



Top-10 Trends in Capital Markets: 2019

What You Need to Know



Contents

Introduction	3
Trend 01: Intelligent Automation Transforms Trade Functions	4
Trend 02: RPA Enhances Business Process Effectiveness	6
Trend 03: Cloud Will Drive Operational Efficiency and Help with Strategic Decisions	8
Trend 04: Microservices Improve Firm Agility and Workflow	10
Trend 05: Smart Contracts Boost Trade Settlement Efficiency	12
Trend 06: Platformification Will Generate New Customers and Revenue Streams	14
Trend 07: Quantum Computing to Revolutionize the Capital Markets Operating Model	16
Trend 08: RegTechs Will Boost Compliance and Risk Mitigation Capabilities	18
Trend 09: GDPR is Prompting a Deeper Dive into Data Governance and Management	20
Trend 10: AI and ML will Play a Major Role in Handling Cyber-Crimes in the Future	22
References	24
About the Authors	27

Introduction

A decade after the global financial recession that threw some too-big-to-fail banks into freefall, the financial industry continues to bear scars. Banks, financial institutions, regulatory bodies, and investors have taken multiple steps over the last decade to ensure that history is not repeated. Their actions aim to prevent another meltdown while ensuring that industry giants stay competitive in the new age of technology-driven innovative FinTechs. Drawing from intelligent automation, data-driven compliance and deep customer insights, the future of capital markets is taking shape; and in this report, we will explore the top-10 market trends based on these phenomena.

There is growing pressure on financial institutions to consistently innovate to improve customer engagement. To that end established banks and FinTech firms are turning to artificial intelligence (AI) to drive **Intelligent Solution**, which is expected to spur a new wave of streamlined operational processes. Today, AI and related technologies such as machine learning (ML), distributed ledger technology (DLT), and robotic process automation (RPA) are enabling new levels of business process efficiency and effectiveness ranging from trading and post-trade operations to cybercrime and applications of quantum computing.

A key way for banks to innovate is to identify customers' most critical demands and to use that information as a springboard for developing products and services. The ability to analyze customer data and to extract **Deep Customer Insights** will enable firms to identify hidden patterns in data, generate customer insights from large volumes of data, and create actionable strategies to create products with a strong value proposition. Not surprisingly, better products will drive increased customer engagement and better retention.

As customer data is a tremendous asset for any organization in the capital markets industry, ensuring information security is critical. Concerns about security have led to a slate of regulations that require firms to maintain strict standards on usage, distribution, and protection of valuable customer data. To ensure organizations manage compliance regulations and use them to drive business goals, more organizations are turning to **Data-driven Compliance**.



Exhibit 1. : Capital Market Influencers



Trend 01: Intelligent Automation Transforms Trade Functions

Technology can help capital market firms deal with trade exceptions and mitigate risk without compromising returns.



Background

- Over the years, capital markets have made extensive efforts to automate their trade functions, but lately, the focus has been shifting from robotic to intelligent automation.¹
- As the business environment changes, more and more firms are adopting ways to implement and use automation and AI to convert large data lakes into processed, useful information.



Key Drivers

- The growing need to proactively manage trade risk and reduce operating expenses.
- Automated processing reduces trade completion time and post-trade settlement errors.



Trend Overview

- Capital market firms are using AI and machine learning (ML) to optimize trade processes and post-trade activities.² (Exhibit 2)
- On the trading front, these technologies are used to automate funds and manage risks:
 - ML is disrupting both buy-side and sell-side transactions by streamlining complex workflow. Traditional firms with huge datasets are using deep-learning tools to make viable changes to automate funds. ML algorithms are substituting investment managers to drive better returns and positive alphas.
 - Risk managers use AI for real-time trade fraud detection. Complex AI algorithms can run several checks simultaneously during the trade, resulting in better risk management compared with traditional tests.^{3 4}
 - » In 2017, BlackRock cut more than 40 jobs including a few portfolio managers by implementing computerized trading algorithms. The firm expects its cost-to-profit ratio to shrink by 28% as AI algorithms outperform active stock traders.⁵
- In post-trade operations, transactions and reconciliations are being automated using AI-based Natural Language Processing (NLP) and ML. The principal reason for adopting AI for these functions is to reduce manual effort in low-value processes:

1 Intelligent Automation is the combination of robotic automation, artificial intelligence, and machine learning to create self-learning systems that improve decision making over time

2 *Finextra*, "How AI is transforming Trade settlements," Breana Patel, March 22, 2018, <https://www.finextra.com/blogposting/15175/how-ai-is-transforming-trade-settlements>

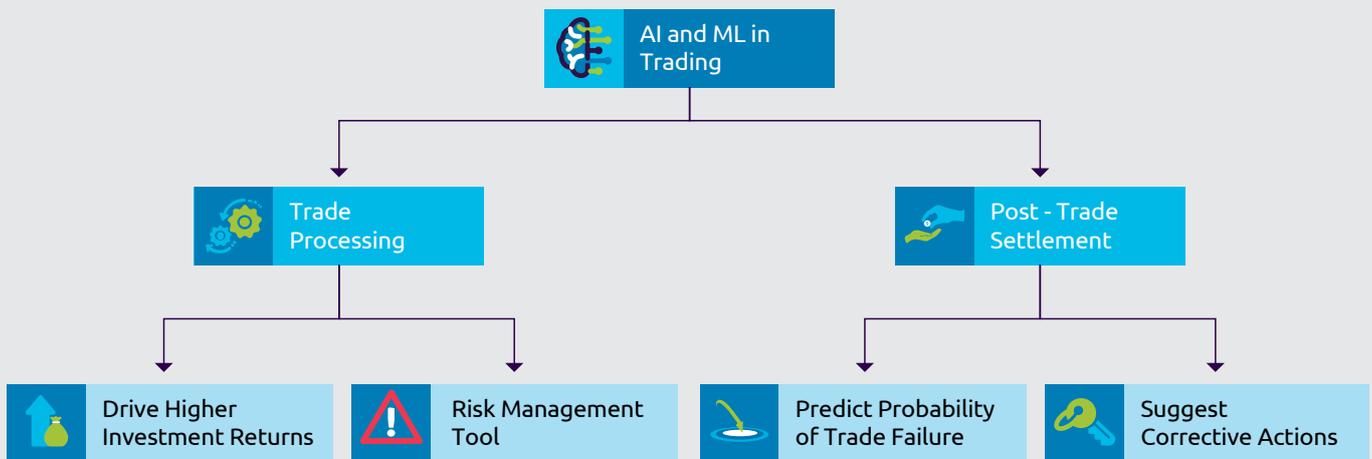
3 Buy-side firms buy investment products. Asset managers, hedge funds, pension funds, retail and institutional investors, private equity funds, and life insurance companies fall under the buy-side umbrella.

4 Sell-side firms create, market and sell financial and investment instruments. Sell-side firms include investment banks, commercial banks and stock brokers.

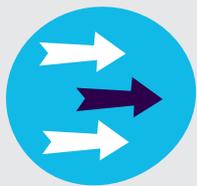
5 *Fortune*, "Robots Are Replacing Humans at All These Wall Street Firms", Lucinda Shen, March 30, 2017, <http://fortune.com/2017/03/30/blackrock-robots-layoffs-artificial-intelligence-ai-hedge-fund>

- Most trade execution and settlement discrepancies are handled manually by middle- and back-office employees. The process is time-consuming, labor-intensive and expensive. By analyzing historical patterns, ML can predict chances of failure and in the event of failure can identify causes.
- BNP’s Smart Chaser, an AI-based trade-matching tool, can predict the probability that a trade will require manual support and will automatically prompt investment managers to intervene. BNP said preliminary test results were 98% accurate.⁶

Exhibit 2. Uses of Intelligent Automation in Trading



Source: Capgemini Financial Services Analysis, 2018



Implications

- ML can quickly analyze large datasets to mitigate risk and drive higher returns for firms.
- AI can quickly identify failed trade transactions along with the exact reason for failure, allowing firms to implement remedies in seconds.
- After identifying failed transactions, AI can propose solutions to fix process gaps, which leads to safer, faster and more profitable trades.

⁶ Tech Emergence, “Artificial Intelligence at Investment Banks – 5 Current Applications,” Raghav Bharadwaj, August 8, 2018, <https://www.techemergence.com/artificial-intelligence-at-investment-banks-5-current-applications>.

Trend 02: RPA Enhances Business Process Effectiveness

Capital market firms are developing applications for RPA across functions, driving efficiency and cost gains.



Background

- Robotic Process Automation (RPA) creates value by freeing up human involvement to provide additional capacity for strategic work.
- With capital markets firms facing operational inefficiencies and reduced profitability driven by increased regulatory costs, they are investing in new ways to use RPA to drive profitable initiatives.

Key Drivers

- The operating expenses of capital market firms are earmarked primarily for employee salaries and benefits. Within a low-profit environment it is critical to keep operating costs down.
- Persistent human involvement in repetitive tasks lowers productivity. Human intervention focused on complex tasks add the most value to the organization.
- Financial operations generate volumes of unstructured data that must be processed to produce useful and actionable insights.
- In today's highly competitive environment, an early-mover advantage can mean additional revenue to the tune of millions of dollars.



Trend Overview

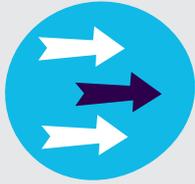
- Presently, most RPA applications under deployment are desktop automation (attended RPA) followed by virtual machine deployments (unattended RPA). With enterprises opting for cloud services, the next significant industry shift will be increased adoption of the cloud to run RPA deployments.
- According to Everest Group, enterprise RPA adoption, defined as the total number of enterprise clients served by independent RPA advisors, increased 105% from 2016 to 2017.⁷
 - The RPA software market grew 97% in 2017 and is expected to grow between 75-90% in 2018.⁷
- As enterprise-level RPA adoption increases, more human resources are being freed up to handle complex situations and strategic problems. RPA has been steadily improving productivity across multiple domains, such as investment management, underwriting, and claims payments.
 - Colombia's largest bank, Bancolombia developed InvestBot to offer its premium clients real-time intelligence about portfolio performance. The bot gathers market information by interfacing in real time with the Colombian stock exchange and receives feedback from the larger global Bancolombia network.⁸
 - RPA has enabled Israel's Kryon systems to shorten claims operations turnaround time for its clients from four days of manual labor to two hours of automated processes to save costs and dramatically increase efficiency.⁹



7 Everest Group, "Enterprise Adoption of RPA Exceeds 100% Growth in 2017, Buoyed by New Buyers of All Sizes, Industries", July 23, 2018, <https://www.everestgrp.com/2018-07-enterprise-adoption-rpa-exceeds-100-growth-2017-buoyed-new-buyers-sizes-industries-everest-group-press-release-46088.html>

8 Finance Colombia, "Bancolombia Wins Digital Transformation Award at Andicom 2017 Conference in Cartagena," Jared Wade, August 26, 2017, <http://www.financecolombia.com/bancolombia-wins-digital-transformation-award-andicom-2017>

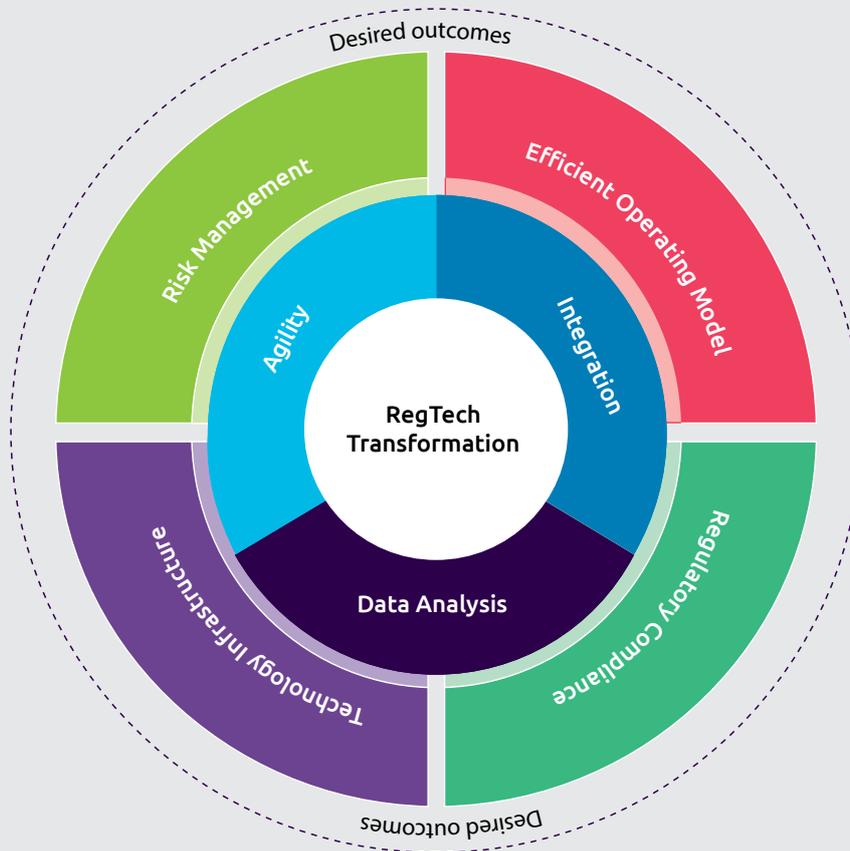
9 FinanceTnT, "RPA in Action: Innovative Ways Five Financial Services Companies Are Using Automation," September 24, 2018, <http://financetnt.com/rpa-real-world-practical-ways-5-financial-services-firms-use-robotic-process-automation>



Implications

- RPA will reduce operational costs significantly by driving processes without the need for human intervention. (Exhibit 3)
- Firms can redirect more resources to work on strategic issues over manual and operational ones, thus creating more value for the organization in the long run.
- RPA can enable automatic parsing of huge datasets to generate intelligence at a faster rate compared to manual processes. This will enable firms to go-to-market faster compared to relying on traditional methods.
- Increased use of AI in capital markets will ultimately lead to more extensive use of cognitive RPA across the industry, where robotic processes can integrate with AI tools, vision interfaces, and predictive and prescriptive analytics to drive efficiency.

Exhibit 3. RPA Impact on Business



Source: Capgemini Financial Services Analysis, 2018

Trend 03: Cloud Will Drive Operational Efficiency and Help with Strategic Decisions

Increased adoption of cloud technology by capital market firms will improve real-time strategic decision making and operational efficiency.



Background

- Capital market firms are facing economic challenges – low interest rates, stringent regulations, and increased capital requirements with high margin pressure.
- Cloud technology can enable firms to be agile, to rapidly respond to external changes, and to reduce upfront capital expenses.



Key Drivers

- The need to meet growing customer demand for real-time data insights
- Opportunity to improve organizational decision making by accessing real-time data and improving data sharing.
- Need to reduce upfront capital expenses to balance costs of regulatory and compliance requirements.
- Cloud adoption in other industries has driven tangible benefits and is spurring capital markets action.

Trend Overview

- Adoption of cloud technology among capital market firms is accelerating, with organizations increasing cloud spending to access new sources of business-critical data to make better business decisions:
 - Public cloud investments will consume 47% of IT budget for capital market firms by 2019, ranging from small hedge funds to large banks.¹⁰
- Capital market firms are also adopting cloud infrastructure to realize cost efficiencies and improve data processing capabilities:
 - DBS bank partnered with data center provider Equinix to migrate its traditional data center in Singapore to the cloud, which reduced infrastructure costs by around 75%.¹¹
- Cloud adoption enables rapid scaling of operations, quicker solution deployments, cost-effective regulatory compliance, and enhanced collaboration with ecosystem partners:
 - Ping An Securities quickly expanded its capital markets business by deploying a cloud-powered, flexible, and integrated risk management platform through collaboration with FinTech firm Finastra. The platform enables Ping An to support a broader range of financial instruments and reduce time-to-market.¹²
- Cloud technology also serves as a platform for investment banks to improve and enhance various in-house operations such as risk measurements, and trading decisions.



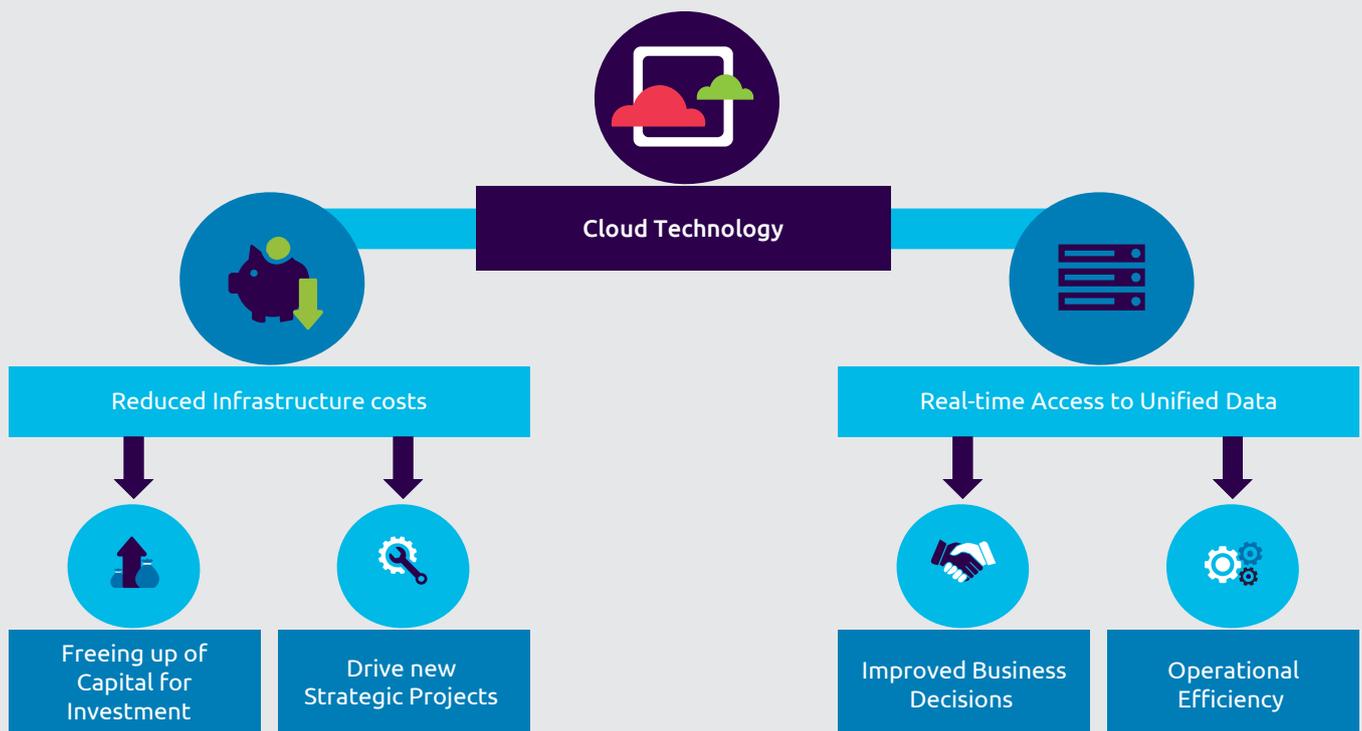
¹⁰ Computer Weekly, “Capital markets firms to ramp up public cloud spending,” Karl Flinders, July 24, 2018, <https://www.computerweekly.com/news/252445424/Capital-markets-firms-to-ramp-up-public-cloud-spending>

¹¹ DBS Bank press release, “First bank in Singapore to launch new cloud-based data centre,” November 13, 2017, https://www.dbs.com/newsroom/First_bank_in_Singapore_to_launch_new_cloud_based_data_centre

¹² Finastra website, “Ping An Securities Strengthens Trading to Move Into New Markets,” February 1, 2018, <https://www.finastra.com/customer-experience/success-stories/ping-an-securities-strengthens>

- There is also a growing prominence of FinTechs that leverage cloud technology and offer innovative solutions to capital market firms:
 - FinTech firm AlphaSense uses AI-powered search technology to provide investment insights to clients. The firm uses Amazon Cloud as a cost-effective real-time data center for clients such as Credit Suisse and Cowen Group.^{13,14}

Exhibit 4. Key Benefits of Cloud Technology Adoption



Source: Capgemini Financial Services Analysis, 2018

Implications



- Adoption of cloud services will drive down technology and infrastructure costs and free up funds for business processes and revenue generation (Exhibit 4).
- By leveraging cloud infrastructure, firms can break data silos across various processes and pool utility data leading to improved decision making and cost efficiencies.
- The cloud can enable firms to deploy analytics and business intelligence applications on their data pool to derive actionable business insights
- Capital market firms can leverage the cloud to move toward digital innovation and provide seamless service to customers.

13 AWS website, <https://aws.amazon.com/solutions/case-studies/alphasense>, Accessed September 2018

14 AlphaSense website, <https://www.alpha-sense.com>, Accessed September 2018

Trend 04: Microservices Improve Firms' Agility and Workflow

Capital market firms are recognizing the capabilities of microservices architecture – improvements in technology development, deployment speed, and service delivery.



Background

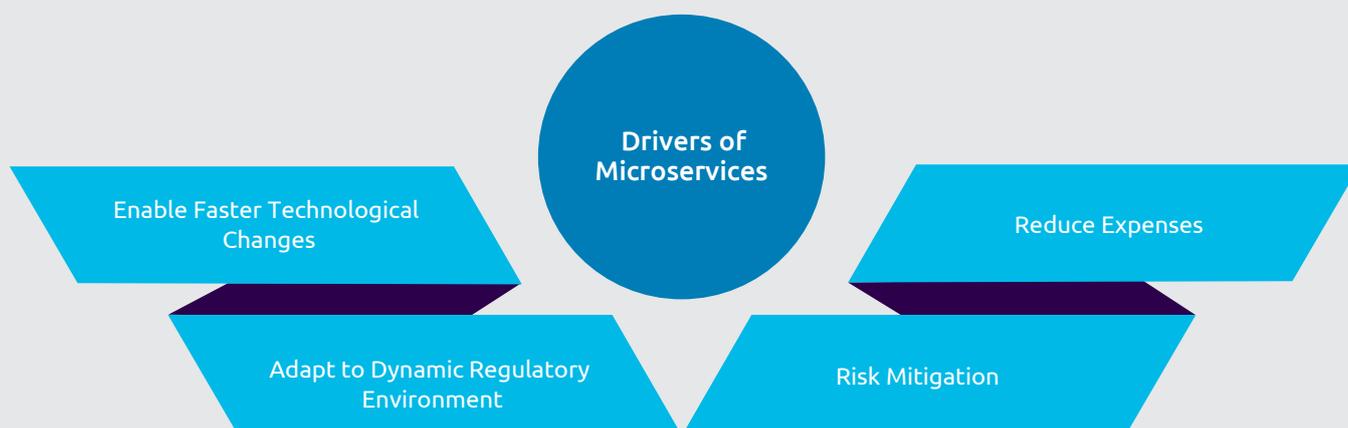
- Technological obsolescence is making agility critical for capital markets firms as every second of downtime represents lost dollars.
- Plug-and-play services and mobile teams that can be deployed on demand are becoming the norm.



Key Drivers

- Companies cannot afford operational shutdowns or interruptions while systems are being upgraded or maintained.
- Frequent regulatory changes have given rise to the need for teams to develop technology applications that can quickly assimilate and implement changes. (Exhibit 5)
- Firms are moving to reduce risks and costs associated with holding positions and data in monolithic systems.

Exhibit 5. Drivers of Microservices Adoption



Source: Capgemini Financial Services Analysis, 2018

Trend Overview

- Firms have started to deploy separate apps on a single interface to decrease internal dependencies. This ensures:
 - The components are easy to maintain and update individually, without affecting system work overall.
 - Faster updates to stay on top of technology trends in the market.
 - For example, PayPal's Make the Payment button is an app in itself and is managed by a dedicated team.¹⁵
- Some firms have also changed their software deployment strategy to adopt the microservices architecture. This has reduced coordination efforts between teams and allowed firms to continue fast development of software.
 - Capital One develops applications fast without compromising on quality or safety. Development teams start with a design and split microservices when they find instances of coordination.¹⁶
- Collateral management is another area where microservices have been used to provide firms need-based services.
 - Companies like AcadiaSoft and DTCC Margin Transit Utility have used microservices architecture to provide collateral management solutions.^{17 18}
- Large banks are investing in technologies to develop microservices capabilities. The banks hope to incorporate their experience in managing mission-critical applications in these new platforms being developed.
 - Goldman Sachs invested in Nginx, a startup that specializes in microservices enablement.¹⁹



Implications

- Large-scale disruption of overall systems caused by single failure points will be significantly reduced as microservices allow firms to decrease internal system dependencies.
- Overhead firm costs will be reduced as teams and systems are re-directed to execute similar functions across different divisions.
- Capital market firms will become more responsive to regulatory changes and technological trends and roll out dynamic changes to current systems without affecting normal workflows.



15 *Business Insider*, "Big companies and startups alike are jumping all over a trendy new tech called 'microservices' - here's why", July 2, 2015, <https://www.businessinsider.in/Big-companies-and-startups-alike-are-jumping-all-over-a-trendy-new-tech-called-microservices-heres-why/articleshow/47904028.cms>

16 *TechTarget*, "Capital One's use cases for implementing microservices," Jan Stafford, September 29, 2017, <https://searchmicroservices.techtarget.com/feature/Capital-Ones-use-cases-for-implementing-microservices>

17 Acadiasoft press release, "Collateral 2020", June 27, 2018, <http://www.acadiasoft.com/blog/company/press/article/acadiasoft-london-collateral-2020-june-27th>

18 *Securities Finance Monitor* "Calypso blog: The Move to Cloud Born Microservices in Collateral Management," Alan Sheehan, February 12, 2018, <https://finadium.com/the-move-to-cloud-born-microservices-in-collateral-management>

19 *Venturebeat*, "NGINX raises \$43 million to help enterprise customers transition to microservices," Chris O'Brien, June 21, 2018, <https://venturebeat.com/2018/06/21/nginx-raises-43-million-to-help-enterprise-customers-transition-to-microservices>

Trend 05: Smart Contracts Boost Trade Settlement Efficiency

Smart contracts are the next big wave of innovation in distributed ledger technology and have the potential to drastically alter the way trading is executed in capital markets



Background

- The trade settlement process in capital markets undergoes a lengthy process and delayed transaction time primarily due to involvement of multiple intermediaries, clearances at various stages, and regulatory compliance.
- Smart contracts are distributed ledger technology (DLT)-based contracts that are automatically executed by computer systems once their underlying criteria are fulfilled. They can be used to settle every low-value trade.
- Smart contracts with DLT can make settlement processes in real-time and eliminate intermediaries that provide settlement and depository functions.



Key Drivers

- In trading, the increased focus on reducing the time taken to settle the trade has shifted focus from front office to middle and back offices; hence, firms are trying to identify opportunities in middle and back offices to improve processes.
- Implementations by cryptocurrencies such as Bitcoin and Ethereum have given a push to smart contracts for post-trade settlements.
- The potential benefits of smart contracts such as automatic enforcement and lower compliance costs make it economically viable to form smart contracts for numerous low-value transactions.
- Smart contracts will help regulators enhance transparency in transactions, which has been a major concern among investors.



Trend Overview

- Smart contracts are one of the most recently developed applications of distributed ledger technology. At least 23 different cryptocurrency trading platforms are currently utilizing or planning to use smart contracts in future, with capital market firms likely to follow suit.²⁰
- In May, HSBC became the first bank to complete a commercial trade transaction using this technology. The transaction took 24 hours which usually takes 5 to 10 days to settle.²¹
- Smart contracts have inherent benefits to the entire capital market system as well as to individual firms (Exhibit 6).

Capital Market System:

- Smart contract becomes undisputable once accepted in general ledger, thus the scope of manipulation in capital markets becomes minimal.
- Automatic regulatory reporting from capital market trading desks could be achieved in near-real time using DLT and smart contracts.
- Smart contracts have the potential to reduce trade time via auto settlement and, at the same time, reduce errors in trade execution.

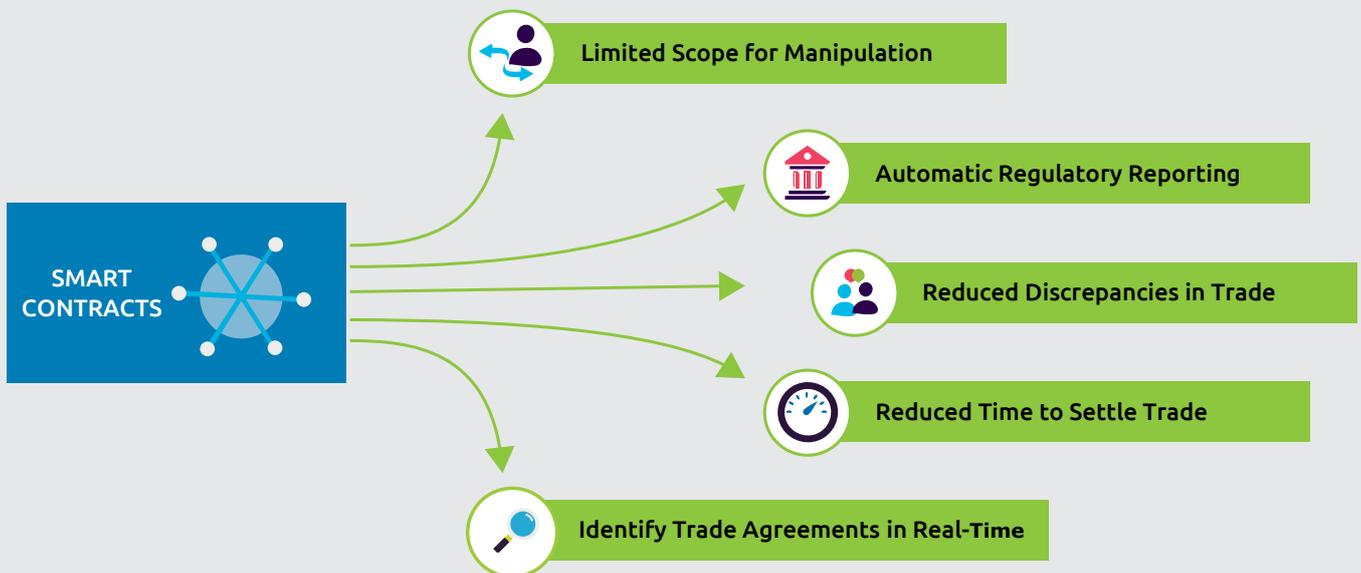
²⁰ The Motley Fool, "Smart Contracts and the Blockchain, Explained," March 9, 2018, <https://www.fool.com/investing/2018/03/09/smart-contracts-and-the-blockchain-explained.aspx>

²¹ Market Screener, "HSBC : ING Bank and Cargill Prove the Viability of Trade Finance on Blockchain", May 17, 2018, <https://www.marketscreener.com/HSBC-HOLDINGS-16896790/news/HSBC-ING-Bank-and-Cargill-Prove-the-Viability-of-Trade-Finance-on-Blockchain-26602952/>

Capital Market Firms:

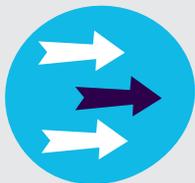
- With smart contracts, trade agreements such as collateral, swap, and margin agreements could be met by writing specific instructions via code on to the ledger.
- For example, a smart contract could automatically compute the market exposure, the subsequent margin required, and debit the cash from the counterparty for a transaction.
- A combination of distributed ledger and smart contracts can reduce the violations in trading limits.

Exhibit 6. Benefits of Smart Contracts



Source: Capgemini Financial Services Analysis, 2018

Implications



- The implementation of distributed ledgers with embedded smart contracts will lead to substantial improvements in compliance, cost-efficiency and accountability for capital market firms.
- Smart contracts will speed up processing of trade agreements on complex financial products, thereby increasing efficiency of transactions and reducing the cost burden on customers.
- Smart contracts will ensure zero errors as the contracts are executed as per the exact code provided by the parties involved.
- The encryption of documents makes them immune to theft thereby improving safety and trust as all parties have access to the documents on the shared ledger.

Trend 06: Platformification Will Generate New Customers and Revenue Streams

The rise of platformification makes it imperative for capital market firms to move from build to buy side to meet customers' growing needs.

Background



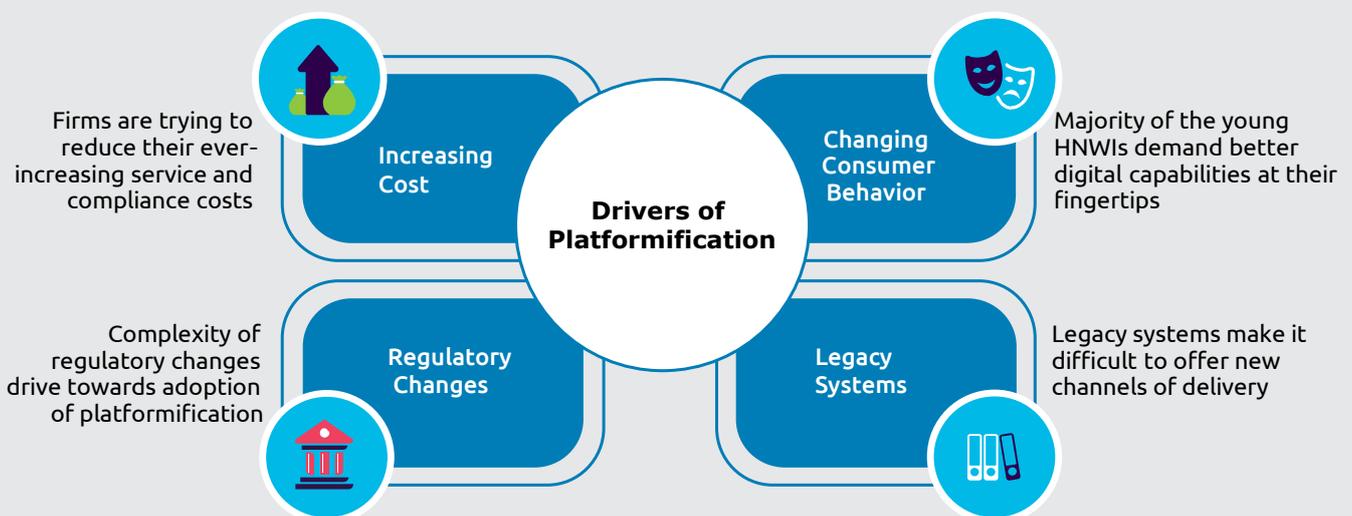
- Younger investors are more inclined toward technology and they require a wide range of digital tools to support their decision making.
- FinTechs have shaken the established capital markets' status quo and incumbents may lose customers if they don't provide targeted products and services.
- Platformification allows capital market firms to meet evolving client demand for digital experiences by using a plug-and-play service delivery model.
 - Platformification will reduce the burden on capital market firms to develop new products and services, effectively ensuring that it can offer a plethora of third-party services to engage customers meaningfully.

Key Drivers



- Capital market firms have limited capabilities to develop and support the varied nature of applications demanded in today's technology-driven world.
- In-house development is time-consuming and adds additional cost when the firm is coping with costly issues such as legacy upgrades and regulatory compliance.
- Legacy systems make it difficult for firms to offer new channels of delivery in response to customer demand.
- Regulatory changes and the rise of open architecture have pushed capital market firms to connect with external systems and take advantage of new platforms to get access to new customers and new sources of income.

Exhibit 7. Drivers of Platformification



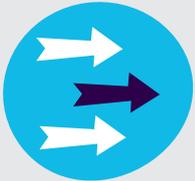
Source: Capgemini Financial Services Analysis, 2018

Trend Overview



- Capital market firms have opened their infrastructure to allow clients to securely and consistently interact with various divisions of the firm.
 - For example, Goldman Sachs' Marquee platform empowers clients to educate themselves and make decisions without the intervention of the sales team.²²
- Trading is another area where capital market firms use platformification to offer better digital customer experience to clients.
 - For example, BBVA launched BBVA Trader a platform for the purchase and sale of shares, warrants, and exchange-traded funds that existing and prospective clients may access from all devices and which has an intuitive user interface.²³
 - Denmark's Saxo Bank launched a platform for traders and institutional clients, SaxoTraderPro. Clients can also directly access the API to develop their own functionalities for a more flexible environment.²⁴

Implications



- Reduced firm overhead costs because clients will be able to access a variety of services via a plug-and-play model.
- Consumers will not have to make duplicate data entries and pay multiple providers while getting access to a wider range of products and features.
- Introduction of new revenue streams for capital market firms as more third parties get access to the bank's historical data.
- Capital market firms will have shorter development and deployment cycles for newer technologies while ensuring their consumer data safety is not compromised.

22 Efinancial Careers, "I launched Goldman Sachs' Marquee, but I quit to tackle Fintech's biggest opportunity," Paul Clarke, January 31, 2017, <https://news.efinancialcareers.com/uk-en/272629/goldman-sachs-marquee>

23 BBVA website, "We introduce BBVA Trader, the new markets platform for clients and non-clients", Elisabet Furio, December 2, 2016, <https://www.bbva.com/en/introduce-bbva-trader-new-markets-platform-clients-non-clients>

24 *FinTech Futures*, "Saxo Bank launches new trading platform", Antony Peyton, April 4, 2018, <https://www.bankingtech.com/2018/04/saxo-bank-launches-new-trading-platform>

Trend 07: Quantum Computing to Revolutionize the Capital Markets Operating Model

Quantum computing is poised to be the new gold standard of capital markets' technology, with applications ranging across risk management, portfolio optimization, fraud detection, and asset pricing.



Background

- Driven by new computing abilities, capital markets are on the verge of a revolution, with quantum computing set to enhance the speed and processing power required to run complex financial algorithms.
- Quantum computers are designed to execute algorithms that were previously considered not executable. In doing so, they have the potential to disrupt the nature of transactions prevalent in financial markets today.



Key Drivers

- The increase in machine learning techniques by quantum computers to detect recurring patterns in capital markets will drive adoption of quantum computing.
- Many banks are interested in using quantum computing for risk management. Risk calculations entail large numbers in complex simulations, and if the algorithm has a self-learning module that can build on existing information, it can add new layers and abilities to manage risk better.
- Quantum computers are equipped to solve algorithmic trading problems with speeds that are exponentially faster than traditional digital computers.
- Many FinTechs are developing new applications of quantum computing:
 - For example, 1Qbit (funded by RBS) helps to reformulate financial problems for quantum computing.²⁵
 - Numerai (raised US\$6 million) allows user to test their financial algorithms on quantum computing machines.²⁶

²⁵ CB Insights, "Speeding Up Industry: 12 Early-Stage Quantum Computing Startups to Watch," October 6, 2016, <https://www.cbinsights.com/research/quantum-computing-startups-early-stage>

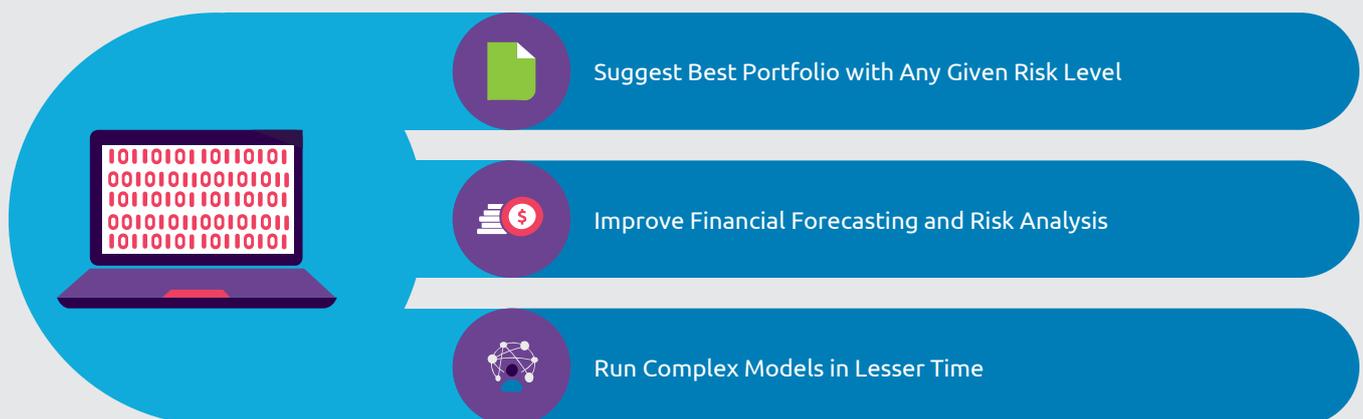
²⁶ Wired, "Trading places: the rise of the DIY hedge fund", Greg Williams, April 2, 2017, <https://www.wired.co.uk/article/trading-places-the-rise-of-the-diy-hedge-fund>



Trend Overview

- In 2018, the binary classical computing technology is arguably nearing its end of life in terms of its long-term development cycle. Over the next few years, those systems will be replaced by a new, non-binary, qubit-based quantum computing technology, which could dramatically expand the data processing and business model capabilities of any type of organization. (Exhibit 8)
- Morgan Stanley projects the quantum computing industry to generate revenues in the range of US\$5-10 billion every year while Homeland Security Research estimates that the quantum computing market will grow at 24% annually throughout 2018-2024.²⁷
 - In association with JPMorgan Chase, IBM is applying quantum computing to trading strategies, portfolio optimization, asset pricing, and risk analysis. IBM expects quantum computing to be the industry norm over the next decade.²⁷
- Currently operational adiabatic Quantum computers such as Google's D-Wave can solve the portfolio problem in a finite amount of time, which was considered impossible under classical computing.²⁸

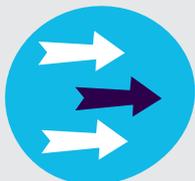
Exhibit 8. Applications of Quantum Computing Technology



Source: Capgemini Financial Services Analysis, 2018

Implications

- In stock markets, quantum computing can help find an effective frontier of portfolios with best possible returns for any given risk level – currently considered a non-deterministic polynomial time (NP) problem in today's market.
- The data encryption technique used currently can become obsolete soon, owing to the power of quantum computing; this will enable capital market firms to reduce the database request times, improve financial forecasting and risk analysis in capital markets.
- To achieve the same result, quantum algorithms require logarithmically fewer calculations than a classical computer, and capital market firms can leverage that capability by running complex financial models faster.
- Quantum computers will provide deeper levels of insight and understanding, which investors and firms can use to help fight fraudulent activities previously thought inconceivable.



²⁷ Nasdaq, "Quantum Computing: What It Is, And Who the Major Players Are," Prableen Bajpai, March 26, 2018, <https://www.nasdaq.com/article/quantum-computing-what-it-is-and-who-the-major-players-are-cm939998>

²⁸ Medium, "How quantum computers would be able to process all of Wall Street financial models at once", March 20, 2018, <https://medium.com/swlh/how-quantum-computers-would-be-able-to-process-all-of-wall-street-financial-models-at-once-a7d536469d16>

Trend 08: RegTechs Will Boost Compliance and Risk Mitigation Capabilities

RegTechs have the capability to endlessly monitor risk, which can help firms reduce compliance obligations and enhance productivity and efficiency.²⁹

Background



- After the 2008 economic crisis, there has been a rise in the regulatory requirements in the capital markets, requiring firms to invest heavily in capital, human resource and time to ensure full compliance with the regulatory requirements.
- With the challenges associated with rising compliance, capital market firms need to reassess their complete risk ecosystem, including operational risks and compliance.
- By allowing new operating models, RegTechs will help to overcome the regulatory hurdles with the use of innovative technologies.
- RegTech will also enable capital market firms to bring their whole risk ecosystem under a common platform.

Key Drivers



- Capital market institutions are battling to comply with new regulations such as MiFiD II, General Data Protection Regulation (GDPR) and the revised Payment Service Directive (PSD2).
- With the introduction of Fundamental Review of the Trading Book (FRTB), banks with trading books will need to enhance risk aggregation capabilities to survive market volatility.
- Financial institutions currently do not possess the capabilities and resources to develop solutions to ensure compliance with the wide-ranging list of regulatory requirements.
- With rapid growth in Big Data and the capability of the firms to acquire flexible infrastructure and cloud storage for data, disruptive technologies are being used in the operational aspects as well.

Trend Overview

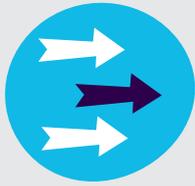


- RegTechs can bring significant improvements in the operating model of firms resulting in enhanced productivity and efficiency.
 - A bank implemented RegDelta, a regulatory data management platform developed by JWG, to help reduce regulatory gap-analysis time by 80%.³⁰
 - Ayasdi helped Citi automate its stress-testing process, reducing the time from nine to three months with a smaller workforce.³¹
- Currently, capital market firms are highly dependent on manual processes, which exposes them to the possibility of errors and gaps. RegTechs will help automate the entire risk management system along with standardization of data and regulations within different verticals of an organization.

²⁹ RegTechs are regulatory technologies that uses technology such as cloud through software-as-a-service (SaaS) to help businesses comply with regulations efficiently and less expensively.

³⁰ Burnmark | Alvarez & Marsal, "RegTech 2.0", January 2018, https://www.alvarezandmarsal.com/sites/default/files/regtech_2.0_report_final.pdf

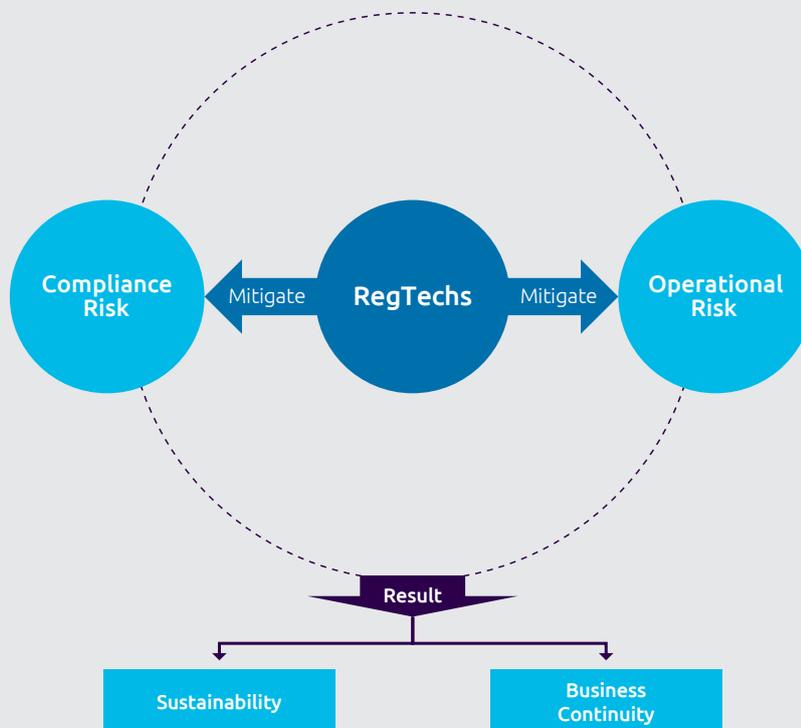
³¹ TechEmergence, Artificial Intelligence in Regulatory Technology (RegTech) – 5 Current Applications, Raghav Bharadwaj, July 20, 2018, <https://www.techemergence.com/artificial-intelligence-in-regulatory-technology-regtech>



Implications

- RegTechs will help firms create an integrated risk management system which will aid to evaluate risks in various functions of the organization and encompass regulations under a single umbrella. (Exhibit 9)
- By bringing all regulatory risks and business processes under a single umbrella, firms will be able to standardize compliance requirements, thus reducing the cost of regulatory compliance.
- Firms will be better equipped and agile to scale their operations with standardized regulatory platform in a dynamic regulatory environment.

Exhibit 9. Integrated Risk Management System



Source: Capgemini Financial Services Analysis, 2018

Trend 09: GDPR is Prompting a Deeper Dive into Data Governance and Management

Since the introduction of the EU's General Data Protection Regulation, there is an increased focus on using data in a compliant way to scale up business.



Background

- Data governance and management is one of the major agendas for capital market firms, and this has become more critical with the European Union's General Data Protection Regulation (GDPR) in effect.
- According to Gartner, "Under GDPR, not all data requires the same level of governance; the use cases can define the differentiation. This favors a trust-based approach to governance, where the most critical and most commonly referenced data is centrally controlled and less critical data with single-use cases can be governed more loosely."³²

Key Drivers

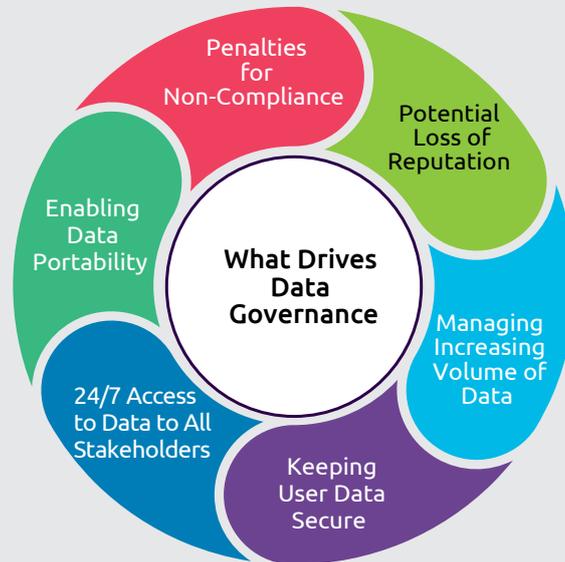


- The volume and variety of data to be processed, managed, analyzed, and reported is increasing exponentially (Exhibit 10).
- Specific guidelines under GDPR such as Article 30 require companies to keep an updated record of processing activities that use personal data. Non-compliance can result in heavy penalties and reputational loss.³³
- Among GDPR rules, "ensuring the right of access, the right to data portability, and the right to erasure," are key drivers to maintaining a complete and secure data structure.
- Firms must also identify overlaps with other regulations (such as FINCA record-keeping/data storage requirements) that push for better data structure and management frameworks.

³² Gartner Inc., "How GDPR is an Opportunity to Create Business Value," Rob van der Meulen, January 24, 2018, <https://www.gartner.com/smarterwithgartner/how-gdpr-is-an-opportunity-to-create-business-value/>

³³ PrivazyPlan, "Article 30 GDPR: Records of processing activities," <http://www.privacy-regulation.eu/en/article-30-records-of-processing-activities-GDPR.htm>, Accessed September 2018

Exhibit 10. Drivers of Data Governance



Source: Capgemini Financial Services Analysis, 2018

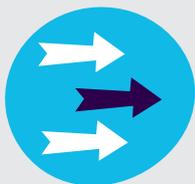
Trend Overview

- GDPR compliance is not only a regulatory requirement but also a tool to build and safeguard a firm's brand value. With rising awareness regarding the use of individuals' personal data, the risk of reputational damage in case of non-compliance has increased.
- European firms will need a GDPR transformation program to address gaps between their technology capabilities and GDPR requirements. The program should have sustainable IT implementation to ensure complete data protection and full compliance to build and retain trust with clients and consumers.
- Identifying and leveraging targeted technologies will be key for firms to store data in a structured manner and perform regular audits to report breaches, as required by GDPR.
- The changing regulatory landscape has opened ways for non-traditional companies to enter the space and help firms manage their data better:
 - London-based startup Cybertonica helps banks and e-commerce platforms identify anomalous transactions.³³
 - CoVi Analytics simplifies and automates the end-to-end compliance process for financial institutions through an AI-powered SaaS suite.³³



Implications

- GDPR will lead organizations towards a stronger and more advanced information governance system. This will help organizations understand their existing data, update the retention and disposition policies and adhere to those policies.
- Firms should embrace the regulations as an opportunity to simplify and rationalize data structures and review internal processes.



³³ PrivazyPlan, "Article 30 GDPR: Records of processing activities," <http://www.privacy-regulation.eu/en/article-30-records-of-processing-activities-GDPR.htm>, Accessed September 2018

Trend 10: AI and ML will Play a Major Role in Handling Cyber-Crimes in the Future

With increasing use of AI and ML, more sophisticated cybersecurity infrastructure can be implemented to protect firms and investors.

Background



- The inability to foresee and understand the increasing threat of cybercrimes is affecting capital market firms.
- Industry is slowly shifting towards Artificial Intelligence (AI) and Machine Learning (ML) for fraud detection.
- Considering the huge volume of data being generated, AI and ML can help identify a pattern and detect system irregularity within seconds.
- Firms are integrating AI and ML to track and process parameters such as transaction size, device, time, location, and purchase data.
- Machine learning continuously evolves its own rules based on changing market risks, thus building on its own set of fraud-detection guidelines.

Key Drivers



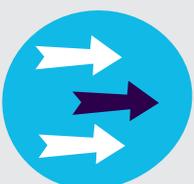
- Capital markets are extremely vulnerable to sophisticated cyberattacks adopted by cybercriminals globally.
- Increasingly, valuable business data is stored online, thereby creating sizeable data-security risks.
- Regulators face challenges in cases that require processing huge volume of data.

Trend Overview



- Investigating fraudulent transactions and suspicious money laundering is a tedious task for regulators, primarily due to the huge number of suspicious activity reports (SAR). AI and ML-based solutions will help streamline the process by reducing the time required to analyze through each report.
 - For example, UK's Serious Fraud Office has been using AI and ML to scan through millions of documents and communications such as texts and emails to determine the charges.³⁴
- Organizations can switch over to self-learning algorithms from rule-based fraud management tools that require high maintenance.
 - Self-learning algorithms enable organizations to stay up-to-date on the latest fraud detection techniques and will ensure that they are learning from patterns in historical data. This will increase system efficiency and safety from cyberattacks

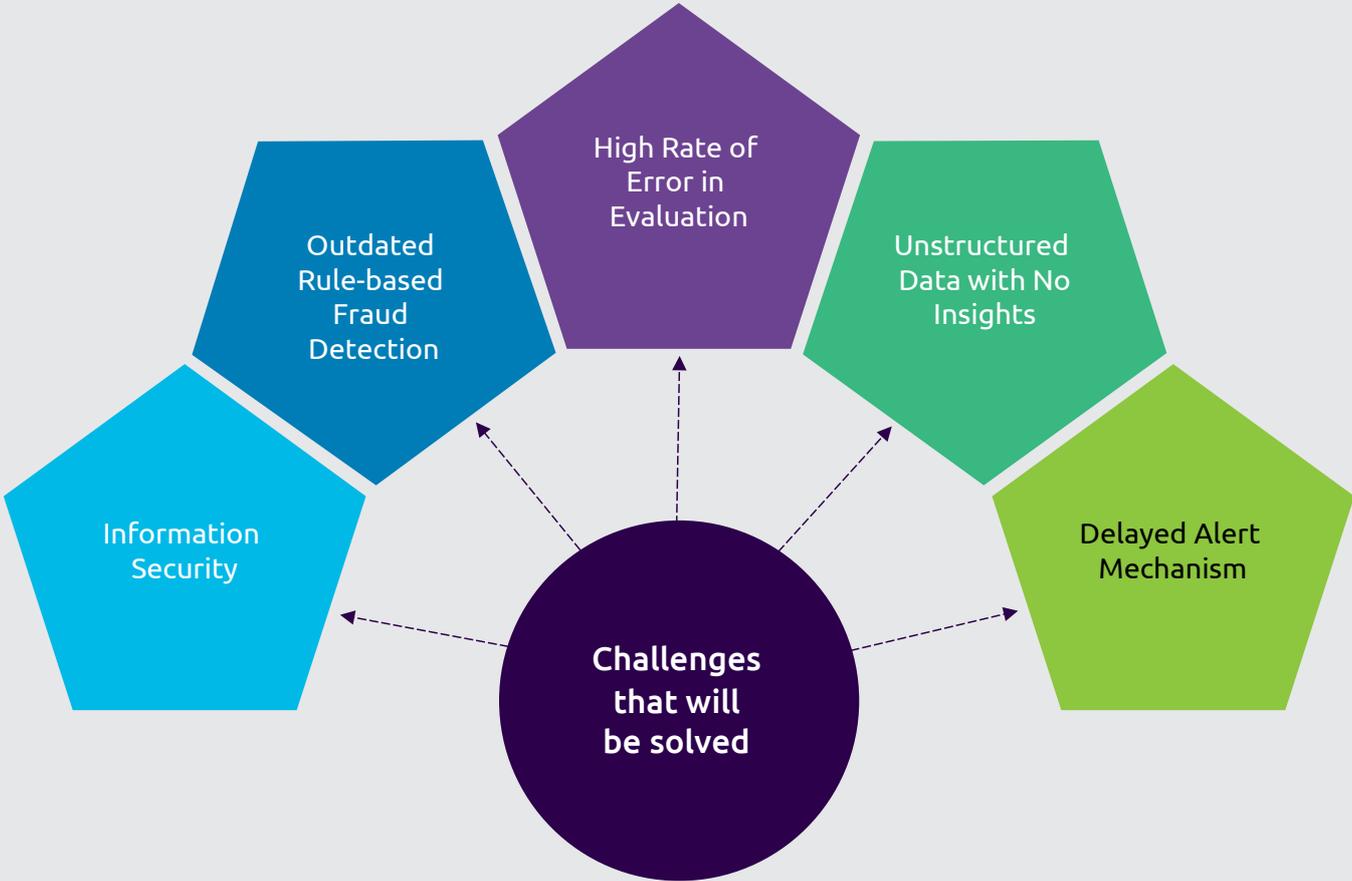
Implications



- AI and ML help regulators and investigators scan through mountains of documents to identify relevant documents quickly.
- As the technology attempts to learn from the information it processes, firms can identify and categorize similar red flags in related cases.
- AI and ML will help institutions overcome several key challenges including detecting financial fraud. (Exhibit 11)

³⁴ American Banker, "How this regulator is using AI to probe financial fraud," Penny Crosman, September 17, 2018, <https://www.americanbanker.com/news/how-the-uks-serious-fraud-office-uses-ai-to-probe-investigations>

Exhibit 11. Uses of AI and ML in Cyber-security



Source: Capgemini Financial Services Analysis, 2018

References

1. Imarticus website, "Cyber Crime – Threats to Capital Market Firms," May 23, 2018, <https://imarticus.org/cyber-crime-threats-to-capital-market-firms/>
2. *Finextra*, "AI and ML in Financial Services Compliance Management: Use Cases for the Regulators," Anjani Kumar, August 28, 2018, <https://www.finextra.com/blogposting/15713/ai-and-ml-in-financial-services-compliance-management-use-cases-for-the-regulators>
3. Towards Data Science "Detecting Financial Fraud Using Machine Learning: Winning the War Against Imbalanced Data," Rafael Pierre, June 27, 2018, <https://towardsdatascience.com/detecting-financial-fraud-using-machine-learning-three-ways-of-winning-the-war-against-imbalanced-a03f8815cce9>
4. Financial stability board (FSB), "Artificial intelligence and machine learning in financial services," November 1, 2017, <http://www.fsb.org/wp-content/uploads/P011117.pdf>
5. *Forbes*, "Artificial Intelligence and The Future Of Financial Fraud Detection," Vian Chinner, June 4, 2018, <https://www.forbes.com/sites/theyec/2018/06/04/artificial-intelligence-and-the-future-of-financial-fraud-detection/#1b3de387127a>
6. *Global Banking & Finance Review*, "Leveraging advanced analytics for real-time fraud and money laundering detection," Yoav Einav, August 16, 2018, <https://www.globalbankingandfinance.com/leveraging-advanced-analytics-for-real-time-fraud-and-money-laundering-detection/>
7. SC Media UK, "Call of duty: Fighting cyber-crime in the capital markets comes down to AI", May 10, 2018, <https://www.scmagazineuk.com/call-duty-fighting-cyber-crime-capital-markets-comes-down-ai/article/1472803>
8. Big Data Made Simple, "The role of machine learning in financial fraud prevention," Nataliia Kharchenko, November 28, 2017, <http://bigdata-madesimple.com/the-role-of-machine-learning-in-financial-fraud-prevention>
9. *Forbes* website, "How Smart Contracts Could Change The Way You Do Business", May 16, 2018, <https://www.forbes.com/sites/forbescoachescouncil/2018/05/16/how-smart-contracts-could-change-the-way-you-do-business/#f28f85d1288f>
10. Government Office for Science website, "Distributed Ledger Technology: beyond block chain: A report by the UK Government Chief Scientific Adviser," 2016, https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/492972/gs-16-1-distributed-ledger-technology.pdf
11. *Finextra*, "Blockchain in Capital Markets", March 1, 2018, <https://www.finextra.com/blogposting/15096/blockchain-in-capital-markets>
12. Quantum for Quants, "Why Quantum Finance?" Marcos Lopez de Prado April 26, 2016, <http://www.quantumforquants.org/quantum-computing/why-quantum-finance/>
13. *Market Mogul*, "How Quantum Computing Will Affect Global Finance," Paul Laverne, March 19, 2018, <https://themarketmogul.com/quantum-computing>
14. *Information Age*, "How quantum computation will be a goldmine for the financial world", January 11, 2016, <https://www.information-age.com/how-quantum-computation-will-be-goldmine-financial-world-2-123460756>
15. *Efinancial Careers*, "Five reasons quantum computing is the future for traders," October 10, 2016, <https://news.efinancialcareers.com/be-en/262194/five-reasons-quantum-computing-is-the-future-for-traders>
16. *Razor risk* website, "First Reds Then Black", March 14, 2017, Peter Walsh, <https://razor-risk.com/frtb/first-reds-black-frtb>
17. *Percentile* website, "The Rise of RegTech for Capital Markets," November 7, 2017, <http://www.percentile.co.uk/blog/rise-of-regtech-for-capital-markets/>

18. *Finextra*, "RegTech - the smart future for model risk management", Sylvia Shepperson, June 21, 2018, <https://www.finextra.com/blogposting/15496/regtech---the-smart-future-for-model-risk-management>
19. Thomson Reuters, "How can RegTech ease the risk management burden?" Clare Koehler, October 31, 2017, <https://blogs.thomsonreuters.com/financial-risk/risk-management-and-compliance/how-can-regtech-ease-the-risk-management-burden>
20. Nex | Celent, "Cloud in Capital Markets", March 2018, https://www.nex.com/~media/Files/N/NEX/nex-insights/201803_NEX_Celent_Cloud_Paper.pdf
21. *Finextra*, "How AI is transforming Trade settlements", Breana Patel, March 22, 2018, <https://www.finextra.com/blogposting/15175/how-ai-is-transforming-trade-settlements>
22. Wealthmanagement.com, "Why Even U.S. Wealth Managers Should Care About GDPR," April Rudin, May 2, 2018, <https://www.wealthmanagement.com/technology/why-even-us-wealth-managers-should-care-about-gdpr>
23. *Forbes*, "What Is Consumer Data Privacy, And Where Is It Headed?" Keith Johnson, July 9, 2018, <https://www.forbes.com/sites/forbestechcouncil/2018/07/09/what-is-consumer-data-privacy-and-where-is-it-headed/#3580dda21bc1>
24. *DTCC Connection*, "Unlocking the Benefits of RPA for Financial Services," Joseph King, May 30, 2018, <http://www.dtcc.com/dtcc-connection/articles/2018/may/30/unlocking-the-benefits-of-rpa-for-financial-services>

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