, with very few being interoperable, even within the same country⁴

Increasing customer expectations for instant payments

- **“Faster service” is the second most important factor** in retaining customers, according to payments institutions⁵
- **Only 51% of UK payment providers** believe they will be able to send real-time payments globally by 2020⁶

Disintermediation as a result of P2P payments

- **200% growth in P2P payments** expected from 2016–2018 globally⁷
- **Payments modernization efforts** (e.g. PSD2, UK Open Banking Standard) are opening access to payments infrastructure to third parties

Growing burden of financial crime and fraud

- **53% of institutions report increased costs** in fighting economic crime over 2014–2016⁸
- **246% increase in global credit card fraud loss** from 2012–2017⁵
- **US institutions were fined \$12 billion** for failing to meet financial crime requirements from 2009–2015⁹

AI presents new tools to fight fraud, respond to the shifting form of payments and draw valuable insights from data

The rise of AI will initiate and accelerate the following changes in payments:

Data becomes the most valuable aspect of payments businesses as AI unlocks opportunities to create new insights

An accelerating shift away from cash in favour of mobile payment interfaces, in all markets, as digital payments are bundled with value-added services

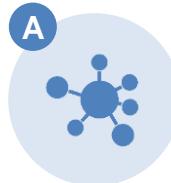
The risks of real-time payments are overcome as new AI-led pattern-detection methods make significant inroads against financial crime (e.g. real-time fraud)

Payments customer experiences continue to disappear as AI removes the need for manual effort from customers (e.g. automated fraud detection and handling)

Key AI-enabled strategies in payments include:

Strategy A

Reduce fraud and malicious activity in the payments system



→ E.g. Use machine learning to significantly reduce false positives in fraud detection

Strategy B

Unlock the power of payments insights



→ E.g. payment providers using payment data to provide machine learning-based merchant analytics “as a service”

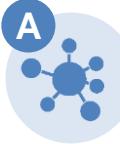
Strategy C

Respond to the disappearing moment of payment



→ E.g. use image recognition to authenticate and transact point-of-sale payments

The following slides will explore each strategy, detail the components and highlight key examples



AI is increasing customers' confidence when making payments by enabling real-time interventions and responses to criminal activities

- Why reduced malicious activity matters

Speed of payments

Institutions' lack of confidence in their ability to combat the increased velocity and volume of fraud has slowed down the implementation of real-time payments

Growing, high-cost processes

As regulators increase security and privacy requirements (e.g. GDPR), the cost of processing payments for institutions will grow

Emerging cyberthreats

Institutions must invest in new methods for protecting the payments system to keep pace with the sophistication of cybercriminals

- Observed opportunities

➤ Deploy real-time surveillance capabilities

Pain point

Institutions lack resources to identify the breadth of threats

Traditional "flagging" methods predominantly place the onus on manual review, limiting the ability to screen a high volume and increasing velocity of transactions. As a result, institutions have placed dollar thresholds on the screening of transactions and have slowed the speed of settlement to combat risk¹⁰

New capabilities

- **End-to-end resolution engines** can use machine learning to detect patterns in transactions and proactively intervene with increased confidence to stop abuse before a transaction is settled. This can allow for threshold limits to be expanded while limiting losses due to abuse

AI and/or Advanced Automation Examples



FICO's Falcon Platform uses AI-driven predictive analytics to provide fraud-detection services to institutions. Falcon learns from case dispositions in real time and integrates merchant-owned data into continuously updated "behavioural profiles" for every individual

➤ Increase detection precision to eliminate false positives

Pain point

Back-office resources are plagued by false positive results

Significant resources are spent on analysing and auditing false positive results generated by rules-based systems. These systems provide limited insight into the root cause, risk-ordering and response required vis-à-vis flagged transactions

New capabilities

- **Looking for patterns in new datasets** (structured and unstructured) can provide precise detail and context on the potential for abuse
- **Complex relationship mapping** using machine learning can recognize more complex patterns, as well as understand results from past investigations

AI and/or Advanced Automation Examples



Feedzai generates fraud insights by integrating data from across channels to generate hyper-precise risk profiles. It also uses machine learning to process transactions in real time. Feedzai detects 61% more fraud earlier and without increasing false positive rates¹¹

➤ Automate compliance and reporting

Pain point

Costs of resolving and reporting on criminal activity

System limitations and data inaccuracies that require manual entry slow down the process of understanding, responding and reporting on malicious events. This requires ever-increasing staff levels to meet regulatory and customer expectations

New capabilities

- **Dynamic data-gathering** using AI to validate and transmit transaction details enables the automation of downstream back-office processes and streamlines workflows
- **Automated reporting** can source, sort, generate and store reporting requirements to maintain audit trails, risk logs and reports

AI and/or Advanced Automation Examples



Alation automatically catalogues all business data and indexes it for easy reference, using machine learning to learn the lexicon of the business. Alation also proactively makes smart recommendations to support compliance-reporting processes



AI enables payments providers to generate new revenue streams by using their datasets to provide unique insights

- Why payments data matters

Declining margins demand diversification

Margins in payments may continue to decline if regulators continue to impose interchange fee caps and customers expect fee free solutions

Access to excludable, high-value data

Payments information is point-in-time and flow-based, allowing data holders to develop precise analytics that provide unique insights capable of being put into action

Source of unique customer insights

Participants across the payments value chain (e.g. issuers, retailers) are seeking access to payments data to better understand customer needs

- Observed opportunities

➤ Act as the ultimate personal shopper for customers

Pain point

Time-consuming data collection and analysis

It is difficult for customers to make optimal decisions based on their personal financial constraints, for both routine and high-value transactions, due to the time and effort required to source comparative information

New capabilities

- **Optimization engines** can generate highly specific and accurate recommendations by using machine learning to analyse and predict shoppers' behaviour
- **Analysis of third-party datasets** (e.g. personal data, available market information) can provide insights into the needs of shoppers

AI and/or Advanced Automation Examples



Spotify uses AI to analyse the listening habits of its 100 million users to generate playlists of suggested songs¹²

Dynamic Yield provides personalized recommendations to shoppers that maximize revenue for leading retailers

➤ Offer prediction "as a service" to merchants

Pain point

Many institutions have insufficient data-analytics capabilities

Small and medium-sized business in particular struggle to keep pace with rising data flows, affecting their ability to draw insights, take action or make meaningful decisions (e.g. targeted promotions)

New capabilities

- **Bespoke analytics solutions** can combine payments providers' unique datasets with machine-learning capabilities to provide targeted insights for merchants and other clients. This in turn can provide contextual and specific recommendations (e.g. next best action) for services, products and personalized promotional campaigns.

AI and/or Advanced Automation Examples



PXP Solutions' AnyPay provides smart analytics that allow smarter resourcing and marketing decisions¹³

Upserve supplies merchants with data-analytics, marketing and loyalty tools built on credit card transactions

➤ Create an advisory capability for macroeconomic trends

Pain point

Traditional economic data is often generic and infrequent

Macroeconomic data (e.g. demographics, consumer spending) is usually produced infrequently (e.g. quarterly or annually), is not granular, nor provided in machine-readable formats. This limits the ability of third parties to derive deep, product-specific insights

New capabilities

- **Advanced analytics** can automatically generate core macroeconomic indicators and provide real-time statistics to satisfy various client requests
- **Build dashboards** that use deep learning and visualization to allow users to drill into data in a simple and easy-to-use format

AI and/or Advanced Automation Examples



Mastercard's SpendingPulse uses near-real-time purchase data to build customer reports on macroeconomic trends on up to a weekly basis for a wide variety of industries and geographical areas, from retailers to national governments



AI provides valuable tools for payment providers to preserve relevance as the moment of payment disappears

- Why seamless payments matter

Payments are becoming automatic background events

Modern commerce solutions skip over the payment process (e.g. Amazon one-click-to-order), meaning fewer interactions between customers and their cards

Ability to influence adoption

Payment providers are hard-pressed to differentiate themselves in ways that can improve the “stickiness” of customers as the point of payment disappears

Choice of payment will be made by algorithms

As platforms and invisible point-of-sale payments solutions take hold, the decision about which payment method to use will increasingly be made by optimization algorithms

- Observed opportunities

➤ Drive usage of payment products by offering bespoke incentives and rewards

Pain point

The app ecosystem is creating a winner-takes-all environment among card providers

Whether through digital wallets or decision-support systems, customers are making fewer choices about which card or payment method to use at a point of transaction. Instead, they are tending to use one of a few cards that have been onboarded onto these payment platforms (e.g. Uber and Apple Pay). This is limiting the ability of card issuers to influence customers’ top-of-wallet decisions

New capabilities

- **Niche and custom reward offers** can be generated using machine learning, optimizing the reward rates for different purchasing categories based on each customer’s unique purchasing patterns

- **Real-time benefits optimization** can intelligently maximize benefits for customers through time-based events such as travel or promotions

AI and/or Advanced Automation Examples



Mogl accesses data from Visa, Mastercard and American Express in real time to offer customers personalized, time-based cashback rewards at nearby restaurants (based on how busy the restaurant is, menu promotions etc.), optimizing benefits for both customers and restaurants

➤ Compete to become a provider of invisible payments infrastructure

Pain point

Payment providers risk losing control of the merchant environment as “invisible commerce” becomes more important

Large technology players are introducing radically new point-of-sale solutions for merchants, moving the transaction below the level of perception. If widely adopted, invisible payments could eliminate the interaction between payment providers and customers, perhaps even replacing traditional card networks with new payment rails

New capabilities

- **Seamless authentication** can be introduced by payment providers using image recognition and/or biometrics to verify identities without disrupting the customer experience

- **Automated checkout** can be delivered “as a service” by payments providers using image recognition to compile shopping carts and determine when to collect payment, removing the “point of payment” as a separate event that requires conscious effort from customers

AI and/or Advanced Automation Examples



Alipay’s Smile to Pay uses facial recognition as a method of authentication and consent, offering retail customers a frictionless checkout experience



Amazon Go is a cashier-less store that tracks what visitors have put in their cart and automatically charges them using their preferred payment method when they exit the store

Looking forward

- 1 Data is quickly emerging as a critical source of value in the payments sector, raising challenging questions around ownership and privacy
- 2 The complexity of today's fragmented payment networks means automation frameworks will be increasingly necessary to facilitate interoperability
- 3 Collective efforts to combat payments fraud and other abuses through the pooling of data would serve the interests of individual institutions and improve the safety and security of the broader financial system
- 4 AI-enabled AML and fraud-management tools will make real-time domestic payments safer, but regulations on cross-border data flows may constrain faster international transfers
- 5 In order to mitigate the risk of system-wide outages and the potential for broader contagion, the stability and reliability of new payments infrastructure must be validated before it fully displaces legacy rails

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Investment management

Sector exploration

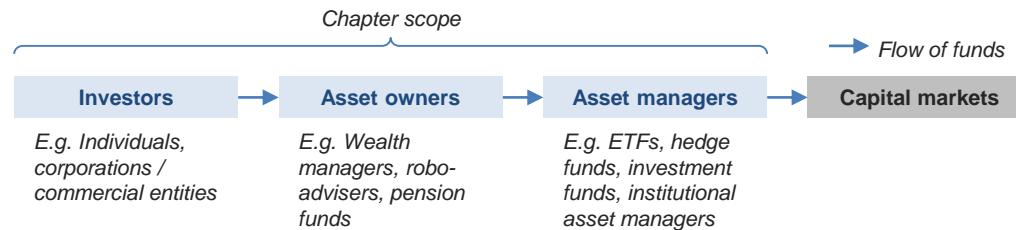


Investment managers are adapting their customer experience and product offerings in response to new competition

Overview

Sector description and chapter scope

Investment management is a diverse sector made up of a variety of services provided by a broad group of financial institutions. Typically, investment management firms will offer a combination of asset management (i.e. direct investing), brokerage (i.e. facilitating transactions) and advisory (i.e. financial planning) services.



Sector trends

- **Shift from high-fee active to low-fee passive investments.** As consumers and institutions become increasingly fee-conscious, assets under management (AuM) are flowing to low-fee passive investments
- **Regulatory scrutiny** of wealth managers (e.g. Financial Conduct Authority's review of wealth managers' suitability practices in the UK¹)
- **Saturation of investment strategies**, particularly traditional discretionary investment strategies, has reduced profitability due to overuse
- **Intergenerational wealth transfer** in developed markets will move trillions of dollars in assets across customers (\$30 trillion over the next 30–40 years in North America²)

Issues facing the sector

Customer expectations of digital channels are increasing

- **62%** of consumers find cross-channel switching important³
- **48%** say they speak to a person only when online services aren't good enough³

Ageing adviser talent pool

- **51** is the average age of financial advisers in the United States, and this is set to increase in the coming years as the industry struggles to recruit younger advisers⁴

Risk of new entrants owning customer experiences

- **Two-thirds** of millennials are open to trying financial services from trusted brands (e.g. Nike, Google and Apple)⁵

Advisory fee and revenue compression

- **8% fee compression** is expected over the next three years, with analysts forecasting up to a 50% fall in fees⁶

Large global unmanaged deposits

- **\$50 trillion** in global wealth is earning no return⁷
- **\$17 trillion** of potential new AuM in China by 2030 (14% CAGR)⁸

Growth in demand for alternative investments

- **63% increase** in the share of systematic trading strategies as a percentage of all hedge funds from 2011–2016⁹
- **\$940 billion** AuM in quant funds¹⁰

AI is enabling investment managers to adapt their business models by altering or replacing core differentiating capabilities

The rise of AI will initiate and accelerate the following changes in investment management:

Investments will be increasingly personalized as investment firms ingest new data about their customers

Passive products will develop active characteristics as models mimic complex strategies or develop their own

Wealth management in emerging markets will rapidly develop as digital distribution bridges existing gaps

Alpha-seeking arbitrageurs will be pushed to new horizons as systematic investors make greater use of advanced data science and alternative data sources

Key AI-enabled strategies in investment management include:

Strategy A

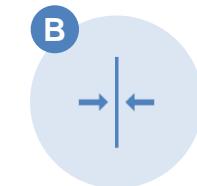
Enhance and expand wealth advisory



→ E.g. provide clients with a branded chatbot that seamlessly integrates with existing advisory relationships

Strategy B

Become a hyper-efficient, low-fee investment manager



→ E.g. use machine learning to make macroeconomic analysis faster and cheaper than traditional methods

Strategy C

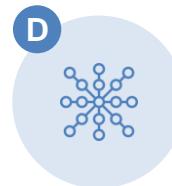
Offer more customized investment portfolios



→ E.g. use new data sources to better inform and articulate investor profiles and preferences

Strategy D

Pioneer emerging markets and low-income wealth



→ E.g. use digitized account setup and management to expand access for lower-net-worth clients

Strategy E

Use data to generate alpha and differentiate returns



→ E.g. use deep learning and other cutting-edge techniques to innovate in the creation of investment strategies

The following slides will explore each strategy, detail the components and highlight key examples



AI is allowing wealth advisers to provide personal and targeted investment advice to mass-market customers in a cost-effective manner

- Why improved advisory matters

Cost of service

AI and automation solutions have the potential to decrease the cost of serving customers through reduced human capital costs and faster timelines

Demand for differentiated experience

Improved wealth-management advice can serve as a differentiator for mass-market customer segments that are traditionally under-served by advisers

Pressure to become self-service

As self-service tools become more sophisticated and easy to use, advisers are seeking to change their value proposition for customers

- Observed opportunities

➤ Equip advisers with highly personalized insights

Pain point

Over-the-counter financial advice is limited in scope

Branch advisers are ubiquitous but limited in their ability to serve customers with tailored financial advice due to the size of their books. This gap is often extended by other disconnects (e.g. age, lifestyle) between advisers and their clients

New capabilities

- **Advanced analytics dashboards** provide detailed insights about clients' needs and enable easy calculations to optimize products, services and advice. This can expand the branch adviser role by enabling junior and non-dedicated financial advisers to provide personal – and potentially niche – advice to clients (e.g. portfolio modelling)

AI and/or Advanced Automation Examples



Right Capital provides easy-to-use financial-planning software tools (e.g. tax projections) to aid financial services employees in performing ad hoc analysis that helps clients make decisions and plan their finances

➤ Share more detailed economic insights

Pain point

Advisers struggle to differentiate advice and retain customers

With limited access to data, wealth advisers are unable to provide detailed and specific financial advice, resulting in generic advice and a lack of differentiation among advisers. This, in turn, leads to low customer stickiness

New capabilities

- **Econometric indicators** can combine economic datasets and market events to provide customers with relevant insights and data on macroeconomic trends; customers will tend to stay with the platform that houses their historic data and consequently delivers stronger insights

AI and/or Advanced Automation Examples



Addepar offers software to wealth managers that integrates customers' financial information to generate detailed and specific reports in real time



ForwardLane has introduced an API through which investors can query the firm about how strategies and wider market-related events can affect their portfolios

➤ Enable users to effectively manage their investments

Pain point

Impulsive and uninformed decisions result in poor outcomes

Mass-market investors sometimes fall into "beginner traps" (e.g. buying high and selling low, impulse investing, tax inefficiencies), because the oversight afforded to higher-net-worth clients – such as private bankers – is not available

New capabilities

- **Cross-product analysis** can use machine learning to look across a customer's financial products and automatically optimize areas of improvement (e.g. suboptimal savings allocations)

AI and/or Advanced Automation Examples



Albert combines customers' financial data across insurance, deposits, lending and wealth management to provide personalized financial advice that considers the individual's holistic financial position

B AI is taking on a growing portion of investment management responsibilities, delivering high-quality service at a lower cost

- Why being low-fee matters

Win price competition against peers

Combining high efficiency with low fees allows institutions to reduce expense ratios and remain competitive in an environment of low interest rates and anaemic growth

Changing benchmarks for success

Passive strategies have changed the basis of competition among investment managers from “generating alpha” to “having low fees”

Maintain performance quality

It is critical for hedge funds and other high-end investment products to maintain risk-adjusted return performance while they engage in cost-cutting

- Observed opportunities

➤ Control ballooning back-office compliance costs

Pain point

Reviews and disclosures are performed manually

Investment institutions have often implemented tactical stop-gap solutions using manual processes and paper documents to meet regulatory requirements. This results in high operating costs and the need for more labour-intensive work with each regulatory change

New capabilities

- **Data-gathering automation** can be employed to find information to generate reports
- **Image recognition** can be used to digitize compliance documents and extract key figures
- **Automated legal disclaimers** and boilerplate text can be generated using machine learning

AI and/or Advanced Automation Examples



Fundapps tracks position limits, **Fortia Financial Solutions** disclosure requirements and automates compliance investment restrictions to create processes for fund managers warnings and regulatory filings

➤ Establish passive products that track new datasets

Pain point

Passive products are limited to tracking established indices

Current passive products are built on the same set of assets and data, which are easy to analyse and readily available. Many new data sources are unstructured, requiring cleansing and normalizing, which is labour-intensive and thus unappealing

New capabilities

- **Parsing unstructured data** (e.g. voice, text, images) at scale using machine learning can open up new data sources that can be indexed to market trends. Trading strategies based on these indices offer differentiated return profiles at lower costs

AI and/or Advanced Automation Examples



Vortexa, **iSENTIUM**, **RavenPack** and many others are packaging alternative data (e.g. Twitter feeds or satellite data) as trading signals for hedge funds, suggesting a strong demand to use this data for new investment strategies

➤ Mimic advanced strategies while controlling costs

Pain point

Funds with specialized strategies tend to have high fees

Firms that attempt to differentiate based on financial performance must invest heavily in talent, increasing the fund’s operating costs and requiring it to charge higher performance fees

New capabilities

- **Automation of data analytics** through machine-learning technologies and cloud processing significantly increases the analytics throughput of talent, allowing a small number of professionals to replicate what previously took an army of analysts

AI and/or Advanced Automation Examples



Wealthfront has launched a risk-parity fund to mimic Bridgewater’s “all-weather fund” without the \$100 million account minimum and lower fees, allowing it to extend differentiated return profiles to its non-traditional client base¹¹



AI-driven personalized portfolio management enables more tailored customer experiences and better investment outcomes

- Why customization matters

Differentiated financial outcomes for clients

Customized advice and portfolio management ensures that personal finances are aligned to the objectives of the client

Extend a unique customer experience

Customization allows institutions to position themselves as the smarter, more understanding and more caring money managers

Potential to reduce attrition via product availability

As new products such as smart-beta ETFs become more popular, stagnant investment managers risk losing customers and Aum

- Observed opportunities

➤ Holistically understand investor preferences in real time

Pain point

Current methods for understanding customers' investment needs are inaccurate and onerous for customers

Customers are presented with simplistic risk-profile surveys that do not develop nuanced, quantitative profiles of their tolerances, leading to individuals feeling that their investment manager does not truly understand their needs

New capabilities

- **Analysing new data sources**, including transaction and third-party data, using machine learning, allows for the generation of personalized risk factors

- **Achieving continuous monitoring in real time** by building data feeds that monitor clients' finances and detect immediately when rebalancing is necessary

AI and/or Advanced Automation Examples



Decipher Finance analyses data to reveal investment needs and provide tailored advice to wealth clients

CleverNudge uses machine learning to generate contextual triggers and customer segments

➤ Develop unique strategies to customize portfolios

Pain point

Existing investment strategies are simplistic and merely adjust asset allocation across a limited product shelf

Building customized hedging strategies or risk exposures is a high-cost activity that requires high-skill investment professionals to make value judgements. This means that institutions are not able to offer these services to some or all of their clients

New capabilities

- **Building personalized asset-allocation models**, despite their complexity, to expand products
- **Analysing new risk exposures** can develop proxy portfolios for common risk areas (e.g. real estate)
- **Correlating new data** with market performance using machine learning allows development of customized strategies

AI and/or Advanced Automation Examples



Fidelity and BlackRock's products give low-cost investors access to strategies such as multifactor weighting and have over \$100 billion Aum¹²

Clarity AI quantitatively tracks the social responsibility of firms, which can be used by fund managers to optimize socially responsible portfolios

➤ Offer outcome-based portfolio modelling

Pain point

Portfolio optimization is product-focused instead of customer-focused, leading to a mismatch between goals and outcomes

Often, wealth managers separate customers into preset risk buckets that fit standardized portfolios; this model is easier for wealth managers but risks misalignment with customers' financial goals

New capabilities

- **Integrating customer views** can personalize financial advice in the context of a broad set of potential client life goals (e.g. holidays, starting a business)
- **Modular offerings** can provide goal-driven solutions rather than product-driven bundles

AI and/or Advanced Automation Examples



FOUNTAIN

Fountain Money combines bot-based and human-based advice to build bespoke investment plans for clients that focus on the specific life goals of the investor



AI enables institutions to serve low-income markets in a cost-effective manner

- Why new markets matter

Opportunities in high-growth markets

Divergent global growth rates promise a boom in the wealth of emerging markets, where existing wealth-management solutions do not meet customer demand

Growth in developed markets

Increasingly, small deposit amounts can be profitably managed, allowing for continued growth in mature markets

Lower switching costs

Digital tools are making it easier for investors to change their investment and advisory providers, creating the opportunity for firms to access new customers

- Observed opportunities

➤ Seamless account setup and portfolio construction

Pain point

Opening investment accounts is a complex process

Legal and regulatory requirements mean that opening an investment account often involves completing and signing numerous forms and documents. This forces customers to dig for information that is not readily available (e.g. status of other investments), as well as make time to be present in-person

New capabilities

- **Data normalization** allows institutions to access data from disparate sources, increasing the scalability of digital channels
- **Digital identity solutions** can be bolstered by AI using image recognition to reduce uncertainty of identity verification

AI and/or Advanced Automation Examples



Onfido uses image recognition to verify ID documents, as well as facial recognition to facilitate cross-border ID verification – increasing the global scalability of onboarding

➤ Explore existing digital platforms for distribution

Pain point

The cost of opening and servicing small-cap accounts today outweighs the potential revenues

It is often uneconomical for institutions to target low-net-worth accounts in emerging middle-class segments even though their wealth is significant and rapidly growing

New capabilities

- **Building integration points** allows account setup and servicing to be connected to digital platforms that hold deposits (e.g. payment apps)
- **End-to-end automation** allows straight-through processing of accounts opened on digital channels, at low marginal cost

AI and/or Advanced Automation Examples



Yu'e Bao is built into the Alipay platform and allows Alipay customers to invest their leftover balances. This has led to AuM of \$235 billion in four years, making it the world's largest money market fund¹³

➤ Digitize customer servicing

Pain point

Dependency on human advisers increases the cost of operating channels

Inflexible and unresponsive user experiences limit digital channels to a predefined set of actions and recommendations, requiring investors to access high-cost phone or in-person channels for personalized answers or recommendations

New capabilities

- **Voice search** allows clients to ask questions using natural language when they do not have certainty over where to find a particular answer
- **Intelligent dashboards** adapt to every interaction that advisers have with their customers to make critical information accessible

AI and/or Advanced Automation Examples



UBS Companion is a pilot project, developed with FaceMe, which allows wealth management clients to pose any economic question to a virtual avatar of the firm's chief investment office and receive answers from UBS's chief economist¹⁴



AI can be used to generate products with new return profiles that are uncorrelated with established strategies

- Why differentiated return profiles matter

Fund performance is a clear differentiator

Overall perceived skill as a fund (e.g. ability to earn alpha) is a core factor for investors and enhancing this skill will result in capital inflows

Arbitrage is increasingly fleeting

As data is commoditized and algorithms operate at high speed, the window to profit from new strategies shrinks, forcing arbitrageurs to be more innovative

Traditional investing strategies are saturated

It is increasingly difficult to generate alpha and identify investment opportunities with high potential through typical strategies

- Observed opportunities

➤ Analyse vast quantities of data at scale

Pain point

The capabilities of data scientists are limited by imagination, creativity and the volume of data that can be parsed

Many market correlations are non-linear or convoluted, making them difficult to analyse and turn into useful signals. Traditional analysis techniques are also time-consuming and costly

New capabilities

- **Automate the collection and structuring of data** to support efficient investment decision-making (e.g. by automatically summarizing key insights)
- **Employ modern data storage architecture** to make large datasets accessible (i.e. searchable and sortable)

AI and/or Advanced Automation Examples



Renaissance



Two Sigma and Renaissance Technologies are hedge funds that differentiate their return profiles using quantitative methods and have attracted \$50 billion AuM each¹⁵

➤ Continuously source new and exclusive datasets

Pain point

Defending proprietary datasets is increasingly difficult

It is difficult for institutions to differentiate themselves on the basis of data as it becomes commoditized by service providers. However, the exponential growth of data suggests that there is an opportunity in continuously sourcing new and excludable data

New capabilities

- **Parse unstructured data** using advanced-learning algorithms to continuously and economically build new datasets that can support investment analysis
- **Develop general-purpose analysis technologies** that can derive insights from a wide variety of types of data (e.g. social, quantitative) and formats (e.g. audio, text)

AI and/or Advanced Automation Examples



Eagle Alpha offers asset managers exclusive datasets and an analytics platform to assist in the analysis of alternative data across 24 categories (e.g. mobile app usage, satellite and weather, reviews and ratings)

➤ Find new relationships using advanced analysis methods

Pain point

Most funds' returns are closely correlated with each other

Across many financial markets, it is increasingly difficult to generate alpha through traditional investment strategies. Markets are becoming increasingly efficient as more investors make use of a broad suite of sophisticated investment approaches

New capabilities

- **Use cutting-edge algorithms** (e.g. deep learning) to identify previously unexplored patterns and correlations that support investment decision-making to generate alpha for investors

AI and/or Advanced Automation Examples


Macro Advisory · Machine Learning · Investments

WilmotML uses machine learning to offer advisory and investment tools, using emerging secular trends (e.g. connected cities, designer genes) to develop a deep understanding of the macro environment and inform investment decisions

Looking forward

- 1 There is interest in capturing unmanaged and “dead” cash to increase individual wealth globally, but supervisory bodies must ensure this is coupled with customer education and informed consent
- 2 The consolidation of institutions and algorithms will deliver lower prices for customers due to automation and price competition, but it will also create new systemic risks in the event of failure
- 3 Wealth advisory will increasingly become the centre of customers’ financial lives as it gains access to increasing volumes of data, allowing it to expand reach and take control of financial products
- 4 Participants must consider the risks associated with poor algorithmic decisions and the potential exposure that comes from an increasingly centralized infrastructure for investment management (e.g. shared algorithms)
- 5 The shape of conduct risk will change given that individual mistakes by wealth-advisory algorithms can impact large sets of clients, while mistakes by individual advisers are more frequent but also more contained

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Capital markets

Sector exploration

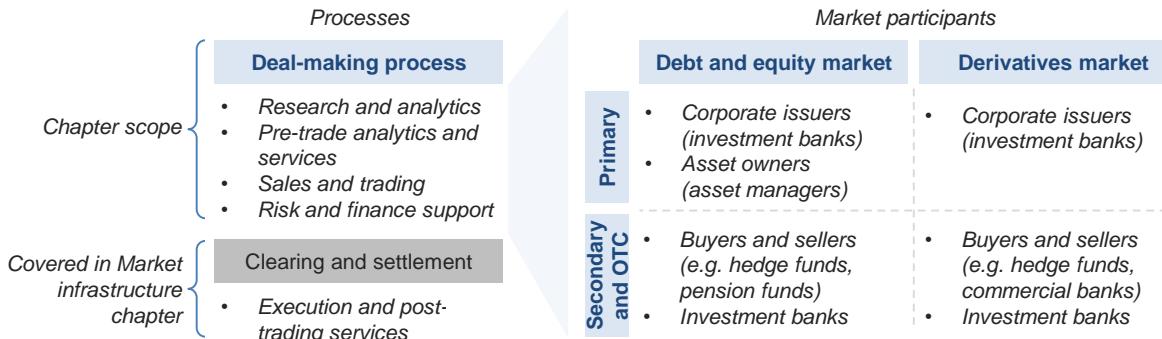
Strict regulations, flat global growth and lukewarm trading volumes have hurt profitability for most actors in the capital markets ecosystem

Overview

Sector description and chapter scope

Capital markets are composed of the buyers and sellers of assorted financial securities (debt, equities, derivatives etc.), as well as the intermediaries that facilitate these transactions.

This chapter will focus on active parties in transactions and the deal-making process. Post-trade functions, such as clearing and settlement, are covered in the Market infrastructure chapter.



Sector trends

- **Macroeconomic uncertainty** stemming from Brexit, rising interest rates and moderate yet volatile growth are dampening trading volume on a global scale
- **New regulations such as the Markets in Financial Instruments Directive II** are decoupling banking services and research fees
- **Declining fixed-income trading revenue** is slowing down industry revenue growth in the short term¹
- **Increasing maturity and rising complexity** of Asian and other emerging economies are creating new markets and institutions that are becoming integrated into the capital markets ecosystem
- **Crypto-assets (e.g. ICOs)** are allowing non-traditional players to introduce new capital-formation methods, the future and regulatory treatment of which is unclear

Issues facing the sector

Falling revenues across core services

- **26% fall in fixed-income trading revenue** across the top 12 investment banks in the five years leading to 2016²

High cost of non-traditional risk

- **\$9.79 billion in fines** paid by the largest ten investment banks globally in the first eight months of 2016³

Increasing reliance on systematically important providers

- **About 80% of the global derivatives reporting markets** is handled by DTCC's Global Trade Repository⁴
- **70% of all global ETF assets** are managed by the three largest ETF providers⁵

Difficulty accessing opportunities in emerging markets

- **12% of global private capital investment** goes to emerging markets, despite the fact that they account for most of global GDP growth⁶

Pressure on derivatives and hedging markets

- **Ten-year low in gross market value of outstanding over-the-counter (OTC) derivatives** as of July 2017⁷

AI has the potential to democratize access to capital across the global economy by unlocking greater efficiency, safety and performance in capital markets

The rise of AI will initiate and accelerate the following changes in capital markets:

Specialized digital tools will proliferate across the deal-making value chain, shifting the workload of bankers in both the front and the back office

Deal-making and investor matching will be increasingly automated, reducing the defensible advantage of the “best-connected” firms and requiring new core competencies

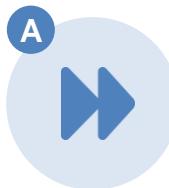
Financial models will become more accurate, improving the ability to extend financing to early-stage or distressed companies

Capital and risk management will be a differentiator, as firms specialize in new margin calculations and offsetting tools

Key AI-enabled strategies in capital markets include:

Strategy A

Simplify the deal-making process



→ E.g. use predictive analytics to automate due diligence

Strategy B

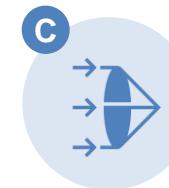
Improve investment performance through research insights



→ E.g. use machine learning to pinpoint deal prospects based on non-traditional or unstructured datasets

Strategy C

Deploy advanced capital and risk-management solutions



→ E.g. use machine learning to detect and report anomalies in stress-testing results

The following slides will explore each strategy, detail the components and highlight key examples



AI can perform administrative tasks faster and better than humans, enabling the latter to focus on higher-value activities

- Why simplifying processes matters

Need for fast and responsive experiences

As commercial due-diligence tools become more important in the digital environment, firms will need to enable faster decision-making on possible deals

Scope of market offering

Lean operations allow for opportunities to service smaller deals and clients, improving the accessibility of otherwise high-cost capital market offerings

Prediction of falling revenues

Fees in the global IPO market have declined from \$12 billion in 2007 to \$4.3 billion in 2017,⁸ pushing institutions to look to cost savings for profit growth

- Observed opportunities

➤ Automate pre-trade analysis, due diligence and administration

Pain point

There are a large number of manual and low-value tasks throughout pre-deal analysis, which are often completed by highly trained investment professionals

Due diligence, prospectus preparation, roadshows, pricing and other processes are labour-intensive and slow, yet they must be handled by highly skilled staff. Many rote tasks in these processes, such as analysing documentation and legal requirements, can be automated, freeing up banker capacity to focus on higher-value interactions

New capabilities

- **New document-preparation tools** and platforms allow for the large-scale automation of key services such as due-diligence documentation and routine preparatory tasks

- **Digitized information sharing** enables content such as reports, performance data, pitch decks and legal documents to be easily circulated with deal prospects in open and automated virtual data rooms

AI and/or Advanced Automation Examples



Goldman Sachs' Deal Link digital interface has enabled it to automate half of the 127 steps of informal IPO checklists⁹



CENTRL's automated due-diligence platform, Assess360, provides a central repository for all diligence content, where all parties can view risk profiling and detailed analytics

➤ Automate investment monitoring and reporting

Pain point

Investors want to receive information in near-real-time on investment and deal performance to track how key financial metrics are developing

Most communications with clients require report preparation and data extraction from different sources. This slows client service as the information will not always be ready for communication immediately, and manual work is required to source data and prepare reports. This process can stretch a single update request to many days

New capabilities

- **Automated investor reports** can streamline the valuation process at scale through the collection, normalization and analysis of financial data using document recognition
- **Voice assistants** allow clients to ask an institution specific questions and receive personalized answers 24/7/365, reducing the reliance on manual work for rote question and answer

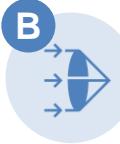
AI and/or Advanced Automation Examples



Clearwater automates data aggregation for investment accounting and reporting by automating data intake and making it easier to produce necessary reports instantly



Deutsche Bank and IBM Watson have announced a partnership to implement a cognitive advisory tool to support clients and advisers in internal and external processes¹⁰



AI can help discover promising investment opportunities by tracking down patterns that are not detectable through conventional research methods

- Why advanced research insight matters

Reliance on tacit information

Investors often over-rely on relationships to identify deal opportunities, even through data-driven, analytical approaches are now available

Growth in quantitative buy-side processes

Sell-side institutions struggle to provide services to quantitative investors, particularly when pitching private companies where data is less available

Risk of new entrants

New players are automating relationship-based processes and mining public data to find companies and teams with unique features

- Observed opportunities

➤ Achieve better investment performance by using new data in opaque markets

Pain point

Market and deal analytics for growing companies (e.g. IPO stage) is slow and labour-intensive

There is notably less data available for venture capital firms to analyse target companies, compared to later-stage organizations. Furthermore, many investments happen in frontier industries where rules and trends are often unpredictable. Even for later-stage companies with predictable financials, scaling analytics is challenging when certain information is missing (e.g. audited financials)

New capabilities

- **Analysis of unstructured data** (e.g. old deals, total money raised, founding-team background etc.) using machine learning can generate indicators of future success

- **Increased speed of analysis** using machine learning allows institutions to test correlations in a more automated way. This reduces the effort required to build models, freeing resources to do more qualitative analysis (e.g. interviews)

AI and/or Advanced Automation Examples



HOF Capital, Hone Capital, Correlation Ventures and others are adding quantitative analysis to venture financing by building tools to filter for deal prospects using criteria such as number of PhDs, founders who worked at successful technology companies, and tier-one university team members. Datasets can be pulled from public sources such as Crunchbase and analysed at low cost

➤ Use predictive models to improve deal identification, pairing and sales activities

Pain point

Historically, the capital-raising process has been highly intermediated, driven by referrals and face-to-face networking, making it labour-intensive and inefficient

Firms are reliant on, and limited to, the knowledge of brokers, resulting in suboptimal pairing of investors and investments. This reduces the overall efficiency of capital markets and performance, both for investors and growing companies

New capabilities

- **Synthesis of deal prospects** and “partners most likely to invest” using machine learning can improve sales efficiency. Proprietary data from investment banks can be used to understand the views and preferred opportunities of different investors

AI and/or Advanced Automation Examples



JPMorgan introduced the “Emerging Opportunities Engine”, which helps identify clients best suited for follow-on equity offerings via automated analysis of financial positions, market conditions and historical data¹¹



Kognetics uses a system to find and catalogue data, to identify attractive acquisition candidates in the technology industry



AI allows institutions to track their risk exposure more accurately and optimize capital reserves in real time

- Why better risk management matters

Pressure from new regulatory requirements

There is mounting pressure to increase capital margins, requiring more sophisticated capital-optimization techniques

Need for more accurate risk management

Increased customization of risk profiles allows for earlier and more accurate risk estimation, which can limit unwanted exposure

Increasing margin costs

Dealers have changed the way they price OTC derivatives to reflect funding costs (e.g. funding initial margins for non-centrally cleared derivatives)

- Observed opportunities

➤ Develop real-time pre- and post-trade risk management solutions

Pain point

Inefficient calculation of initial margins ties up capital and increases costs, particularly when regulatory frameworks are increasingly focused on risk mitigation and de-leveraging

Initial margin-optimization processes are a function of several variables, such as counterparties and underlying assets. Standard optimization algorithms are limited in their ability to take a complex mixture of parameters into account without significant effort

New capabilities

- **Pre-trade risk analysis** can determine the impact of different trade scenarios on overall portfolio positions and factor in the cost of risk capital in profitability calculations

- **Continuous risk modelling** enables institutions to automate risk models, understand changes to exposure in real time and recalibrate capital levels

AI and/or Advanced Automation Examples



DTCC is testing services that inform clients of the capital-ratio impact of trading strategies before, rather than after, trades are completed



Kinetica provides investment firms with tools for near-real-time tracking of risk exposure, enabling the continuous monitoring of capital requirements

➤ Use broader and better data to develop predictive risk models that drive capital savings

Pain point

Excess capital must be kept to meet liquidity requirements due to risk-model inaccuracies from limited use of data

Accurate risk measurement is highly dependent on the quality of data used by risk models, as well as the risk methodology itself. A limited number of datasets are currently used compared to the wealth of unstructured and semi-structured datasets available, which could help validate risk models

New capabilities

- **Scrutinizing alternative datasets** with machine-learning algorithms can improve the coverage and granularity of risk models, as well as improve the quality of data fed into the system overall

- **Analysis of new risk parameters** that influence initial margin requirements via machine learning (e.g. offsetting pairs of trades, offsetting strategies at the same dealer, and innovation in trades from one dealer to another)

AI and/or Advanced Automation Examples



JPMorgan has redesigned its Market Risk platform, which now manages over one billion risk sensitivities and provides visibility 17 times faster¹²



Standard Chartered published a paper outlining cases where AI outperforms standard algorithms for optimizing margin valuation adjustment¹³



Natixis's equity derivatives business uses machine learning to detect anomalous projections generated by its stress-testing models¹⁴

Looking forward

1

While increased efficiency in deal-making may have clear benefits for the global economy, supervisory bodies will struggle to keep pace with innovation, creating potential gaps in macro-prudential oversight

2

AI will be core to the matching of buyers and sellers, in both listed exchanges and over-the-counter markets

3

As portfolio management is increasingly digitalized and customized to the individual, sell-side institutions may consider the opportunity to engage investors and consumers directly without intermediaries

4

Market participants must ensure an ethical, transparent and explainable distribution of capital, which may require new tools and processes when these decisions are aided by AI

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Market infrastructure

Sector exploration

The shift of service offerings beyond trade facilitation exposes infrastructure providers to new strategic and operational challenges

Overview

Sector description and chapter scope

Market infrastructure refers to all entities providing venues, information, networking and IT, custody, clearing and settlement services to capital market participants engaged in trading (i.e. services to broker-dealers, and sell-side and buy-side actors).

This chapter will focus on underlying infrastructure products and service providers, while active financial market participants are discussed in the Capital markets section of this report.

Chapter scope					
					Covered in Capital markets
Pre-trading and execution	Post-trading processing	Core technology infrastructure	Information and data	Deal-making process	
<ul style="list-style-type: none"> Order management Price discovery Market making Risk management 	<ul style="list-style-type: none"> Clearing Custody Settlement 	<ul style="list-style-type: none"> Data management Network and IT 	<ul style="list-style-type: none"> Primary market data reporting Surveillance of activities 		

Sector trends

→ **Increasing use of central counterparty clearing** as more countries impose central clearing obligations and gradually extend them to new types of derivatives and counterparties

→ **Continued appetite for consolidation of exchanges** in spite of rising political and regulatory hurdles to cross-border deals^{1,2}

→ **Increasing competition in data markets** as infrastructure providers have aggressively diversified beyond trading activities and into data and analytics products

→ **Gradual outsourcing** of data hosting and non-core functions to technology service providers, based on rising confidence in the security and operational benefits offered by cloud operators

Issues facing the sector

Uneven growth across geographies

- 6% annual revenue gains for market infrastructure providers in Asia-Pacific vs. 3% in the US and 1% in EMEA in 2017³

New entrants and fintechs entering exchange services

- 15% of global fintech venture capital was invested in capital market infrastructure fintechs in 2016, up from less than 1% in 2011⁴

- 61% of World Federation of Exchanges members believe start-ups and large technology companies will have the most impact on market infrastructure in the next five years⁴

Certain asset classes lag in moving to electronic trading

- Just 19% of the trading volume of investment-grade corporate cash bonds is conducted electronically in the US as of early 2018,⁵ compared to around 90% for equities and forex spots⁶

Increasing competition with information providers

- 45% of Intercontinental Exchange's revenue was generated by data services as of 2017, up from 22% in 2014^{7,8}

Concentration of trading among critical providers

- 95% of OTC interest rates derivatives are handled by LCH.Clearnet⁹
- 98% of credit default swap clearing is conducted by Intercontinental Exchange⁹
- 88% of financial resources, including initial-margin and default funds, sit in ten central counterparty clearing houses (CCPs), raising concerns from regulators¹⁰

AI can bolster the resilience and efficiency of market infrastructure while allowing providers to augment their value proposition through new services

The rise of AI will initiate and accelerate the following changes in market infrastructure:

Speed of transactions for most asset classes is likely to accelerate as straight-through processing increases the speed of settlement

New asset classes will move to electronic trading as AI overcomes data-sharing and risk-management challenges for illiquid securities

Data services will be a core part of the infrastructure provider business model as automated processes enable high-quality content production that is both faster and lower cost

Supervision of the financial system will be reshaped as advanced fraud-detection and security features limit the ability of malicious actors to act without detection or retaliation

Key AI-enabled strategies in market infrastructure include:

Strategy A

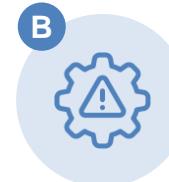
Streamline post-trade processes and increase cost efficiency



→ E.g. use image recognition and robotic process automation to reconcile trade data

Strategy B

Offer advanced compliance and risk management “as a service”



→ E.g. use machine learning to develop services that track down potentially fraudulent trading activity and filter out false positive flags

Strategy C

Develop value-added data and analytics services



→ E.g. use AI to compute economic indicators and swiftly compile marketable trading data and reports

Strategy D

Introduce new order and settlement types



→ E.g. use predictive analytics to optimize order execution in unstable market conditions

The following slides will explore each strategy, detail the components and highlight key examples



AI allows institutions to automate reporting and better integrate workflows, reducing manual labour and improving straight-through processing

- Why streamlining matters

Speed of settlement

Clients are increasingly demanding faster, more connected and more tailored functionality from market infrastructure providers

Support for automated processing

Firms today are more open to automated post-trade solutions that were previously deemed too sensitive to operational risk to change

Increasing risk awareness and regulations

Increasing focus on risk management is motivating market participants to seek solutions that address inefficiencies in post-trade processing

- Observed opportunities

➤ Integrate post-trade workflows to achieve straight-through processing

Pain point

Post-trade processes are slow and costly due to the amount of disparate systems, requiring manual operation and input

Post-trade processes involve several disconnected trading and back-office systems as well as external interfaces across institutions and vendors, which limits straight-through processes. The fragmented nature of capital markets creates many breakage points where systems are not interoperable

New capabilities

- **Data normalization** can detect input and output type, facilitating interoperability across different systems with different data standards, headers and reporting frequencies

- **Robotic process automation** allows institutions to automate systems integration with external workflows with limited reprogramming, simplifying the development of automated multi-vendor platforms

AI and/or Advanced Automation Examples



GlobalCollateral

DTCC-Euroclear Global Collateral, a joint venture between Euroclear and the Depository Trust & Clearing Corporation (DTCC), and NEX, announced a new partnership to streamline and improve OTC derivatives margin-call processes. This manages the entire margin-call process on the triResolve Margin platform, achieving greater straight-through processing¹¹

➤ Automate reconciliation and incident reporting to improve service quality and cut costs

Pain point

Reporting and reconciliation of irregular transactions often requires manual investigation, regardless of the severity of the abnormality

Post-trade processes are one of the largest sources of errors in both trading and operational risk management due to the level of manual intervention required in processes such as trade life-cycle management, position reconciliation, trade fails management and reporting

New capabilities

- **Automation of review** and reconciliation of trades can reduce manual efforts in workflows and optimize cycle times, generating greater efficiencies and minimizing operational costs
- **Analysis of process failures** using machine learning allows firms to search for patterns in incident data to predict future incidents and prepare advanced incident and exception management

AI and/or Advanced Automation Examples



truePTS, owned by the exchange trueEX, is a post-trade-processing platform using robotic process automation, NLP and other automation techniques to automate manual post-trade processes. It offers matching and validation engines as well as AI voice deal-capture technology



AI is creating new opportunities to develop software ‘as a service’ solutions that address the regulatory and compliance pressures faced by clients

– Why efficient compliance matters

Increasing regulatory pressure

New regulatory programmes are increasing reporting requirements, creating the opportunity to market standardized and scalable solutions

Constraints of traditional service offerings

Infrastructure providers’ “core” product shelves are limited, creating the opportunity for internal capabilities to generate new revenue streams

Ever-changing regulatory requirements

Institutions are continuously working to comply with new regulations. Technology services have the opportunity to centralize this effort

– Observed opportunities

➤ Deploy holistic market-surveillance services

Pain point

Market surveillance is performed inefficiently, with work duplicated across many institutions
 Rules-based approaches to detect market abuse are based on retrospective flagging of transactions using individual institutions’ incomplete transaction histories. While every financial institution needs to adhere to certain surveillance requirements, systems that are built internally cannot use insights from transaction patterns across institutions, limiting the accuracy of internal systems

New capabilities

- **Advanced surveillance systems** using machine learning can bring together providers’ “whole-market” order data and other unstructured data (e.g. traders’ messages) to increase accuracy and reduce false positive rates

- **Modularized and digital systems** with straight-through processing can be deployed as market surveillance “as a service” for clients, reducing their infrastructure and implementation requirements while increasing surveillance accuracy

AI and/or Advanced Automation Examples



Nasdaq’s SMARTS uses AI to deliver “360-degree surveillance” for buy- and sell-side clients, covering significantly higher global market standards^{12,13}



Software AG’s market-surveillance system analyses real-time and historical data across asset classes and markets to create flags for positive and negative trading patterns

➤ Automate alert triage, investigation and reporting

Pain point

A significant number of compliance costs arise due to regulatory reporting requirements for transactions that have been flagged as suspicious

Every positive alert in today’s market-surveillance engines needs to be validated, classified and documented. This is often a manual process that requires the collation of data from various sources in order to complete paper reports that will be submitted to regulatory bodies and risk groups

New capabilities

- **Score alerts** based on severity and potential exposure of the client or the institution to risk. Institutions can use this scoring to ensure analysts prioritize the most pressing investigations

- **Automated report drafting** can allow draft reports to be issued upon signal of an alert, reducing the processing time from when each alert is generated through to completion of a report and action, if required

AI and/or Advanced Automation Examples



Sybenetix’s real-time decision-support tools flag suspicious market activity to compliance teams and provide analytics to detect false positives



B-Next’s CMC:Suite uses speech analytics to search and analyse trading voice-call recordings and expedite investigation capabilities



AI is allowing infrastructure providers to introduce new insights by experimenting with their unique access to trade data

- Why new services matter

Emergence of a new data market

Increasing demand for data, combined with new technologies, will lead to accelerated product development and sharpened competitiveness

Value-chain diversification

Potential new revenue streams exist through the provision of multifaceted datasets, tools for pre-trade insights and predictions, and other services

Excludability of data ownership

Providers that operate in multiple markets across asset classes are in a unique position to create valuable and proprietary datasets and insights

- Observed opportunities

➤ Develop macroeconomic indicators using internal data

Pain point

Market participants use imperfect indicators for valuation

Macroeconomic indicators are often presented as periodic indicators based on surveys. This means there is a delay in factoring rapid shifts in macroeconomic data into market models, creating a risk of mispricing for capital markets participants

New capabilities

- **Macroeconomic forecasting** using machine learning, and the depth of price and order data within infrastructure providers, can allow the provision of new analytics services that can predict market performance in real time

AI and/or Advanced Automation Examples



ICE Data Services brings together data from the Intercontinental Exchange, New York Stock Exchange and the International Data Corporation that can be used in economic analytics, valuation and connectivity solutions¹⁴

➤ Offer insights on market structure and risk

Pain point

Market microstructure presents risks and costs that often go unaccounted

Information contained in order books often goes unanalysed as institutions lack the access, expertise or resources to effectively understand the data

New capabilities

- **Real-time transaction cost and analytics** can be calculated using machine learning to understand how certain trades or trading strategies will affect a variety of indicators (e.g. liquidity, bid/ask spreads). Participants (e.g. high-frequency traders) could use these analytics to plan their trading strategies

AI and/or Advanced Automation Examples



Deutsche Börse is expanding its data service to provide high-volume raw data from across the order life cycle with low latency, error rates and noise^{15,16}

➤ Sell internal analytics capabilities “as a service”

Pain point

Customized insights solutions that use internal and external data are difficult to build

Data necessary for next-generation insight services will need to combine market data (e.g. pricing and order data) with non-traditional external data sources (e.g. news analysis) alongside expertise, and AI tools

New capabilities

- **Flexible data integration** can generate unique and customized insights using internal data, third-party data sources and data from clients
- **Advanced analytics engines** and proprietary tools capable of interpreting raw data can offer unique insight into the behaviour of different classes of traders

AI and/or Advanced Automation Examples



S&P Global has acquired **Kensho**, a provider of machine-learning and analytics tools, allowing S&P to deepen its presence in customer value chains and connect with clients during the deal-discovery and pre-trade analysis processes¹⁷



AI allows institutions to deploy new order types and settlement methods that protect long-term and risk-averse investors

- Why better execution matters

Competing on best execution

The proliferation of complex and opaque trading practices across traditional public exchanges has increased demand for transparency and fairness

Unique order-history data

Infrastructure providers' unique access to full trade histories means they are best positioned to model the impact of order types and design new products

Better segmentation of customers

Long-term investors have different requirements and risk appetites to arbitrageurs when it comes to the speed and price of execution

- Observed opportunities

➤ Deploy trade-protection models for long-term investors

Pain point

Investors are exposed to adverse order outcomes

Market-surveillance activities are retroactive rather than proactive, exposing risk-averse investors to negative effects from illegal activities, predatory trading strategies or price quote instability (e.g. from high-frequency trading)

New capabilities

- **Predictive market-surveillance models** using machine learning can anticipate adverse impacts from predatory, high-frequency trading strategies and protect orders from retail or long-term investors

AI and/or Advanced Automation Examples



IEX Trading has introduced machine-learning techniques to create new order types that protect trades from execution during unstable, potentially adverse conditions (e.g. best bid or best offer is about to decline or increase)¹⁸

➤ Enable dynamic order types

Pain point

Limited order types restrict strategy options for investors

Market design can mean the outcomes of transactions and auctions have a significant effect on the market. By limiting order types to a simple set, market designers are actively restricting the goals that investors can seek

New capabilities

- **Trade-optimization engines** can be used to execute trades in market auctions with the goal of optimizing certain metrics (e.g. volume, price or speed)

AI and/or Advanced Automation Examples



Google uses machine learning in its real-time advertisement-placement marketplace. This allows companies to place ad orders on the Google AdWords network based on additional objectives (e.g. to maximize conversion) as opposed to only price¹⁹

➤ Use dynamic execution to improve trade speed and price

Pain point

Signals created by orders can adversely affect execution price

Institutional clients create market signals when they undertake portfolio or sector rotation, or make changes that require large market transactions. These signals can be used by traders to profit from a changing order book, resulting in worse prices for institutional clients and often slower and more uncertain execution

New capabilities

- **Real-time price-impact modelling** can apply machine learning to predict the price impact of a given order, and the resulting transaction costs
- **Trade fragmentation** using AI can divide a large order into smaller orders placed over a longer time horizon to best mitigate price movements and execute at the best price

AI and/or Advanced Automation Examples



JPMorgan is testing a system called LOXM in its European equities business. It learns how to execute client orders with maximum speed at the best price (e.g. how best to offload big equity stakes without moving market prices)²⁰

Looking forward

- 1 New service offerings will make infrastructure providers more resilient and improve participants' access to analytics, yet they will also raise questions about ownership of data and conflicts of interest
- 2 Increased automation will make global trading much more streamlined. However, participants risk being exposed to further malicious activity from new participants integrated into digital trading networks
- 3 As market infrastructure becomes increasingly global, digital and complex, institutions will struggle to track their fragmented regulatory requirements
- 4 As data-service providers become critical to the functioning of the financial markets, new standards may be necessary to ensure the quality, accuracy and availability of data
- 5 Increasing the speed of transactions and the velocity of money will challenge institutions and regulators to address the increased risk of financial contagion during market turbulence

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20. "JP Morgan Develops Robot to Execute Trades". *Financial Times*. Retrieved from <https://www.ft.com/content/16b8ffb6-7161-11e7-aca6-c6bd07df1a3c>

How might the continued evolution of AI affect the future of financial services?

Selected “what if?” scenarios for the long-term implications of AI for financial services

The continued evolution of AI will enable new leaps in capabilities, causing further disruptions in financial services

— Overview of AI-driven future scenarios

AI's development is unpredictable and, through our research, we encountered several **future scenarios** that may not be feasible given the technology currently available and the existing regulatory structures. Nonetheless, these scenarios represent fundamentally different ways of thinking about financial services that merit consideration in the public and private sectors alike

— Selected future scenarios



Death of deposit accounts



Insurers act as “lines of defence”



A central claims fraud utility is formed



Disappearance of funds



Rise of a master insurance model



Illiquid assets are tokenized



Everything is managed wealth



Online platforms become debt warehouses



A central anti-money-laundering utility is formed

The following slides will explore these scenarios across sectors, examining their implications as well as degree of possibility



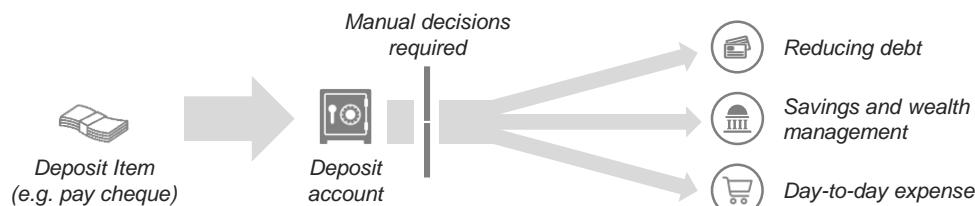
What if... cash was continuously and automatically allocated across financial products, leading to the death of deposit accounts?

What if...?

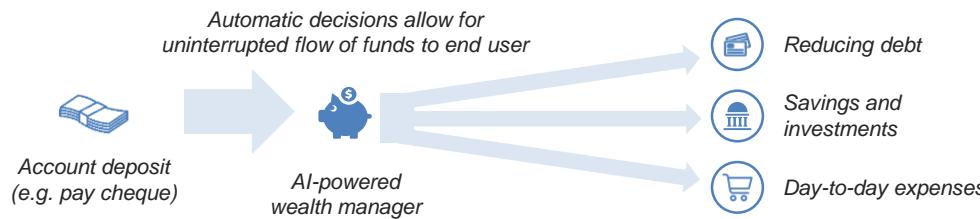
Common deposit accounts, where money sits idle earning no interest, cease to exist:

- Wealth managers move to become the centre of the retail customer experience, managing all flows of money for customers
- Funds flow to the “optimal” account, including debt, savings and spending categories – matching customers’ “mental accounting” of their overall budgets and accounts

Current state



Future state



Why might this happen?

- **Customers' desire to manage their money better**, and a behavioural understanding of “mental accounting”, are the drivers behind this development, which allows better personal financial management. By clearly articulating spending categories and allocating funds directly to accounts, this trend helps customers realize their aims better than they could through manually managing their own cash flows
- **Increasing levels of automation allow institutions to optimize deposits** in real time (e.g. pay debts to cut interest expenses), reducing the need for customer interaction

What would be the implications?



Customers' financial health is radically improved through optimized savings rates and automated loan repayments that minimize interest expenses



Deposit accounts are no longer the locus of control for customers as the centre of the retail customer experience shifts to financial-management platforms, reducing interaction points between large banks and customers



Demand deposits shift further into the capital markets and wealth industry and away from the balance sheets of retail banks



The cost of funds for lenders increases significantly as liquid deposits become increasingly scarce



The demarcation between spending, borrowing and wealth management breaks down as one service-based offering manages the flow of customers' money across multiple accounts



Current regulatory frameworks, largely focused on liquidity and leverage, need to be adjusted for a new banking model that is not centred on demand deposits

WHY HASN'T THIS HAPPENED?

- Ensuring that an offering can automatically make optimal choices on behalf of customers requires the development of AI solutions that can consider a broad set of financial and non-financial information to understand customer contexts comprehensively
- Institutions are restricted by regulation in their ability to transfer funds across other institutions and across accounts without explicit, per-transaction customer consent, limiting the ability to automate flows of money



What if... insurers transition to becoming providers of 'lines of defence' in addition to 'funders of last resort'?

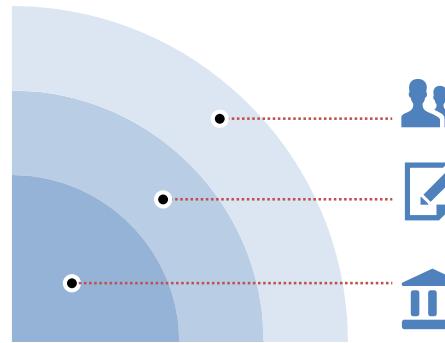
What if...?

Insurance becomes focused on preventing risk, in addition to pooling risk as a last resort, by:

- Using internal and external datasets (e.g. real-time sensor data), allowing insurers to predict loss events with greater accuracy and pre-emptively deploy loss-avoidance services
- Prompting users with actionable recommendations based on real-time data (e.g. IoT devices, weather feeds), detecting when clients are not covered by their current insurance policy and "nudging" them to purchase additional insurance



Insurer – lines of defence



Risk prevention and advisory

e.g. "Alert: you left your window open in the rain"

Proactive policy augmentation

e.g. "Hurricane season approaching – would you like to add flood insurance?"

Claims and recovery

e.g. "We've deposited \$500 in response to water we detected in your basement"

Why might this happen?

- The continued proliferation of connected devices** in homes, cars and public spaces creates a large breadth and depth of data that – in conjunction with advanced predictive models – is used to provide proactive, real-time advice to prevent losses
- Modularization and commoditization of common individual general lines** leads insurers to seek new differentiators and sources of loss-ratio optimization

What would be the implications?



Customers experience fewer property losses as the new focus on prevention at insurers reduces their risk exposure



Policyholders have increased transparency with regard to policies and coverage as they are updated on the risks to which they are exposed and alerted to situations for which they are not covered



Insurers focus on creating positive touchpoints with customers, in addition to minimizing negative touchpoints that are associated with claims and damages



New monetization models emerge as reduced loss rates lead to declining prices, and revenue is instead generated by prevention services



The ethics of data use and targeted pricing in insurance products need to be revisited as highly accurate models create "risk pools of one" and potentially price certain segments out of the insurance market

Why hasn't this happened?

- Current analytical tools are not sophisticated enough to enable the precision and accuracy required to provide customers with valuable preventative advice, or to augment policies, in real time. Access to the required data is not yet easily available to insurers
- Insurers have historically been unable to demonstrate to customers the benefit of connected devices, as these are often seen as punitive features (e.g. telematics devices punishing bad drivers) rather than as being in customers' best interests



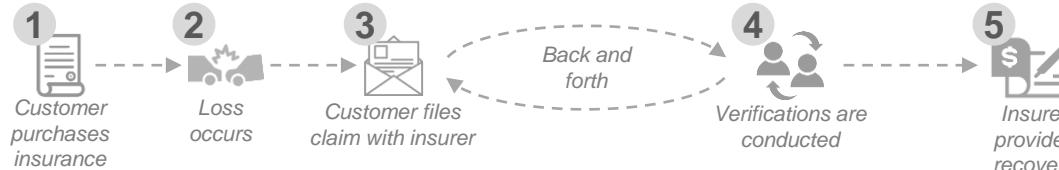
What if... all insurance claims were routed through a central fraud-prevention utility before payments were made?

What if...?

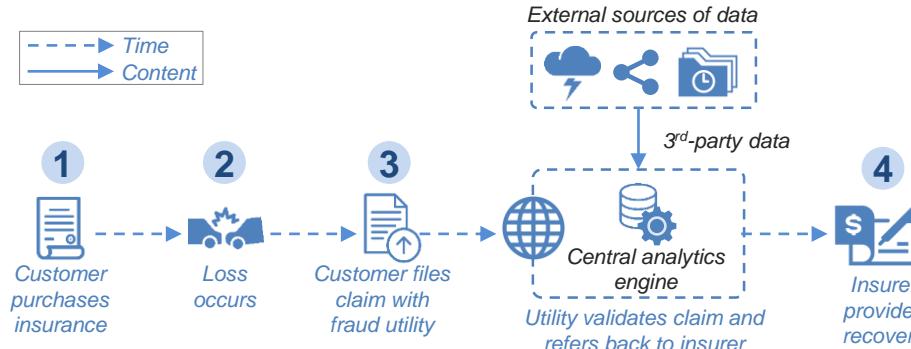
A central fraud-prevention utility for insurance claims is formed, to which all claims are sent, by:

- **Consolidating claims data across insurers into one central utility**, which uses an advanced, AI-based model to more accurately identify fraud and reduce false positive rates
- **Filtering out fraudulent claims** and approving legitimate claims for policy issuers to pay damages

Current state



Future state



Why might this happen?

- Fraud is a systemic issue as malicious actors often target multiple institutions with similar methods. The development of collective intelligence allows institutions to dramatically reduce the financial cost of fraud
- The focus on fraud protection distracts institutional investment and executive focus from more pressing, competitively significant priorities. A collective utility would provide institutions with greater certainty that they are protecting themselves from excess loss

What would be the implications?



Improved claims experience for customers since a central utility would decrease false positives and reduce the processing time for investigations



Reduced cost of handling claims for insurers as the utility more efficiently identifies fraud and removes the need for expensive fraud investigations. Insurers may pass on these savings to customers through lower premiums



Reduced fraud losses because the central utility can more accurately identify fraud and blacklist malicious actors across the entire insurance environment



Insurers need to find new differentiators as differences in operating efficiency across institutions partially normalize due to the central claims fraud utility, increasing focus on more direct modes of competition



A larger number of the insurance workforce may be displaced as many current claims-verification personnel across different institutions are made redundant



Regulators become critical to the development and ongoing monitoring of the central utility to ensure the system is fair and to develop safeguards against abuse

Why hasn't this happened?

- AI solutions are not yet able to fully automate the claims fraud prevention process, which relies heavily on manual analysis and human judgement
- Connectivity and sensor data for insured goods (e.g. vehicles, homes) is not ubiquitous and will not be for several years, until IoT adoption matures, inhibiting the immediate availability of high volumes of reliable primary data
- Financial institutions are wary of sharing sensitive customer data with third parties in the current regulatory environment, reducing the willingness to collaborate

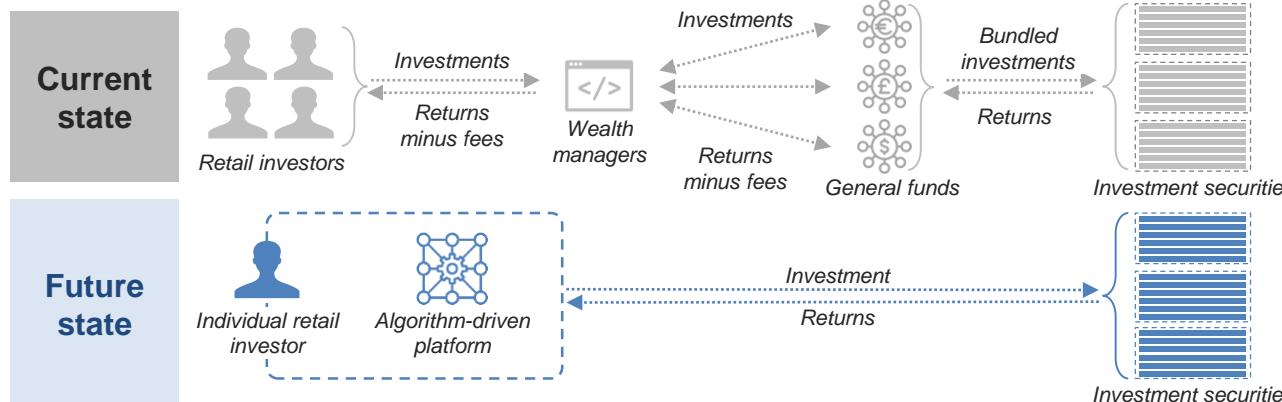


What if... a digital wealth manager invented a platform that built 'funds of one' for each of its clients?

What if...?

An asset manager, focused on self-serve clients, invents an algorithm that can invest in the full market, akin to an ETF but at an individual level, by:

- Allowing individual investors to directly own portfolio assets, with custom portfolio weights determined by their investing needs, effectively eliminating intermediary mutual funds, ETFs or other aggregated investment vehicles, and thereby reducing fees considerably
- Allowing investment managers to automatically create optimal asset allocations for investors, in a fashion similar to current robo-advisers, but by investing directly in market assets. This offers dynamic investment strategies capable of being customized, as opposed to relying on retail funds



Why might this happen?

- Independent robo-advisers can disintermediate asset managers from the investment process, reducing the cost of managing portfolios for clients and bolstering their low-fee value proposition
- Integrated asset managers (e.g. Vanguard, BlackRock) have an opportunity to act as first movers and deploy research and development capabilities that disrupt robo-advisers

What would be the implications?



Customers see lower fees and increased customization through the disintermediation of several layers of asset management



Front-end wealth managers need to quickly develop new core capabilities as they now need to own and harvest core asset-management capabilities akin to funds



Asset managers face the disappearance of funds as hedge funds, ETFs and other asset managers go out of business and are replaced with a new form of asset ownership



Regulators see increased herd risk as few platforms and a limited set of algorithms eventually grow to have an outsized influence on the market



Independent robo-advisers face a fierce competitive response as established asset managers pursue further vertical integration to compensate for the erosion of their legacy ETF business

Why hasn't this happened?

- AI is not yet robust enough for sensitive and high-impact processes (e.g. risk management and capital adequacy) to function without human oversight, nor can it integrate with non-electronically traded asset classes
- Transaction costs at the venue level need to fall so that bulk trades and individual trades become comparable with respect to cost
- Legal requirements for filing and disclosing within funds need to evolve or be automated to facilitate individual-level funds



What if... an insurer builds a master AI solution that incorporates claims, policy issuance, pricing and other activities into a single model?

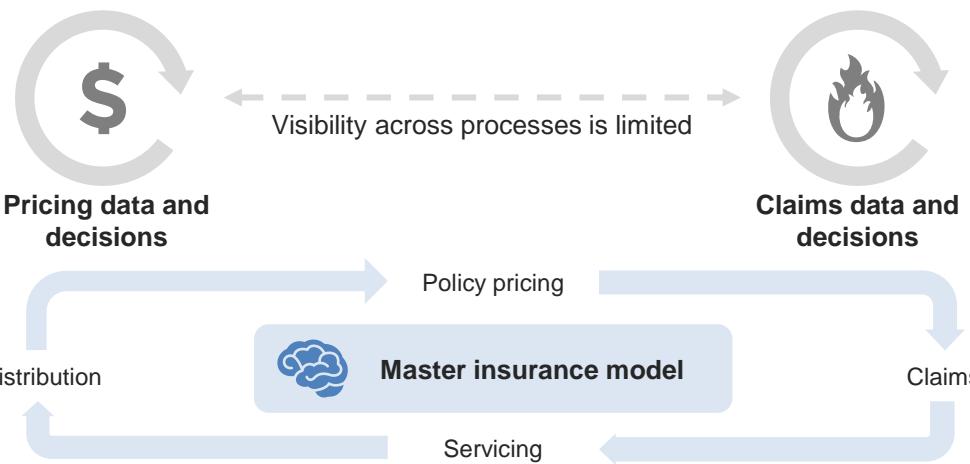
What if...?

Insurers implement AI to integrate pricing, distribution and claims data into a single real-time decision-making engine that executes all decision-making by:

- Using claims data to inform and optimize underwriting in real time, ensuring that pricing engines incorporate new information immediately and have the most accurate view of risk
- Developing “profiles of one” in underwriting through dynamic risk assessments rather than static risk tables, creating a self-learning pricing engine rather than one that requires manual updates from actuaries

Current state

Future state



Why might this happen?

- Insurance pricing is inherently a function of the probability and severity of potential claims with a given policy, yet today pricing and underwriting engines are segregated from claims-adjudication functions. Connecting these datasets in real time gives insurers improved pricing efficiency that leads to improved profitability
- AI-driven solutions are already being used in pricing and claims processes, in addition to AI-based data-integration solutions. The next step is packaging these in a comprehensive, integrated system

What would be the implications?



Increased short-term variance in pricing for customers as prices are not static and prone to change in real time – making it more difficult to compare policies



Insurers' competitive focus moves to developing the best-in-class AI data-science capabilities, as model accuracy is a greater determinant of profitability than scale of distribution or composition of risk pools



Multi-line insurers can more accurately price risk as their access to a wider breadth of data makes them better positioned to build more sophisticated and accurate models



Displacement of talent as the need for actuarial skills in underwriting is replaced by the need for technical and AI talent to build and maintain integrated insurance models



New ethical questions surrounding discrimination arise as near-perfect risk profiling may price certain individuals out of the market and risk creating “risk pools of one”

Why hasn't this happened?

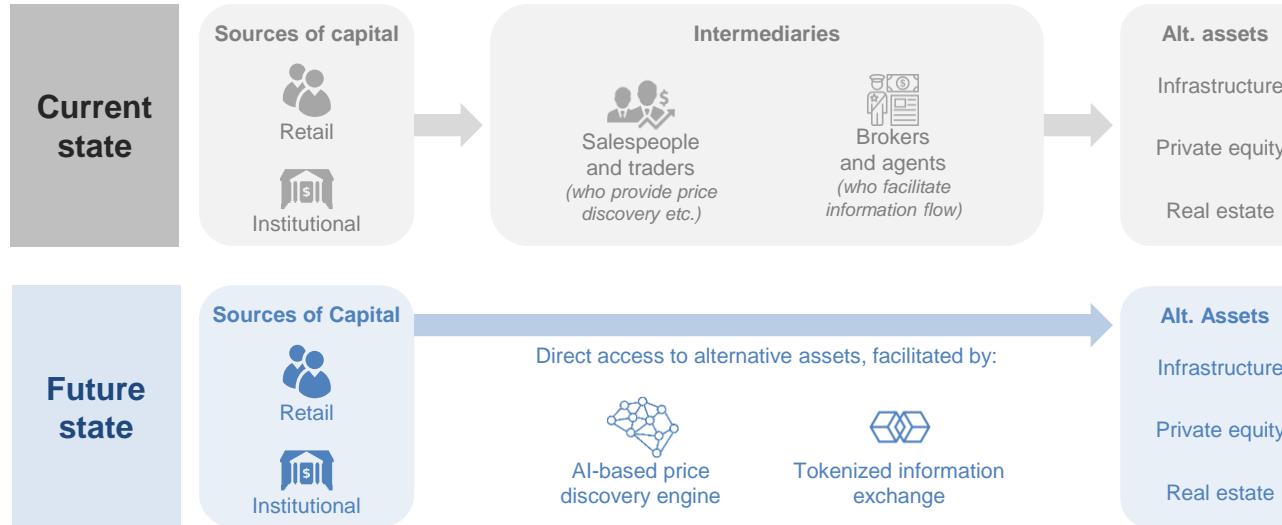
- Claims and policy applications are usually run using very different systems and datasets, requiring complex data-integration efforts to make this functionality available
- Risk-based pricing is heavily regulated; many insurers are not ready to switch to a fully AI-driven model due to uncertainty over performance, auditability and potential for bias
- While the cost of building such a system would be expensive, the magnitude of rewards from improved accuracy are uncertain, thus requiring institutions to make a big investment with undefined rewards

What if... illiquid asset classes were fully digitized using AI and distributed ledger technology, introducing liquidity and easy trading?

What if...?

A variety of illiquid assets (e.g. infrastructure, real estate, private equity/venture capital) were fully digitized and easily tradeable, as a result of:

- A tokenized system supported by AI that validates information about the underlying assets, as well as managing the exchange of ownership of capital and assets. This enables more optimal and democratized price discovery, settlement and clearing processes, minimizing the need for manual oversight



What would be the implications?



A dramatic increase in the liquidity of alternative assets as these asset classes become available to a broader range of investors



The creation of new connections between capital and assets, allowing new pools of capital to access alternative assets



Reduction in financial crime as increased transparency and liquidity leads to easier anomaly detection



Increased price and market efficiency as increased trading activity leads to lower spreads and more accurate pricing



Increased cross-border complexity since the characteristics of many illiquid assets vary significantly by region



Disintermediation of firms that act as brokers and information vendors, as more investors gain direct access to alternative asset classes, reducing the need for specialized intermediary players



The need for standards bodies to act as venues for collaboration on the governance of token exchanges

Why might this happen?

- AI can be used to analyse unstructured data to quantitatively evaluate assets (e.g. pricing), reducing the information asymmetries that characterize illiquid assets. This limits the need for specialized players who facilitate the flow of information (e.g. brokers, aggregators etc.)
- Technology is already being used to democratize access to asset classes (e.g. crowdfunded equity), suggesting customers are willing to use automated solutions to make investments in complex products

Why hasn't this happened?

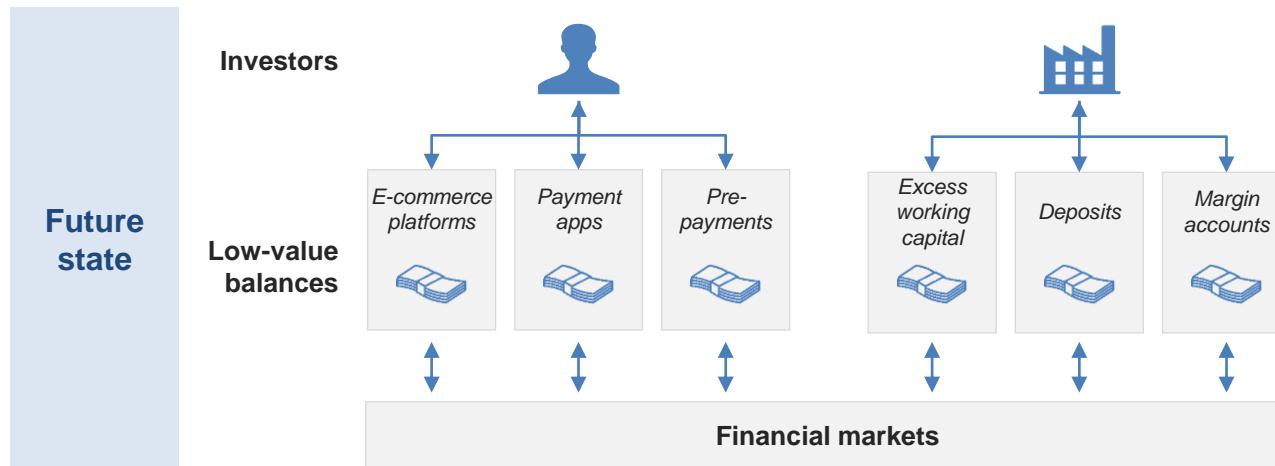
- AI is not yet fully able to build models from tacit knowledge to assess the financial metrics of alternative assets (e.g. trust, political risk etc.)
- Existing blockchain-based digital markets are impeded by both scalability and latency, limiting the efficiency that can be delivered by decentralized versus centralized solutions
- Information required to enable the tokenization of illiquid assets is often private and not available through digital channels, with limited proxy data available

What if... all accounts and balances of cash, regardless of where they are held, earned a return commensurate with their risk?

What if...?

Technology-enabled asset managers (e.g. robo-advisers) transform low-value balances into value-adding investments for their customers by:

- Using algorithms that automate the process of managing money, operating at little or no marginal cost
- Striking individual agreements with companies across industries, offering to unlock leftover balances on payments and e-commerce platforms, margin accounts and excess working capital
- Allowing institutions to earn a cut of the interest income, and passing on earnings to their customers



Why might this happen?

- **Modern payments infrastructure allows for faster and cheaper movement of money**, enabling institutions to seamlessly move funds across accounts using automated solutions to optimize customer returns
- **Expanded access to data** (e.g. through open banking) allows individual institutions to build a comprehensive understanding of customers' finances, even if they do not hold the funds themselves. Furthermore, portfolio construction is a relatively well-understood field and increasingly becomes a commodity, allowing for institutions to automate the process

What would be the implications?



Fragmentation of holdings and minimization of “dead cash” as customers hold funds in many interest-bearing accounts, across institutions. This increases the average return on money for customers



Wealth managers lose customer and asset ownership as wealth management becomes a subsidiary of the experience offered by other products



Increasing omni-channel complexity as navigating a multitude of investment delivery channels becomes a key capability for firms seeking to grow AuM



Scale of assets is no longer a dominant competitive advantage as there is a multitude of sources of investment returns outside traditional asset managers



Regulators need to manage an increasingly complex, fragmented ecosystem as the number of investment accounts and investment firms to which an individual is tied increases

Why hasn't this happened?

- Ensuring the suitability of investments across different institutions requires advancements in AI to process real-time data feeds and relate unstandardized datasets
- It is more cost-efficient to manage funds in a single institution, as high transaction costs make scale a critical requirement (i.e. to receive exchange-level volume deals). And with the current infrastructure, funds cannot flow quickly enough to fully unlock “dead cash”



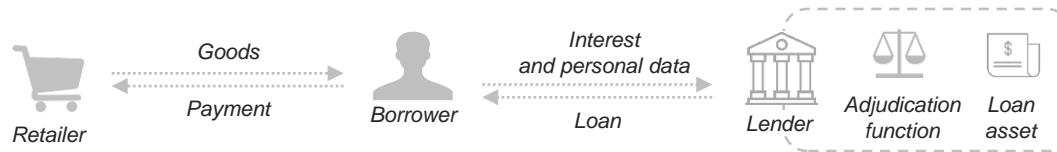
What if... e-commerce and business software platforms become the main point of lending for both retail and commercial borrowers?

What if...?

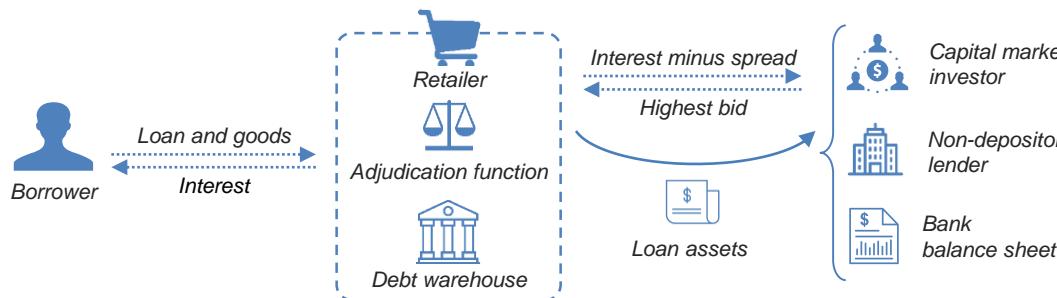
E-commerce and B2B software “as a service” platforms (e.g. Amazon, QuickBooks) enter the lending space by:

- Absorbing the loan-adjudication function, allowing them to price and underwrite loans based on their own proprietary methods
- Originating and temporarily warehousing loans on their books, selling them to the highest bidder through securitized and unsecuritized channels

Current state



Future state



Why might this happen?

E-commerce platforms (e.g. Amazon, Alibaba) own the market because they outperform financial institutions when pricing and underwriting loans:

- They have greater access to broad datasets, modern infrastructure and more mature AI capabilities, which cumulatively lead to more accurate and precise lending than traditional underwriting and pricing models
- As platforms’ relative accuracy increases, financial incumbents reach a tipping point where they earn higher net interest margins by participating in platforms and paying a spread or fee

What would be the implications?



Borrowers are granted highly customized terms as a result of better analytics but have to entrust more data to fewer, larger organizations



Platforms offer deals to encourage customer retention as they can bundle selective credit deals (i.e. low-margin products) with higher-margin products (e.g. subscription services, retail products)



Platforms earn the majority of lending profit pools by developing negotiating power over traditional lenders, giving them the ability to negotiate favourable deals with the lowest bidders



Lenders lose customer ownership and become balance sheet providers to platforms, in effect having to compete directly with capital markets participants to secure loan assets



Regulatory bodies need to quickly deploy new capabilities to assess risk and compliance within commercial platforms as well as banks

Why hasn't this happened?

- AI-driven pricing and underwriting algorithms that use alternative data are nascent and have not demonstrated sufficient increased accuracy over traditional methods to warrant wholesale switching
- Regulations upholding the separation of banking and commerce (e.g. the US under the Bank Holding Company Act) need to adapt to allow additional lending responsibilities to be absorbed by non-financial commercial entities



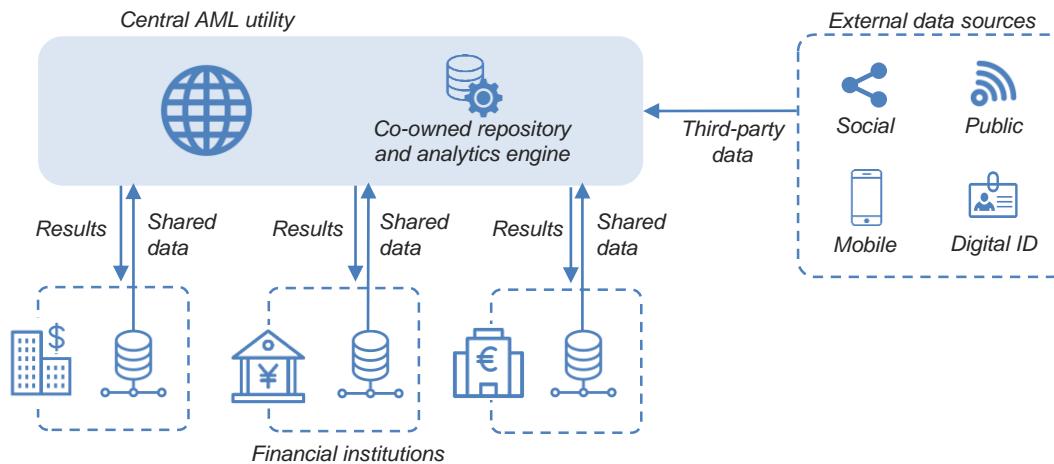
What if... anti-money-laundering (AML) surveillance were provided to all institutions by a centralized and collectively owned service provider?

What if...?

Instead of managing AML on an institution-by-institution basis, a central utility is formed by:

- Consolidated data-sharing and analytics models that allow for new, more robust prevention systems with more accurate detection and insight
- Development of “collective intelligence” to protect against money laundering, terrorist financing and other systemic threats, particularly threats employing transactions across multiple institutions that would otherwise be difficult to detect for any one institution

Future state



What would be the implications?



Increased financial inclusion as institutions and regulators become more confident in servicing customers with limited financial histories, or from more risk-prone geographical areas



Positive impact on financial institutions' bottom lines through cost savings in managing AML. Spillover benefits include the reduction in associated prices and a potential revenue uplift from targeting untapped markets



A consistent consumer-consent model is required as current privacy regimes may restrict the creation of a central utility and cross-border data movement



A redefined liability model is required to clearly identify and define the legal and financial responsibility structure for when AML requirements are breached



Increasing concentration of risk as a single false positive or false negative from a central utility is propagated through the entire financial ecosystem



Risk of displacement for a large number of financial professionals as many current AML personnel across individual institutions are made redundant

Why might this happen?

- Sharing data to form a central utility would allow institutions to access more advanced capabilities than even the most sophisticated incumbents could develop independently; machine-learning systems would be able to work on a more complete view of the transaction landscape, allowing institutions to identify suspicious patterns that may be spread across the environment
- Institutions would be able to collectively decrease costs through the commoditized service, removing efficient compliance as a source of competitive differentiation and allowing them to focus investment on more critical areas of expertise (e.g. investments in customer experience)

Why hasn't this happened?

- Current solutions are not sophisticated enough to derive meaningful insights from these fragmented cross-institution data feeds, which lack standardization and normalization
- Financial institutions are wary of sharing sensitive customer data with third parties, due to security, regulatory and competitive risks

Concluding thoughts

Next steps for the financial services ecosystem

AI's impact on the physics of financial services will demand increased collaboration to address emerging uncertainties

AI will introduce several uncertainties to the global financial services ecosystem

1

Systemic safety: As AI creates new types of risk in financial services systems (both at national and international levels), new risk-management and mitigation strategies will be required

2

Consumer protection: As AI automates decision-making processes, new methods of protecting consumers and ensuring the public interest is sheltered will be required

3

Human capital: As AI creates new forms of labour needs and displaces portions of the labour force, collective action by institutions and regulators will be required

The World Economic Forum will continue to explore outstanding questions and create venues for collaboration among stakeholders

1

Bring together diverse groups of stakeholders to explore the potential for collaboration, which can overcome key barriers to unlocking the value of AI

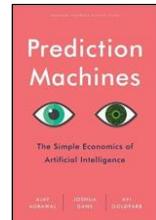
2

Convene industry leaders, regulators and public policy organizations to explore and address emerging societal issues

Additional reading

Additional reading

The following texts were instrumental in shaping the perspectives of the project team. For those interested in exploring further and learning more detail about the topics covered in this report, we highly recommend reading the following documents:



Prediction Machines
Ajay Agrawal, Avi Goldfarb, and Joshua Gans



Ghosts in the Machine
Baker McKenzie



Social Networks, E-commerce Platforms, And The Growth Of Digital Payment Ecosystems In China
Better Than Cash Alliance



The Seven Deadly Sins of Predicting the Future of AI
Rodney Brooks



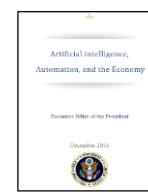
The New Moats
Jerry Chen and Greylock Partners



Bank of the Future
CITI GPS



When Will AI Exceed Human Performance?
Katja Grace, John Salvatier, Allan Dafoe, Baobao Zhang, and Owain Evans



Artificial Intelligence, Automation, and the Economy
Executive Office of the President, Obama White House



Artificial Intelligence: Potential Benefits and Ethical Considerations
European Parliament



Artificial Intelligence And Machine Learning In Financial Services
Financial Stability Board



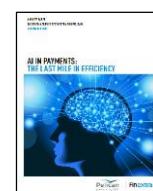
Artificial Intelligence, Ethics and Enhanced Data Stewardship
The Information Accountability Foundation



Machine Platform Cloud
Andrew McAfee and Erik Brynjolfsson



Outlook On AI in the Enterprise
NarrativeScience



AI in Payments: The Last Mile in Efficiency
Pelican and Finextra



Humans Wanted
RBC



Intelligent Automation
UBS

Acknowledgements

Contributors (1 of 6)

The project team would also like to express its gratitude to the following subject matter experts who contributed their valuable perspectives through interviews and by participating in workshop and roundtable discussions (in alphabetical order):

Mikaal Abdulla	8 Securities	André Bourbonnais	Public Sector Pension Investment Board
Raul Abreu	HSBC	Andre Boysen	SecureKey
Jeremy Achin	DataRobot	Jon Bradford	Motive Partners
Mukul Ahuja	Deloitte LLP, Canada	Lise Estelle Brault	Autorité des Marchés Financiers
Elena Alfaro	BBVA	James Breeze	XL Catlin
Dr. Larisa Angstenberger	AIM	Macro Bressan	Satellogic
Thomas Ankenbrand	Lucerne University of Applied Sciences and Arts	Stephen Bulfer	StreamLoan
Martin Arnold	The Financial Times	Claire Calmejane	Lloyds Banking Group
Anthony Bak	Palantir	Marcelo Camara	Banco Bradesco
Lee Baker	Seldon	Graeme Carmichael	Deloitte LLP, UK
Jo Ann Barefoot	Barefoot Innovations	Anna Celner	Deloitte AG, Switzerland
Rainer Baumann	Swiss Re Management	Soumak Chatterjee	Deloitte LLP, Canada
Mariano Belinky	Santander InnoVentures	Rohit Chauhan	Mastercard
Brad Berning	Craig-Hallum Capital Group	Chris Cheatham	RiskGenius
Ayan Bhattacharya	Deloitte Consulting LLP, US	Marie Chinnici-Everitt	DTCC
Alain Biem	S&P Global	Calvin Choi	AMTD Group
Michael C. Bodson	DTCC	Moses Choi	Orange
Greg Bonin	XOR Data Exchange	Diwakar Choubey	MoneyLion
Laurence Boone	Axa Investment Managers	Nelson Chow	Hong Kong Monetary Authority
Victor Botlev	Iris AI	Rob Claassen	Camp One Ventures
Josh Bottomley	HSBC	Andrew Connell	HSBC

Contributors (2 of 6)

The project team would also like to express its gratitude to the following subject matter experts who contributed their valuable perspectives through interviews and by participating in workshop and roundtable discussions (in alphabetical order):

Michael Cooper	BT	Adena Friedman	Nasdaq
Jean-Philippe Courtois	Microsoft	Dennis Gada	Infosys
Jason Crabtree	Fractal Industries	Jan Coos Geesink	Thomson Reuters
Bill Dague	Nasdaq	Bisesti Gennaro	Generali Insurance
Ray Dalio	Bridgewater Associates	Avi Goldfarb	University of Toronto, Rotman School of Management
Andrew Davidson	Salesforce	Zor Gorelov	Kasisto
Charlie Delingpole	ComplyAdvantage	Adam Gottlieb	True Accord
Adam Dell	Clarity Money	Andrew Graham	Borrowell
Thomas J. DeLuca	AMP Credit Technologies	Gero Gunkel	Zurich Insurance
Alain Demarolle	My Money Bank	Ashish Gupta	BT
Kees Dijkhuizen	ABN AMRO Bank	Paul R. Gupta	Reed Smith
Daniel Drummer	JP Morgan Chase	Peter Hafez	RavenPack
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Jeff Holman	Sentient Technologies	Fabio Kuhn	Vortexa
Ian Horobin	Swift	Shameek Kundu	Standard Chartered Bank
Matthew Howard	Deloitte MCS Limited, UK	Angela Kwok	China Broadband Capital
John Hucker	Swiss Finance & Technology Association	Christian Lanng	Tradeshift
Stephan Hug	Credit Suisse	Laurence Latimer	IEX Group
Patrick Hunger	Saxo Bank	Ian Lee	IDEO Colab
Timothy Hwang	FiscalNote	Rob Leslie	Sedicii
Jeremy Jawish	Shift Technologies	Joaquim Levy	The World Bank
Cédric Jeannot	Aprivacy	Ting Li	Yunfeng Financial Group
Gurpreet Johal	Deloitte MCS Limited, UK	Luca Lin	Domeyard
Mark Johnson	Descartes Labs	Wayne Liu	AMTD Group
Husayn Kassai	Onfido	Kevin Lynch	BMO Financial Group
Boris Khentov	Betterment	Justin Lyon	Simudyne
Reza Khorshidi	AIG	Sunil Madhu	Socure
Shirine Khoury-Haq	Lloyd's of London	Neeraj Makin	Emirates NBD
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Contributors (4 of 6)

The project team would also like to express its gratitude to the following subject matter experts who contributed their valuable perspectives through interviews and by participating in workshop and roundtable discussions (in alphabetical order):

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Jonathan Matus	Zendrive	Matt Ober	Third Point Capital
Máxima of the Netherlands	Dutch Royal Household	Kevin O'Donnell	RenaissanceRe Holdings
Ofer Mendelevitch	LendUp	Robert Palatnick	DTCC
Francois Mercier	Autorité des Marchés Financiers	Harry Pang	Fountainhead Partners
Armen Meyer	Lending Club	Diana Paredes	Suade Labs
Greg Michaelson	DataRobot	Mark Patterson	Deloitte MCS Limited, UK
Jerry Miller	Guggenheim Partners	Ana Pinczuk	Hewlett Packard Enterprise
Ross Milward	Quantifeed	Hans Ploos van Amstel	Adecco
Mauricio Minas	Banco Bradesco	Jayne Plunkett	Swiss Reinsurance Company
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Hans Morris	Nyca Partners	Andy Rachleff	Wealthfront
Craig Morrow	Atom Bank	Vinoth Raman	ING Netherlands
Sophia Mouhoub	Fortia	James Ramirez	Essentia Analytics
Peter Moyo	Old Mutual Emerging Markets	Aki Ranin	Bambu
Brody Mulderig	Wells Fargo	Arun Rao	Starbutter
Patrick Murk	Berkman Center at Harvard University	Sunil Rawat	Omni-Science
Prakash Nanduri	Paxata	Anne Richards	M&G Investments (Prudential Financial)
Krishna Nathan	S&P Global	Ellen Richey	Visa
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Kirsty Rutter	Barclays UK	Nathan Stevenson	ForwardLane
Koby Sadian	Viking Global Investors	Homer Strong	Cylance
Jacob Safra	J. Safra Group	Shalini Sujanani	ING Bank
Mark Salmon	Cambridge University	Michael Sullivan	Point72 Asset Management
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Rob Sears	BBVA	Aneesh Varma	Aire
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Travis Skelly	CitiVentures	Anna Wallace	Financial Conduct Authority
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Contributors (6 of 6)

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Aric Whitewood	WilmotML
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Greg Wolfond	SecureKey
Ray Yang	Marathon Ventures
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Janet Yuen	HSBC
Snejina Zacharia	Insurify
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