



FINTECH DECODED

Capturing the opportunity in capital markets infrastructure

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Executive summary

Technology has long been the engine driving capital markets efficiency—both for investors in the markets, and for the capital markets infrastructure providers (CMIPs) that operate the exchanges and other trading venues, central counterparties, securities depositories, index providers, and data and analytics companies. More lately, fintechs are bringing new technologies to market even faster and with a greater impact. Hundreds of fintechs are focusing their development on capital markets infrastructure (CMI), and while CMIPs recognize that fintech will have a significant influence on the industry, many remain unsure of which technologies to adopt and to what degree, and how best to engage and interact with fintech companies.

of over-the-counter [OTC] derivatives or ever-increasing reporting requirements), in the investor landscape (e.g., a higher profile for buy-side firms) and in customer behavior (e.g., an increasing call for data and analytics solutions).

In the coming years, many CMIPs will seek to protect their businesses, and achieve even higher levels of efficiency, service provision, and growth, through innovation and adoption of new technologies, some of which may prove revolutionary. These technologies will come from current technology leaders that tailor their services to CMI applications, from firms' internal development, and from the new generation of fintechs.

Capital markets infrastructure

The capital markets infrastructure (CMI) industry comprises a global network of organizations that handle and safeguard the world's investments. These organizations carry out the execution of trades, clear securities positions and settle payments, take custody of assets, and facilitate these functions with secure networks for transactions, communications, data analytics, and value-added services (e.g., regulatory services and corporate solutions).

CMI providers (CMIPs) include traditional exchanges and alternative trading venues, interdealer brokers, broker-dealer trading platforms, providers of order management systems, central counterparties and clearing houses, securities depositories, and securities services firms. An important opportunity, for both exchanges and independent firms, arises from information services, ranging from streams of data on market transactions and market indices via financial and economic news to advanced analytics that develop value-added information.

The role and importance of CMIPs in the markets has grown in the past decade—along with their revenues—owing to changes in the regulatory environment (e.g., a push towards mandatory central counterparty [CCP] clearing

This report evaluates the fintech landscape within the CMIP industry, potential uses of the new technologies across the industry value chain, and some of the areas likely to see the most innovation. Although growth in fintech investment

across the broader financial services sector has slowed since 2015 due to investor caution over a more uncertain macroeconomic environment, the growth trajectory of CMI fintech has remained steep, and likely has yet to reach a peak.

We have identified four fintech themes shaping the CMI value chain. Some of these themes increase productivity and lower costs, while others generate new sources of revenue:

- The use of **advanced analytics and artificial intelligence (AI)** is set for rapid growth, as the amount of available data circulating through capital markets grows, and amid increasing interest in the application of advanced analytics to market, financial, and economic data.
- **Distributed ledger technology (DLT)** is applied to a range of CMI operations. Use cases include clearing and settlement, alternatives to the traditional markets for access to capital (initial coin offerings [ICOs]), and new digital markets.
- Fintechs will bring greater efficiency through innovative technologies such as **cloud and quantum computing**—for example, in the sphere of matching technologies—while driving depth in traded markets and expansion towards new asset classes.
- Post-trade services will gain in productivity through the application of **automation and robotics**. A separate branch of regulatory tech firms (regtechs) will bring efficiency and uniformity to risk management and regulatory reporting.

To date, the fintechs most active in CMI are smaller start-ups. For the purposes of this report, CMI-related fintechs are defined as companies founded since 2000 that are unlisted, employ

fewer than 1,000 people, and operate outside the areas of robo-advisory, brokerage, and foreign-exchange trading. Most are developing products as components within the CMI industry, and appear to be mainly interested in working together with existing providers, rather than in poaching their customers. Still unclear, however, are the interests and intentions in CMI of the global tech giants, such as Amazon, Google, and Microsoft, and whether they might venture into the core of the industry at scale. Given their great capital resources, deep data pools, and world-class analytic capabilities, their entry could significantly change the CMI landscape. Most CMIPs believe that it is either these tech giants or incumbents working with fintechs who have the greatest disruptive power.

This report is based on a survey of the membership of the World Federation of Exchanges (WFE) (see sidebar, “Survey methodology”). Respondents were largely positive about the potential of fintechs, and were unanimous in expecting enhanced productivity or new revenues from incorporating their technologies in their businesses. None saw fintechs as a threat, but instead viewed them as potential partners and enablers of growth. They acknowledged, though, that the extent of the impact is difficult to ascertain.

CMIPs follow various routes to bringing fintech into their organizations. Some firms surveyed reported relying on more than one, depending on their view of the size and importance of the opportunity:

- **Development of internal capabilities.** Most of the survey participants have established one or more internal groups dedicated to studying the global fintech landscape. Only a few indicated they were aggressively developing new technologies themselves, as this is a resource-heavy approach.

Survey methodology

The study that underpins this report was developed jointly by the World Federation of Exchanges (WFE) and McKinsey. The WFE is the global industry association for exchanges and clearing houses, representing over 200 market infrastructure providers, including standalone central counterparties (CCPs) that are not part of exchange groups. The WFE advocates on behalf of its members and frames industry guidelines, best practices, and standards, in addition to supporting market development. McKinsey is a global management consulting firm that helps its clients significantly and sustainably improve their performance and achieve their goals. McKinsey has supported CMIPs in more than 400 projects over the past eight years.

Amidst continuous debate on the disruptive power of fintech, this report aims to demystify these new technologies. It examines

opportunities for CMIPs to use fintech to achieve greater efficiency and enhanced client service, and to work with and invest in fintechs.

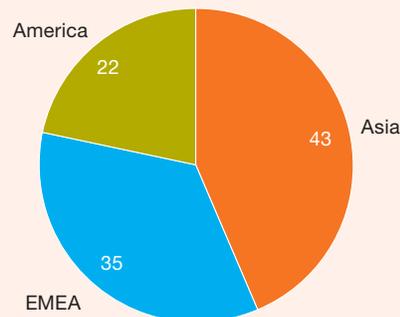
The insights have been derived from an anonymous survey of 46 WFE members worldwide as well as in-person interviews with staff of WFE members and McKinsey experts. The survey consisted of 24 questions. Twenty of the 46 survey participants are based in Asia, 10 in the Americas, and 16 in Europe, Middle East, and Africa. Readers interested in further detail can contact the WFE or McKinsey.

The analysis of the fintech landscape is based primarily on the McKinsey Panorama Fintech database, which catalogs more than 6,000 fintech innovations globally. It categorizes solutions along nine dimensions, according to where they fall on the value chain, technologies used, or customer segments served.

Demographics of survey participants

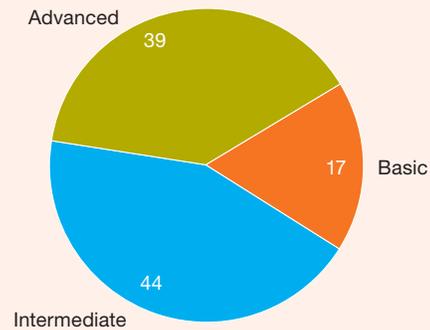
Headquarters location

Share in percent, n=46



How would you rate your understanding of the fintech landscape?

Share in percent, n=46



Source: WFE-McKinsey Fintech survey 2017

- **Collaboration and joint ventures.** Forty percent of the WFE members surveyed believe that collaboration is the most efficient approach to fintech, followed by joint ventures at 25 percent. The primary reason cited is a shortage of resources, inhibiting the development of their own solutions. Moreover, the speed of innovation is rapid, and diverse talents are needed for internal development.
- **Minority or majority financial investment.** Of the 46 WFE members surveyed, 11 said they are investing in fintechs through minority stakes, while 10 said they use majority investments (multiple choices were allowed). Most innovations may fail, but one or two are likely to become success stories, WFE members said.
- **Outright acquisition.** Just 9 percent of survey participants cited acquisition of fintechs as the most effective approach.

The fintech landscape is evolving at an accelerated pace, as new firms and innovations enter the market while others drop out, and ideas are rapidly developed and deployed. One approach to a successful CMIP fintech strategy calls for a “portfolio of initiatives”: incumbents invest in multiple fintechs of different sizes, time horizons, and objectives—some with a short-term focus aimed at enhancing the core business, and others with longer-term objectives based on a smaller number of revolutionary ideas. With so many fintechs in the market and more to come, a structured approach is essential to identify the technologies best suited to a CMIP’s strategy and operations. It is also important to determine which projects to develop internally or through reliance on fintechs, and what form the relationship and investment in fintechs should take.

Fintechs and the CMI value chain

The McKinsey Panorama Fintech database covers over 6,000 of the more than 12,000 fintech innovations in the global marketplace. Based on their activities and technologies, about 700 fintechs are relevant to the CMI industry. Through steady growth totaling 277 percent, this number has almost quadrupled since 2010, and has outpaced other areas of fintech within financial services, such as corporate banking (growth of 186 percent), and payments (184 percent) (Exhibit 1).

In this report, we look at where fintechs reside on the CMI value chain, and analyze the technologies they rely upon. The distinction between location on the value chain and technologies used in development is essential to a full understanding of the CMI fintech universe. Certain technologies, such as DLT, are a component of CMI fintech products and services, rather than end products in their own right. In other instances, significant product innovation can be achieved without the use of new technologies—one prominent example

being the crowdfunding platforms that have emerged in the last several years.

Fintech-led innovation can be found in all five major parts of the CMI value chain (Exhibit 2):

- **Access to capital**—creating innovative ways to reach and serve issuers and investors, and broadening the range of asset classes offered
- **Trade execution**—gaining new efficiencies
- **Post-trade services**—bringing simplification, automation, and improved security to incumbents' operations
- **Data, analytics, and information services**—developing new techniques to mine and interpret data to its full potential
- **Operations and technology**—creating greater cost efficiency, lower latency, and reduced operational risk

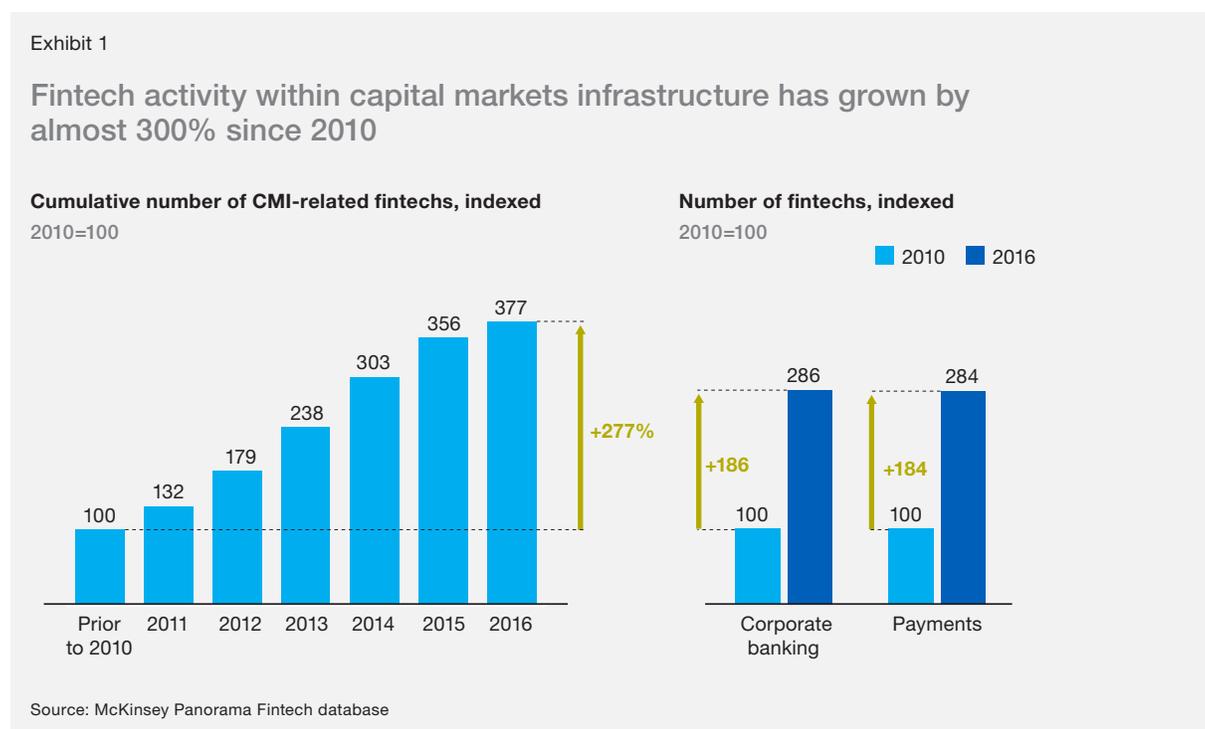
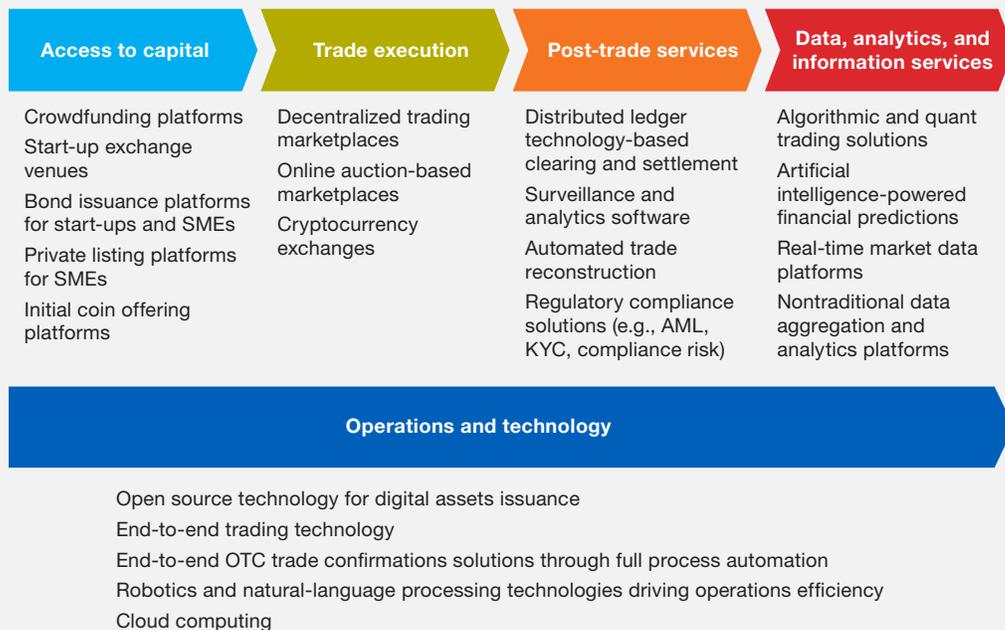


Exhibit 2

Innovation is occurring across the entire CMI value chain



Source: McKinsey Panorama Fintech database

According to the McKinsey Panorama Fintech database, the density of fintechs is greatest in access to capital, at 37 percent of all CMI fintechs, followed by trade execution, data, analytics and information services, and post-trade services. By contrast, WFE members perceive little fintech activity in access to capital (just 3 percent), and ranked post-trade services as the most active (Exhibit 3). The difference in emphasis is understandable, however, in view of the broad media attention over the past few years to developments in blockchain and other DLTs, as well as the high-impact potential of the technology, particularly in the post-trade realm of clearing and settlement. Moreover, in separate interviews, WFE member executives mentioned

that investment in post-trade technologies has historically lagged investments in other parts of the value chain, and currently draw greater attention than access to capital.

While the boundaries among fintech technologies may blur, the solutions they deliver can be grouped in four categories: according to Panorama, about half of CMIPs are working in *advanced analytics and AI*, followed by *DLT* (including blockchain), *cloud and quantum computing*, as well as a small number in *automation and robotics* (Exhibit 4). By and large, WFE members' assessments of fintechs' technology deployment aligns closely to the observed state of the market.

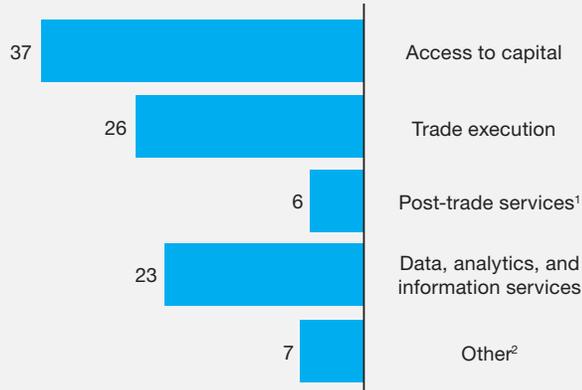
Exhibit 3

Fintechs focus on a range of activities

Where in the CMI value chain are you seeing the most fintech-driven innovation?

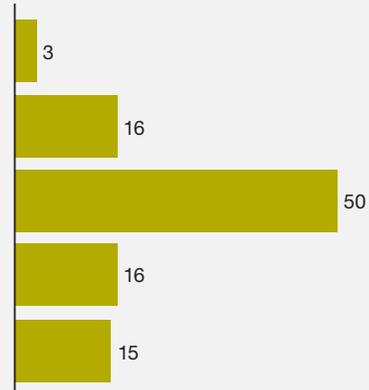
Fintech view

Share by number of companies in percent, n=675



Participant view

Responses in percent, n=46



¹ Includes clearing, custody and settlement, risk and regulatory solutions.

² Operations and technology, corporate solutions.

Source: WFE-McKinsey Fintech survey 2017; McKinsey Panorama Fintech database

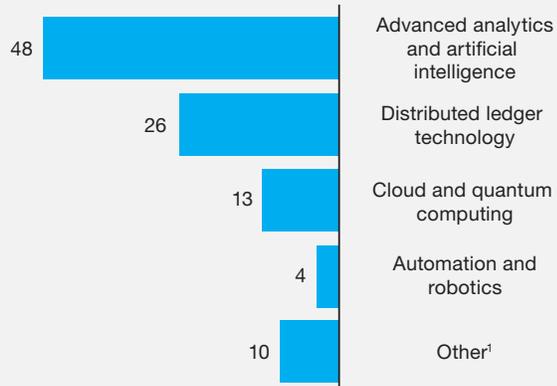
Exhibit 4

Advanced analytics and artificial intelligence are the leading fintech technologies

The technology solutions offered by fintechs in the capital markets industry are mostly based on:

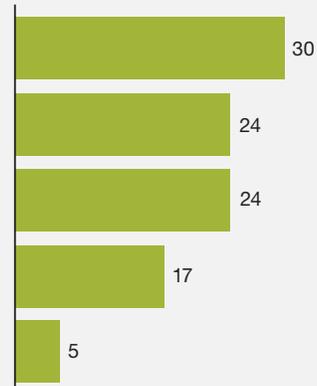
Fintech view

Share by number of companies in percent, n=303



Participant view

Responses in percent, n=46



¹ Includes cybersecurity and biometrics.

Source: WFE-McKinsey Fintech survey 2017; McKinsey Panorama Fintech database

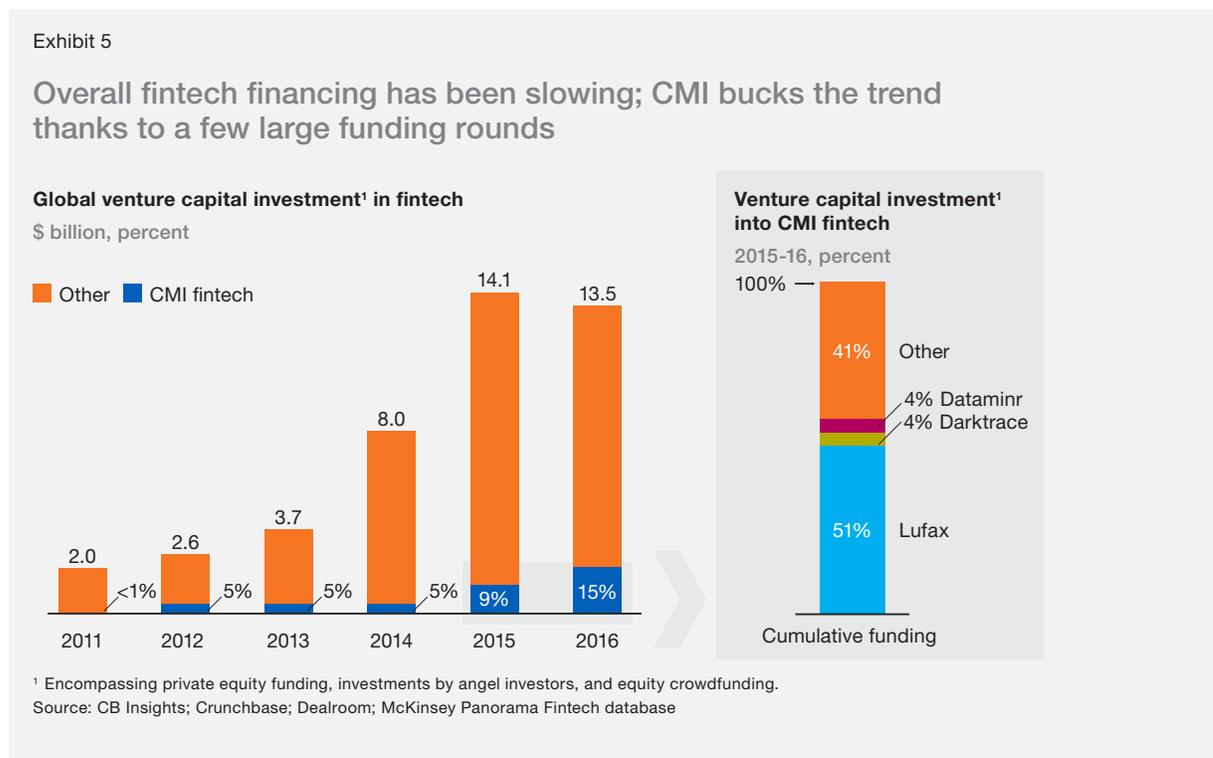
Bucking the trend of a slowing broader fintech funding market

Following rapid growth in overall fintech funding in 2014 and 2015, global capital raising plateaued in 2016 at about \$14 billion. Investors seem to be tuning out the hype around fintech with greater scrutiny of actual results. Furthermore, the offerings of the current crop of start-ups are less innovative than earlier entrants, raising the bar for entrepreneurs trying to win investors.

Investment in CMI fintech has, however, continued its rapid growth, reflecting the variety and novelty of the offerings. The funding rounds from 2015 and 2016 were exceptional, at \$1.3 billion and \$2 billion, respectively (Exhibit 5). This growth was mainly driven by a handful of large individual transactions. The largest investment went to Lufax (a peer-to-peer lender in China, at \$1.7 billion); other

considerable commitments went to Darktrace (machine learning-enabled cyberthreat detection) and Dataminr (aggregation of news and market data). CMI fintechs should continue to draw significant levels of investment, as both nascent and more mature solutions emerge across the CMI value chain, leveraging a wide spectrum of technologies.

In 2017, a new means of funding start-ups, initial coin offerings (ICOs), raised more than \$2 billion. According to an analysis by CB Insights,¹ ICOs have surpassed venture capital as the biggest source of funding for companies developing blockchain technology. While ICOs can have great potential, regulators around the world are mostly skeptical, and have warned investors of their short track record and high risk.²



¹ "Blockchain Investment Trends in Review," CB Insights.

² "IOSCO Board Communication on Concerns Related to Initial Coin Offerings (ICOs)," The International Organization of Securities Commissions, January 18, 2018; "Regulators begin to tackle the craze for initial coin offerings," The Economist, Nov 11, 2017.

Fintechs: Friend or foe?

McKinsey research indicates that at most points in the value chain, fintechs are potential partners to incumbent CMIPs rather than competitors. Within post-trade services, 90 percent of fintechs aim to provide services to incumbents; that is, they have business-to-business (B2B) models (Exhibit 6). This finding aligns with the results of the WFE survey, where 75 percent of participants saw fintech offerings as being aimed at CMIPs rather than their customers (WFE members in Asia saw this proportion even higher, at 90 percent).

However, at the front end of the value chain, in the “access to capital” portion, 82 percent of fintech business models have a business-to-consumer (B2C) focus, and therefore represent more of a threat to incumbents.

Overall, WFE members see potential for fintech integration rather than incursion: 61 percent of survey respondents envision fintechs becoming integrated into their franchises and generating new sources of revenues, while 37 percent expect to benefit from greater productivity. Only one survey participant saw fintechs as direct competitors (Exhibit 7), and none thought that fintechs might bring disintermediation. Moreover, the consensus opinion was that less than 20 percent of the industry’s current revenue base was at risk to fintech encroachment.

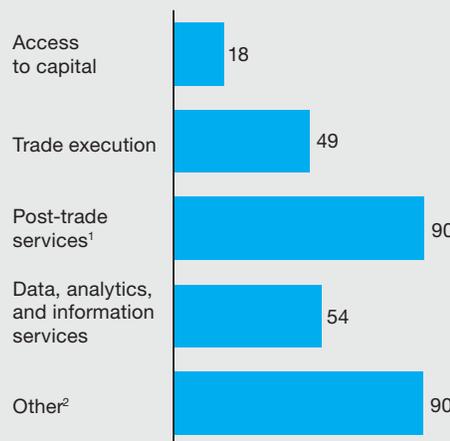
In separate interviews, however, executives at some WFE members in Europe and the Americas did note that the industry’s clearing and settlement processes, as well as capital-raising activities, are vulnerable to new competitors, and

Exhibit 6

B2B fintech solutions dominate the post-trade services arena

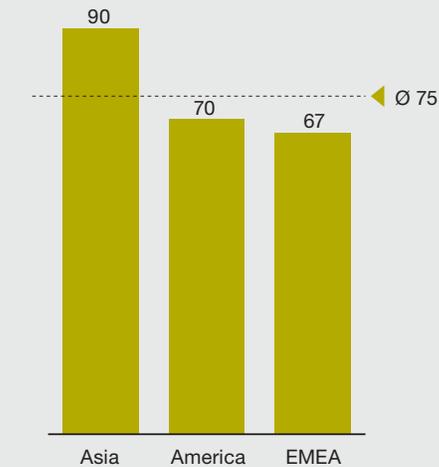
Fintechs with a B2B business model

Share by number of companies in percent, n=675



Industry view: the solutions offered by fintech are mostly B2B

Share of B2B solutions in percent, n=46



¹ Includes clearing, custody and settlement, risk and regulatory solutions.

² Operations and technology, corporate solutions.

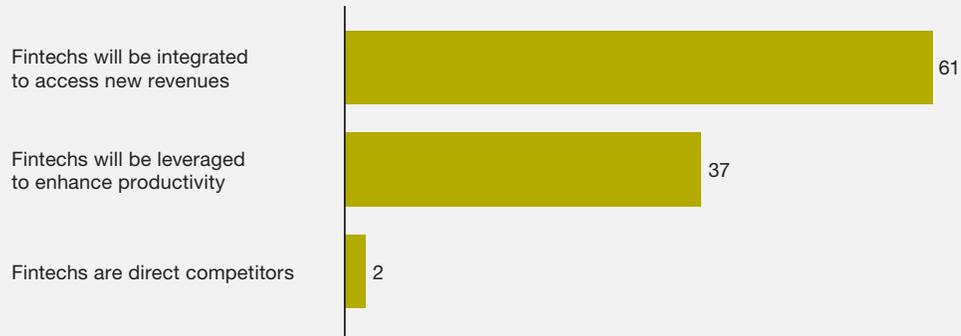
Source: WFE-McKinsey Fintech survey 2017; McKinsey Panorama Fintech database

Exhibit 7

Incumbents are not concerned over the disruption by new entrants

How do you see fintech impacting your ecosystem?

Share of responses in percent, n=46



Source: WFE-McKinsey Fintech survey 2017

that incumbent firms will need to counter fintech innovation to maintain these core franchises.

At the same time, they emphasized that exchange groups are well-established and unique organizations with tested processes for approaching innovation. In addition, they have strong capital bases, regulatory licenses, familiarity with the framework, and client

networks all supported by exacting and safe transactions systems.

For a number of fintechs, the regulatory landscape in which they evolve and the regulatory scrutiny they are subject to is still shifting, making the associated future regulatory costs and restrictions difficult to predict.

The impact of large technology companies

Efforts in bringing new technologies to CMI are not limited to those small and new fintechs dedicated to the capital markets. Further innovation in CMI could also come from large technology companies such as Amazon, Google, and Microsoft, which already serve CMI and the broader set of financial players through, for example, cloud services. In some cases, they have also enriched their capabilities by integrating and partnering with smaller specialists: Google, for instance, collaborates with data-wrangling experts Trifacta in its Google Cloud Dataprep product, while Microsoft acquired Maluuba, a specialist in deep learning for speech and image recognition, to enhance its AI capabilities.

Just over 40 percent of survey participants see large technology companies echoing the moves by Apple, Alibaba, and Amazon into financial businesses, and becoming important potential disruptors in the CMI market in the coming

five years. Others expect incumbent CMIPs (39 percent) or start-ups (20 percent) to have the largest impact within the next five years (Exhibit 8).

Large technology companies are technologically nimble and possess deep pockets and considerable other assets—access to issuers and retail investors, and proprietary information—that could be leveraged to their advantage in the realm of CMI.

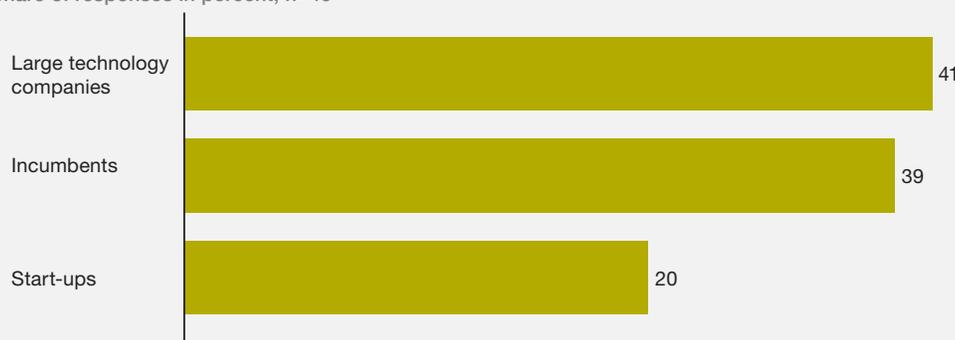
Moreover, for large technology companies, CMI might rank high in the opportunity space when compared to other financial services verticals: the industry is highly digitized and rich in data, and some areas, such as information services, are lightly regulated compared to adjacent financial services sectors. Moreover, the new entrants would not be burdened with incumbents' legacy platforms.

Exhibit 8

Large technology companies are expected to have the most impact in the next five years

Type of companies with the biggest impact within the next five years

Share of responses in percent, n=46



Source: WFE-McKinsey Fintech survey 2017

Innovation across the value chain

Both survey respondents and McKinsey's Panorama Fintech database observe fintech solutions supporting innovation across the value chain, creating opportunities to enhance revenues, reduce costs, and create a better

experience for market players. The use of these technologies in each part of the value chain, together with potential implications, is set out below.

Distributed ledger technology

Distributed ledger technology (DLT) is a cryptographically encoded, highly detailed ledger of transactions, distributed across a public or private network that promises substantial benefits of transaction speed and security, process efficiencies, and cost savings.

Survey participants identified DLT as the technology likely to have the greatest impact on the CMIP value chain, specifically in the areas of clearing and settlement. Expected benefits are shortening of settlement times to a few minutes, mitigating counterparty risk, and reducing the amount of collateral posted against trades. The potential flexibility of DLT could lead to applications across the value chain, from capital raising to regulatory reporting.

Although DLT may have the most potential among the technologies fintechs are deploying in capital markets solutions, it may also be the furthest from realization at scale. In addition to having to live up to high expectations, DLT applications must also be fashioned to fit the current market infrastructure, and at the same time satisfy any relevant regulatory requirements. McKinsey expects the early challenges to be overcome, however, and that networks of participants in DLT solutions will grow. But rather than creating system-wide solutions,

development will emphasize focused use cases. Markets showing the most promise include OTC derivatives, equities, and repurchase agreements, where DLT can match assets, manage collateral, and synchronize the movement of cash.

The first large-scale application is the implementation of a DLT clearing and settlement system at the ASX (see sidebar on page 18 for more on ASX). Other early implementations (see exhibit next page) are more modest in scope, but nonetheless revolutionary. For example, CME Group and Britain's Royal Mint are nearing introduction of a digital market for gold based on a DLT. Through a blockchain and digital vault, a test group of institutional investors are trading digital tokens; rather than representing shares in a commingled fund, they instead record ownership of one gram of physical gold in the vault of the Royal Mint.

Nasdaq has developed a blockchain ledger technology dubbed Linq, and its first use, in late 2015, was to record a trade in shares of a private company in the Nasdaq Private Market. The DLT application ensures comprehensive records of share issuance and transfer. Trading began with six private companies, including Chain.com, a collaborator with Nasdaq on the Linq technology.

These initial cases are encouraging. Nevertheless, successful large-scale application requires long-term commitment, coordinated within the industry as a whole,

calling for firms that are usually competitors to collaborate and invest together in the new technologies for the long term.

A selection of blockchain use cases

Access to capital	London Stock Exchange	Cooperation with IBM to digitally issue private shares of Italian SMEs and digitize shareholding structures	
	NASDAQ	LINQ—a platform that allows private companies to simplify share management and powers capitalization tables	
	Stock Exchange of Hong Kong	Plans to launch a blockchain-powered private market in 2018, aimed at helping early-stage and smaller firms obtain financing	
	Korea Exchange	Launched Korea Startup Market in November 2016 with blockchain technology to enable equity shares of start-up companies to be traded in the open market	
Trade execution	CME Group	Provides a “fast, cost-effective, and cryptographically secure method” of buying, holding, and trading Royal Mint Gold	
	Intercontinental Exchange	Minority investments in digital currency exchange Coinbase	
	Singapore Exchange Limited	Exploring making trading and settlement of fixed-income trading more efficient with blockchain	
	Six Swiss Exchange	Cooperation with NASDAQ providing DLT to SIX for a minimum viable product for its OTC structured products business	
	Cboe Global Markets/CME Group	Launched bitcoin futures contracts in December 2017	
Post-trade services	Clearing and settlement	Australian Securities Exchange	Using DLT to record shareholdings and manage the clearing and settlement of equity transactions in Australia
		Euronext	LiquidShare for SMEs improving the transparency, speed, and security of post-trade operations
		DTCC	Launching industrywide DLT platform for its trade information warehouse for cleared and bilateral credit derivatives by 2018
		Deutsche Börse AG	Prototype for the settlement of securities in delivery-vs.-payment mode for centrally issued digital coins or digital securities
		Euroclear	Partnership with itBit to create Bankchain, a distributed ledger settlement service for the London bullion market
	KYC	TMX Group	Development of a blockchain-based prototype to power a new service offering from Natural Gas Exchange to optimize the NGX gas settlement process
		Tokyo Stock Exchange	Cooperation with IBM testing a trade confirmation prototype for trading and settlement in low liquidity markets
		NSE (National Stock Exchange of India)	Trial allowing participants to access KYC data information in real time
		Bolsa de Madrid	Part of a Spanish multisector network developing blockchain-based identification network
		Proxy voting	Moscow Exchange
Strate	Agreement with NASDAQ to deliver an e-proxy voting system based on blockchain		

Source: Company reporting

Access to capital: New assets, markets, and connections—and a potential entry point for DLT at scale

Fintechs are altering traditional access to capital models in several ways:

- **Providing crowdfunding offerings** that raise equity and debt for smaller firms, and are open to both retail and institutional investors (Exhibit 9)
- **Developing platforms that create new connections** among issuers and investors, focusing on nontraditional asset classes such as real estate, cloud capacity, venture capital, and private equity, as well as cryptocurrencies
- **Deploying new technologies** for the direct issuance of equity and bonds through distributed ledgers, reducing costs, frictions, and settlement times in new issues. This challenge is likely to have the biggest impact on the industry and incumbents. In particular, DLT networks are facilitating ICOs, which

issue digital tokens to investors that can be traded online.

Although few survey participants see much of a threat to access to capital from fintechs, their momentum in this arena could create a true disruption, given the B2C nature of most of the offerings. This could leave traditional exchanges exposed to a direct and indirect loss of listings, as well as the associated trading volumes. Solutions built on DLT may present a revenue risk to incumbents, as what is issued on DLT will stay on DLT, through the stages of trading, settlement, and corporate actions. Fintechs could also capture a first-mover advantage in emerging asset classes, owing to their greater agility, convenience, and insight into customer needs.

Trade execution: Expansion and efficiency

A substantial share of fintechs active in the trade execution space have focused on facilities for trading new asset classes, led by exchanges for cryptocurrencies, and algorithmic trading strategies. In more traditional markets, fintechs

Exhibit 9

The capital formation space has seen more than 200 new crowdfunding platforms and almost 200 ICOs



¹ Until November 26, 2017.

Source: Coindesk; McKinsey Panorama Fintech database

are aiming to introduce greater efficiency by enhancing computational power, leveraging quantum computing, realizing trading systems with very low latency, and offering broad views of order books across markets in real time for improved price discovery. Survey participants saw trade execution as the second-most active area of fintech innovation.

If DLT is broadly accepted in trade execution (recognizing potential regulatory and market integrity challenges), it may bring substantial efficiencies—through bilateral trading between participants in decentralized markets.

Post-trade services: Large potential as DLT reaches the mainstream

Survey participants believe that fintechs are most active in the clearing, custody, and settlement parts of the value chain, and see the most innovation in these areas. Streamlined processing and settlement result in a combination of reduced operating costs, and less need for capital. Early forecasts held that applying DLT to these areas would save the financial world billions in operating costs. McKinsey estimates that for OTC derivatives alone, there is a value generation opportunity of \$4 billion to \$7 billion.

Despite the estimated size of the opportunity, to date there have been few tangible results. DLT might have taken a significant step forward, however, in December 2017, when the Australian Securities Exchange (ASX) announced that it would replace its existing equity clearing and settlement systems with a DLT-based system (see sidebar, “Australian Securities Exchange: DLT for equity post-trade processing”).

Regulatory compliance solutions, a subset of post-trade services, have also evolved, with regtechs bringing big data, machine learning, and AI to increasingly demanding regulatory and

compliance regimes. These technologies enable the implementation of automated, standardized approaches for more complex tasks such as customer onboarding and KYC requirements, AML compliance, trade surveillance, fraud and cyberattack detection through forensic analytics, and the preparation of compliance and regulatory reporting. Regtechs also offer technology for managing collateral and counterparty risk for more efficient use of institutions’ capital.

CMIPs have begun to develop advanced regulatory solutions, and have turned to regtech firms for enhancements through natural language and machine intelligence. They are also developing trade-reporting systems that meet the newly implemented MiFiD II regulations for firms that internalize their equity trading.

Data, analytics, and information services: Insight and revenue opportunities

Fintechs are also finding, gathering, and processing data, and in some cases creating new revenue sources. WFE members surveyed ranked the importance of innovations in data analytics on a par with those of trading technologies, at 14 choices each from the 46 survey participants.

Operations and technology: A silent revolution

In a show of hands at McKinsey’s 2017 Sibos Securities Services CXO Roundtable, 44 percent in attendance cited automation and robotics as the industry’s most important and effective no-regrets move. CMIPs adopting automation benefit from fewer errors and can rapidly scale their operations in response to changing market volumes. A number of players have started automating components of complex workflows—those which are not susceptible to full straight-through processing—by optimally allocating tasks to machines versus humans, and thus materially improving productivity and promoting process transparency.

The Australian Securities Exchange: DLT for equity post-trade processing

A primary bottleneck in conventional equities trading is the need to reconcile transactions between different market users and financial market infrastructures. This is caused by delays in finding securities in time for settlement, and from mismatches of settlement instructions. These restrictions in turn result from brokers, exchanges, and custodians all using their own custom-designed solutions for transaction capture, and a lack of common technologies and standards. This makes identifying errors in reconciliation time consuming and expensive. Post-trade systems based on DLT can eliminate many of these issues, as they are centrally managed, and work with common data models.

DLT post-trade systems require new means of data privacy and security, and thus will require features not available in public blockchains. In some senses, this represents a leap of faith for incumbents, but the benefits of DLT mean it stands a strong chance of widespread acceptance: No one vendor “owns” the underlying technology, and there are many different types of DLT platforms being developed in public and private permissioned DLT environments. Having said this, there is a growing understanding of what DLT can deliver—cost savings from reduced reconciliation, greater scale and speed for operations, greater fintech innovation, and shared costs of development.

Following extensive testing of DLT and validation of its security, capacity, and resiliency, the Australian Securities Exchange (ASX) is introducing a DLT application to replace its existing CHESS system. It is being developed in conjunction with Digital Asset Holdings, a fintech based in New York. The ASX plan calls for a private and permissioned DLT system operated by the exchange—thus addressing the requirement of regulators to continue to have full accountability lodged with one party to operate the market (ASX) and ensuring that all users of the platform are known and meet appropriate regulatory standards (including KYC and AML). The ambition is that participants will enjoy lower costs, improved functionality, and potentially shorter settlement times. It also provides the opportunity for participants to greatly reduce the manual process of reconciliation: With a central operator, ASX provides a single “source of truth” for all clearing and settlement data that can be independently and mathematically verified by participants as being correct without the need for reconciliation. The system will provide for open access where customers are able to interact with the exchange’s systems through traditional message-based interaction, or directly with the distributed ledger via taking a “node” of the database operated by ASX. Importantly, the node preserves privacy as it only contains the information related to a participant’s own transactions and is not a full copy of the ledger.

Advanced analytics and AI

Advanced analytics and AI are expected to reshape industries. The McKinsey Global Institute estimates the global total of AI spending across all industries in 2016 was between \$26 billion and \$39 billion.

Although large technology companies account for most of the spending, the financial services industry is a leading early investor in AI. This stands to reason: Information has always been a crucial resource for financial markets, and financial services firms have long been on the forefront of adapting new information technologies.

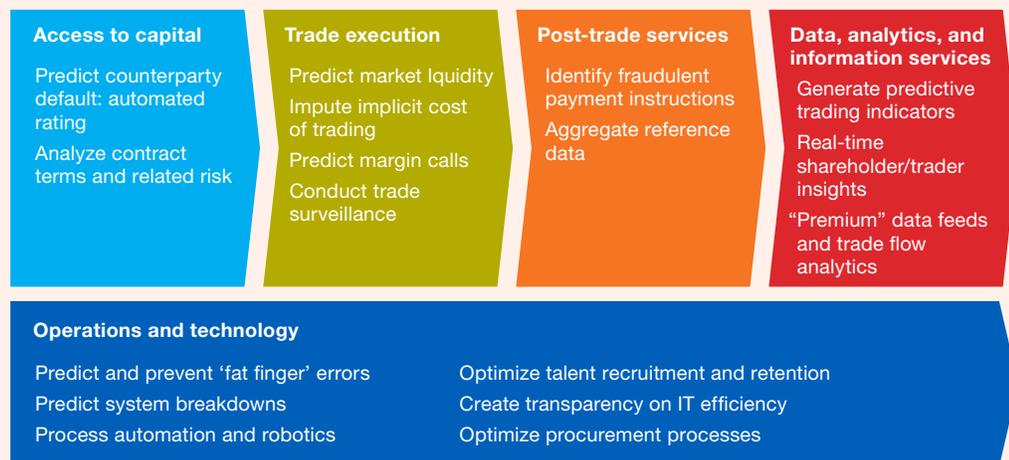
In capital markets, providers of advanced analytics and AI services have become influential players. At McKinsey's recent CMI Roundtable, industry leaders ranked AA and AI as the most important forces shaping the near future of the industry.

New applications are finding homes across the CMI value chain. In trading, advanced

analytics predict sources of market liquidity to guide customers in placing orders, and refine the measurement of market impact and other transaction costs. Risk in clearing and settlement is being reduced through automated analysis of counterparties, including enhanced analysis of payments flows. CMI firms are selling many forms of market data to investor customers, including indicators of market sentiment, comprehensive industry analyses, and analytics of trade flows and best executions. CMIPs' own operational risks are mitigated through improved advanced analysis of trades and predictive maintenance of trading systems, as well as market surveillance monitoring for fraudulent trading.

Some applications have been developed internally by CMIPs, but in most cases, large incumbents—even those with strong internal technology groups—have turned to fintechs for solutions.

Advanced analytics use cases in CMI



Source: McKinsey; Quantum Black; Spark Beyond

McKinsey estimates the potential cost reduction from automation and robotics at scale can reach as high as 20 percent in the aggregate, depending on the pre-existing level of automation. Estimated savings are relatively minor—up to 10 percent—in areas that require frequent intervention and handwork, such as client service and back-office management. But

as tasks become more repetitive, in areas such as custodian services, maintenance of client reference data, and collateral management, cost savings can rise to 15 to 25 percent. The greatest efficiencies—estimated at 25 to 50 percent—are to be had in areas where work is highly repetitive, but not yet automated, such as reconciliations, confirmations, settlement, and payments.

Identifying the fintech opportunity

It is too early to know the full extent of fintech's impact on capital markets over the next five years. But if some of the most disruptive technologies reach wide scale and adoption, fintech could be an evolution that becomes a revolution. For CMIPs, however, it is essential to understand that fintech, in itself, is not a strategy. Instead, it is a means to a strategic end—a collection of new tools and technologies that have to be tested and thoughtfully introduced into each CMIP offering.

The fintech environment is highly complex, and populated with potential business partners and acquisition candidates, enabling cost savings and opening up new revenue sources. From the survey participants' point of view, the advantages of fintechs are their agility with technology and the singular product focus of early-stage businesses. Surprisingly, they do not regard fintechs' ability to attract top talent or their being subjected to lighter regulation as core advantages (Exhibit 10).

A meaningful approach to navigating this environment does not entail building new technology for its own sake, but rather mitigates risks to the existing businesses, fortifies the incumbents' market positions, ensures efficient compliance on data security and regulation, and captures new revenue and customer opportunities. CMIPs should consider a number of factors in developing their strategies (Exhibit 11).

Protect the core business from erosion

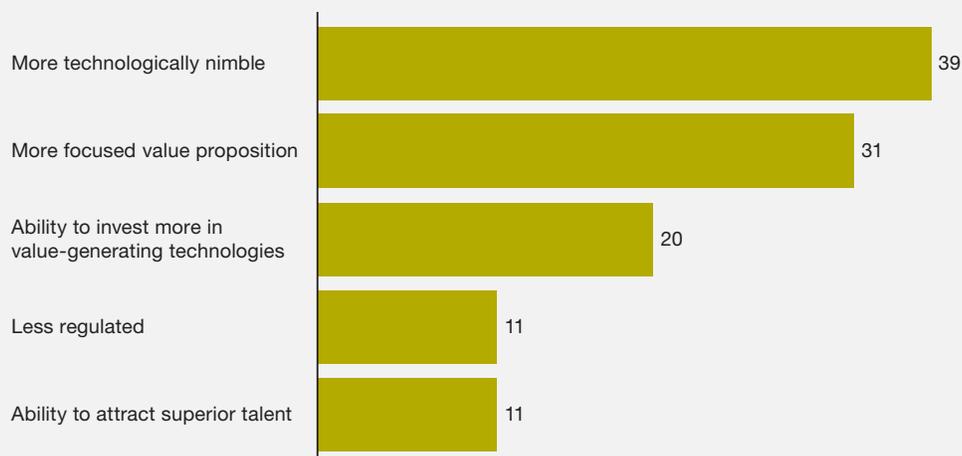
Thus far, technological changes to CMI have been subtle and isolated, but incumbents must guard against shifts in the broader industry—including other incumbents incorporating fintechs, as well as large technology companies operating largely outside finance—that render established ways of doing business obsolete. Examples from other industries include digital cameras displacing an enormous industry for processing traditional film, or Internet streaming replacing chains of stores renting videos and

Exhibit 10

Incumbents see nimbleness and focus as fintechs' main advantages

What are fintechs' biggest advantages?

Top 5 answers by number of mentions, up to 3 answers possible, n=46



Source: WFE-McKinsey Fintech survey 2017

Exhibit 11

CMIPs should consider the following elements as they formulate fintech strategy

Protect the core business from erosion

Strategy and investments should reflect threats and opportunities in the space. Scrutinize ecosystem and identify disruptive trends with potential to erode or replace core business; sources of disruption include:

- Competitors launching truly differentiated offering (e.g., lower latency execution platform)
- Shifts in clients priorities and needs (e.g., collateral optimization solutions)
- Players evolving in adjacent areas with potential to move into CMI space (e.g., large technology companies creating data products on the cloud)
- Emergence of effective new technologies/fintech solutions (e.g., DLT-based crowdsourcing)

Modernize existing businesses

- Invest in robust technology foundations and ensure best-in-class connectivity and computing power (at lower costs) through, for example, migration to cloud computing
- Modernize and “lean” front-end processes through use of automation and robotics
- Explore alternatives to classic platforms to reduce costs and enhance flexibility and security, by, for example, implementing DLT-like technologies

Capture new business opportunities through fintech

- Develop value-added data insights through advanced analytics
- Create new markets leveraging DLT-like technologies
- Launch new regtech and risk management solutions
- Partner with emerging companies to create dynamic ecosystems

DVDs. While the industry is not likely to face a Blockbuster moment any time soon, CMIPs must recognize the disruptive potential of fintechs, and how they might reshape CMI’s structure and value chain.

A test case is developing in the capital markets: 40 percent of fintechs are focused on the front of the CMIP value chain, providing access to capital. And yet, few survey participants seemed to appreciate the extent of their engagement. Traditional protocols for capital raising and issuing new securities could be replaced by DLT structures that are simpler and cheaper, so that more secure and long-prevailing systems could disappear. Incumbents need to carefully watch and stay engaged with fintech development at all points on the CMI value chain.

For a number of investors, technological resilience and security are seen as a key attribute of incumbent CMI businesses. They should, therefore, keep investing in these areas to ensure they stay ahead.

Modernize existing businesses

The technologies utilized by fintechs provide many opportunities for modernizing existing capital markets offerings through efficiency gains, higher levels of customer experience, and executing the current business in new ways:

- **Cloud processing** can generate savings over traditional internal information systems. WFE member executives cautioned, however, that while moving to the cloud was fairly simple, cost savings on one end of a system must be weighed against the risk of data

leakage, creating potential liability and reputational damage.

In addition to moving their own systems to the cloud, exchanges have started offering a variety of cloud-based services to their clients: broad and deep historical market information, big data handling, collateral management, and regulatory reporting, as well as risk analytics and valuation. These allow for more agile development and cost-efficient services, with the additional benefit of creating stronger connections with clients through open application programming interfaces (APIs), exchanging data, and the creation of ecosystems.

- **Automation and robotics** built into trading, clearing, and settlement operations can lower staff costs, reduce the incidence of errors, and allow for automatic adjustments to changes in trading volumes, all raising efficiency levels within the cost curve. More complex applications can also enhance the analysis of trading and liquidity risks. In the most successful implementations, however, firms have realized that the impact of automation and robotics is greatest when applications include a true re-engineering of processes and modus operandi.
- **DLT** applications are still novel, but as noted earlier have arrived in the mainstream with the ASX adopting a DLT system for its equity clearing and settlement operations. The ASX emphasized the security, capacity, and resilience of the new system, but DLT implementations are also expected to bring significant cost savings to customers.

In making short-term adjustments, CMIPs must be careful to balance changes to their core systems with barriers to adoption. The approach

should integrate new components into existing systems, while avoiding significant workflow changes for partners and customers.

Capture new business opportunities through fintech

Fintechs are generating many new ideas, from which CMIPs can draw a range of new revenue sources. These include demand for products such as better-informed market analytics, trading in new asset classes (either directly, or through more conventional financial products such as the CME and Cboe-futures on cryptocurrencies), expanded algorithmic trading, capital and collateral efficiencies, or risk mitigation. Much of the current focus has been applied to existing processes and activities, but they are equally relevant to fundamentally rethinking core CMIP functions.

- **Advanced analytics-based data.** About 25 percent of CMI fintechs are active in this area. The availability of more data, and new and more efficient ways to mine and visualize it, results in more sophisticated products and greater demand. Among others, natural language processing and machine learning techniques are being applied to develop more precise smart beta products for asset managers, and unique data streams for the sell side.
- **DLT for new market structures.** The new technologies of fintech are facilitating the fundamental redesign of markets. One example, built on a DLT foundation, is the digital market in gold created by the Royal Mint and the CME, discussed above. Another is Conjoule, a novel exchange for the energy market, also based on DLT. Stated simply, as the production of electricity becomes decentralized through greater local production of solar and wind power, a DLT-based market

can facilitate trading of small amounts of energy with low transaction costs, and enable small producers to efficiently enter and trade in the market. Implementations that involve many parties with competing interests are difficult to arrange, however. Therefore, CMIPs are likely to best leverage their unique positions in the value chain with independent projects under their own control, while maintaining optionality for other stakeholders to adopt the technology (e.g., by allowing participants to plug into the technologies through readily accessible interfaces).

- **Regtech and risk management.** Following the global financial crisis, the regulatory climate has become more complex, and banks and brokers are seeking compliance systems to handle order capture and post-trade compliance. Asset managers, too, face a greater compliance burden. In addition, all these groups are potential customers for solutions managing balance-sheet risk, efficient use of collateral, and other areas. CMIPs that can develop sophisticated systems for trade surveillance, anti-fraud and AML technology, and regulatory reporting will likely find large audiences.
- **Ecosystems.** The wave of innovation by fintechs, and their willingness to partner with incumbents, creates opportunities to develop ecosystems where customers can access a wide range of services and products through one entry point. Already, in information

services, Thomson Reuters provides not only financial market information and news, but expert information across a range of industries and business functions. In early 2017 Thomson Reuters acquired Clariant Global LLC and Avox Limited, specialists in KYC and legal entity data, to expand its portfolio of risk management and compliance services. In 2017, Thomson Reuters also announced a collaboration with Finatext, a fintech start-up originating from Tokyo University. Finatext monitors social media sentiment and refines the raw data into investment insights. These are made available to individual investors whose financial institutions grant them access to a Thomson Reuters wealth management platform. Similarly, Bloomberg has been actively building an ecosystem around its platform, adding, for instance, innovative Internet compliance, management, and security solutions through the acquisition of Netbox Blue in 2016, and integration technology solutions with the addition of Bloomberg PolarLake. Another example is BNY Mellon, which has established a network for a range of custody and other securities services. Through such capital markets ecosystems—enhanced by the offerings of fintechs—CMIPs could strengthen their ties with their customers, and attract new customers seeking investment research and commentary, analysis of big data trends, and trading in niche financial markets.

Capturing the fintech opportunity

CMIPs have a significant opportunity to draw on CMI fintech specialists. But given the usual constraints on available investment and time, to fully capitalize on fintechs CMIPs need to establish knowledgeable and committed teams, then establish a framework for selecting those fintechs that offer the best fit and strategic or financial upside.

We suggest approaching the fintech investment decision in three steps:

1. *Ensure that leveraging a fintech solution is the best option*, by assessing whether it is aligned with strategic priorities, has a clear and objective upside, and that there are no better alternatives, that is, “classical solutions.”
2. *Determine which fintech solution to adopt* by reviewing the breadth of solutions available and determining which type of technology creates the most distinctiveness and fits best with internal processes.
3. *Pick the winning fintech partner* by assessing the business case, the potential partners’ track records, and the sustainability of the setup considered.

For many CMIP firms, investing in fintech will be an attractive choice. An efficient and high-return approach to the fintech opportunity will require:

- **Understanding the fintech ecosystem and building relationships.** CMIPs can establish fintech and innovation centers to research the industry, understand its achievements, and communicate with fintech experts, venture capitalists, the fintechs themselves, and their suppliers and customers. This effort needs to be broad-based: fintechs span the globe, and

important developments are happening not only in Silicon Valley, but also in technology centers such as Tel Aviv, London, and Berlin. One WFE member executive said his firm had established two teams: one for in-house development and research on the industry, and another for setting a strategy for investing in complementary fintechs. In separate interviews, several WFE members also noted the importance of keeping abreast of the positions of large technology companies.

- **Building internal capabilities.** Capturing the potential in fintech will require a thoughtful commitment from CMIPs, beginning with building awareness across the organization of fintech opportunities and threats. Current technology teams need both education in fintech, and the introduction of new talent from a variety of backgrounds. And as with any important strategic initiative, alignment, endorsement and sponsorship from senior management is crucial.
- **Partnering with and investing in fintechs.** CMIPs can adopt many different approaches to developing relationships with fintechs, each requiring differing levels of commitment. These range from collaboration efforts and joint ventures to various degrees of investment (Exhibit 12). Forty percent of the WFE survey participants identified collaboration between incumbents and fintechs as the most efficient relationship approach, followed by joint ventures (25 percent) and minority and majority investments (13 percent each).³

Few respondents said they were pursuing an aggressive in-house development program. Executives separately stressed that the core

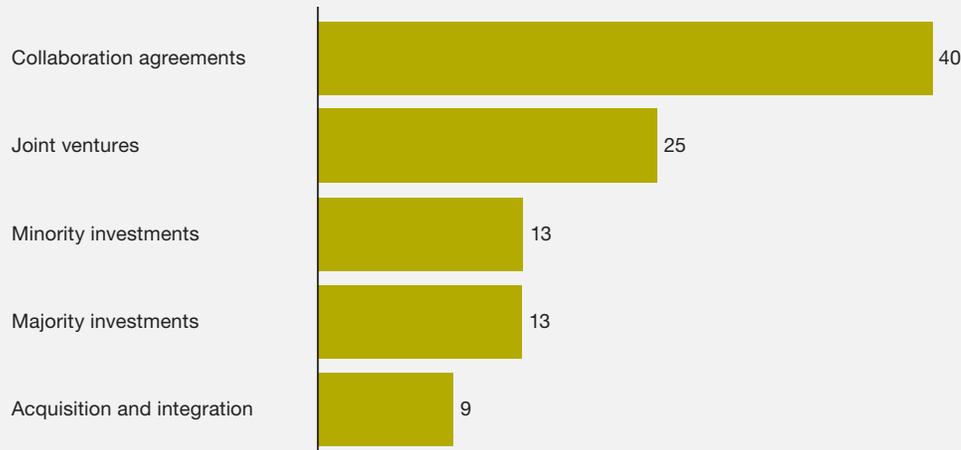
³ Survey participants could choose more than one response.

Exhibit 12

Collaborations and joint ventures are the favored models for fintech relationships

What models are most efficient when it comes to fintech relationships?

Share of responses in percent, n=46



Source: WFE-McKinsey Fintech survey 2017

challenge is leveraging the new technologies, without becoming entrenched in actual application development.

WFE member executives also cautioned that working with startups can be challenging for large firms. Although the relationships can result in a positive learning experience, tangible products are often slow to materialize, frustrating companies accustomed to hitting predictable schedules. Technologies addressing different parts of the value chain, as well as individual fintechs, will progress at different rates, which incumbents need to accommodate.

In illustrating his organization's pilot program for a novel financial market, one executive described a strategy that brought together several approaches to technology and investment. The firm typically builds its core systems in house, but for this new venture partnered with one fintech for a DLT structure, and with another one

for a trading platform (rather than reconfiguring its own existing core system for the pilot). A small acquisition was made for a third facet of the project. In the executive's view, relying on a group of third parties decreased the time to market, and was more suitable for a smaller, non-core project.

Firms that can devote considerable resources to fintech may consider a corporate venture capital approach that invests in multiple targets, with the shared goals of leveraging their technologies and a return on financial investment. Such an approach, however, calls for still more specialized talent to properly manage the effort, and a more tolerant mindset toward the rate of success, or failure, of technological experimentation.

The CMIP imperative: Fintech demands a unique strategy

Developments occurring at CMI-focused fintechs will shape the industry—simplifying the

infrastructure of the capital markets, and opening new customer segments and new revenue opportunities. In addition, CMI fintech appears to bring few direct threats: Among dedicated start-ups, most are developing products for use by CMIP incumbents, rather than designed to compete directly for their customers.

Fintech in the capital markets has lagged its counterparts elsewhere in finance, and in some areas the technologies and benefits seem far off. But the level of investment in CMI fintech is gaining, to the benefit of the early movers. Those incumbents that do not recognize its impact on their business, and fail to take a proactive stance, face a future that will be shaped by their peers and

competitors. For investment in fintech, time is of the essence.

There are roughly 700 fintechs in various stages of development across the CMI value chain. An unfocused investment approach would be both unmanageable and expensive, and while fintech start-ups will not ultimately own the industry, over time, the typical CMIP will likely benefit from dozens of fintech innovations. Thus, fintech investments and partnerships must be chosen wisely—two prerequisites are a thoughtful set of priorities and an understanding of fintechs potential impact on the industry. Fintech is not a strategy, but a means to reach strategic priorities.

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