SIFMA Insights

The Evolution of the Fintech Narrative

Analyzing Opportunities in Capital Markets

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Contents

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Executive Summary

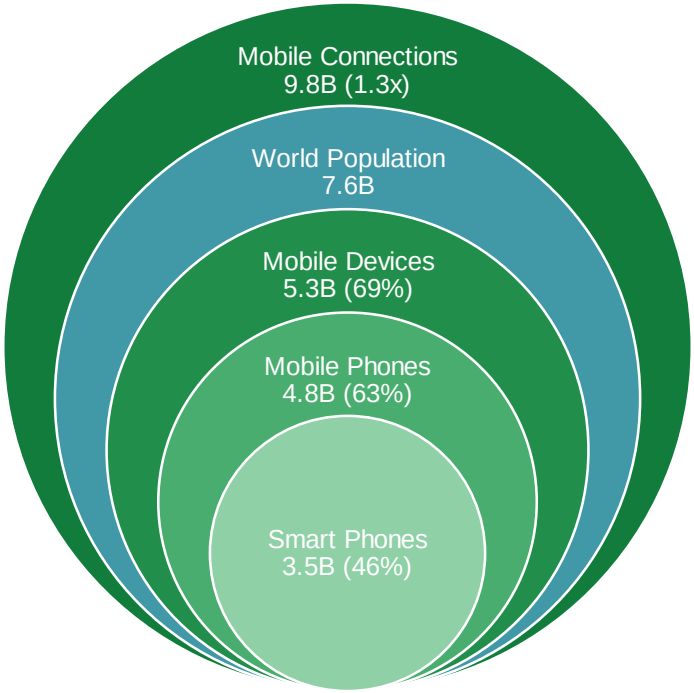
Capital markets have been impacted by the post financial crisis transformation of financial institution business models – not just post crisis regulations, but the opportunities and challenges brought on by new financial technologies. Inside this report, we assess how the narrative around analyzing and deploying fintech opportunities has evolved, including:

- The Client Experience – Technology has changed how people live their lives, and these modern personal experiences (Uber, Amazon) are flowing over into financial services.
- The journey begins a few years back where we first looked at how financial institutions made strategic decisions on IT expenditures. Then, in the beginning, we had what can now be viewed as an overly optimistic tone for how to spend the bucket dedicated to new technologies.
- Now, while many opportunities in the fintech universe hold possibilities, when assessing deployment, we first consider potential hurdles to deployment. We look at what is the objective of the technology – is it transforming processes or platforms?
- The goal remains transforming legacy systems to modern ones, while keeping the economics in place and not disrupting client services. With this, we can assess the capital markets fintech maturity ladder, where not all technologies are on the same rung (capital market case studies included).
- No report on the fintech story would be complete without looking at regtech, an area ripe for technology.
- Cybersecurity for individual firms and the financial ecosystem as a whole is crucial and always on the top of management teams' agendas, to ensure resources (money and talent) are dedicated to the fight.
- While data, or the new oil, is key, firms must watch out for that old adage garbage in leads to garbage out, i.e. data often needs cleaned up to be useful.

Setting The Scene

The Client Experience

Technology has changed how people live their lives. There are now more mobile connections across the globe than people, 9.8 billion versus 7.6 billion (1.3x). People are focused on the experience, not just the product. They want ease and simplicity of use in the technology delivering their services or products, such as with Uber or Amazon. As such, a client's last best experience now becomes the minimum requirement for their next experience. These modern personal experiences are flowing over into financial services.



Source: GSMA Intelligence, Statista, U.S. Census Bureau

Yet, financial services is unique. This is an industry built on trust, one which puts the client first. In financial services, your job is to serve your client, full stop. Firm decisions are made based on client demand – from developing new financial products to strategic decisions to enter new regions or business areas. And it is with this trusted client relationship in mind that firms analyze and deploy fintech solutions. Technology can be used to improve the customer experience, but it is not the destination. The destination is the client, with technology as a means to serve them better.

Therefore, the industry continues to analyze, test and deploy fintech solutions across the capital markets ecosystem. There are many reasons firms looking at fintech solutions, including: enhance the client experience, increase operational efficiencies, decrease costs (for your firm and your clients), manage risk, meet regulatory reporting requirements, increase productivity and free up staff to spend more time on client servicing. Firms also note fintech solutions can provide them a competitive edge, by providing clients with more value-add services at a lower cost base, and potentially create ways to drive revenue.

Additionally, firms who do not at least explore new technologies and better ways to meet changing client demands run the risk of becoming displaced. Before we all carried our iPhones for photo taking and cloud storage – there were Polaroid and Eastman Kodak to meet our photography needs. Before Amazon and Kindle, people shopped at Borders to buy physical books. And people remember going to Blockbuster to pick up a physical copy of a video to watch. Firms cannot keep their head in the sand and ignore technology transformations. Otherwise, they end up as business school case studies as to what not to do.

Therefore, capital markets firms continue to analyze and deploy fintech solutions. To do so, firms must assess the wide range of client demands and comfort levels with emerging technologies. As firms then need to build in an assortment of capabilities for clients to opt into, there is a wide spectrum of time estimates to deploying different technologies.

The Operations Workforce

Operations (ops) leaders are exploring how they can have their teams and processes best support the customer and client journey. One common myth out there is that AI and other fintech solutions kill all jobs. Leaders can prevent this by bridging today's skillsets with tomorrow's needs. One way is by retooling workforces with applied intelligence, the combination of human ingenuity and intelligent technologies. Firms need to help employees understand the advantages they will gain by unlocking the increased productivity brought on by fintech solutions. Firms may also need to expand the hiring pie to include product managers, data scientists, coders, etc. Ops teams should explore how they can develop and acquire the skills needed for this transformation, through new approaches to hiring and training. While some niche jobs may require very deep knowledge, in general, tech is a learned fluency, similar to learning a foreign language. Firms can unleash tomorrow's business opportunities by transforming the ops team into an efficient, agile and digitally capable group.

Build – Buy – Partner

There is also a variety of approaches to investing in fintech solutions. Firms must decide whether to build the technology themselves, buy a firm with expertise in a subject area or partner with a fintech in one or multiple areas. Part of this decision is about costs. Does my firm possess the resources – not just money, but people as well – to develop solutions inhouse? Is the valuation right for me to purchase the fintech firm outright? Is the better strategic option to partner with a tech firm? Or should financial institution go the route of fully outsourcing, remaining simply a client on contract?

When making the build/buy/partner strategy, there is also a balance of integrating the entrepreneurial spirit into a highly regulated financial services firm. Fintechs, and entrepreneurs more broadly, foster an environment of free thinking to enable the creative process. A financial institution is different. It has strict regulations and holds the responsibility of protecting client money and sensitive data. Additionally, most financial institutions are public companies, unlike fintechs. Shareholders are not patient people – they do not hold the fail fast and fail often mentality of a privately held entrepreneurial firm.

Therefore, both the budget and the ability to foster the entrepreneurial spirit must be taken into account in the build/buy/partner decision.

Report Road Map

Inside this report, we assess the evolution of the narrative of fintech opportunities in capital markets, breaking the story out across the following buckets:

In the Beginning	Optimistic, but Realistic	Don't Forget About Regtech	Keep Singing That Song
• Everything is awesome and will change the world!	• Many solutions hold potential, but the ability and time to deploy will vary	• Ripe for technology solutions	• Cyber security remains top of mind
• Fintechs will fully displace incumbents	• It is not that easy to jump right into heavily regulated waters	• A regulator's approach	• Data remains a key commodity (yes, data is the new oil)
• Machines will replace all the humans	• Workforces are and will continue to evolve		

In The Beginning

IT Spend Decisions

To walk you through the evolution of SIFMA Insight's fintech analysis, the journey begins a few years back where we first looked at how financial institutions made strategic decisions on IT expenditures. Fintech solutions present both opportunities and threats to financial institutions. Whatever the use case or challenge to solve may be, capital markets firms across the ecosystem are reviewing and analyzing fintech options in their strategic planning decisions, including:

- **Update legacy systems**: Many financial institutions maintain legacy technology which is not as cost efficient as modern platforms, and opportunities exist to update back office systems. For example, moving to automated systems and away from reliance on manual processes can reduce errors and minimize risks.
- **Adopt new technologies**: As firms look to upgrade systems, it is natural to assess new fintech options. For example, distributed ledger technology can help automate bookkeeping processes. Or, artificial intelligence and big data applications can be used to improve customer service and monitor portfolios.
- **Improve client experience**: As new technologies emerge, client behavior changes. Many clients now prefer to do simple transactions (trade stocks, monitor portfolio balances, etc.) on mobile devices, as well as demand easy to navigate firm websites.
- **Invest in cybersecurity**: Firms have increased, and continue to increase, investments in cybersecurity. This is not an optional spend bucket. Companies must protect their clients' data and accounts from system breaches, which present serious legal, regulatory and reputational risks. This is an essential bucket and will only continue to grow.

Previously Over Optimistic

The tone for how to spend the bucket dedicated to new technologies was everything is awesome and will change the world! Well, maybe not, at least in the near term for large, transformative projects. Yes, process automation is key, with an industry consensus around the need to automate and take processes to the next level. But how do you know when you need big project fintech solutions, such as DLT? Some of these technologies and the benefits they purport to offer are quite seductive, but firms do not buy the technology. They buy the solution to a problem.

This toned down some of the overly optimistic tone around all fintech solutions, slowing down the approach. The slow approach starts with the fact that firms themselves must learn this new technology. They need to get it right, not fast. Slow and steady is warranted, as the primary mission is to keep customer data safe and efficiently complete client transactions. Another challenge for some fintech solutions is critical mass adoption, where the industry needs to collaborate to implement technologies on a wide scale. For example, the move to T+2 settlement in the U.S. took five years. Gathering the comfort level of multiple types of market participants takes time.

While many different fintech options hold potential opportunities, their abilities to be deployed vary greatly, as we explore in greater detail in the next section.

Optimistic, But Realistic

Hurdles to Deployment

While many opportunities in the fintech universe hold possibilities, when assessing deployment, one must first think about potential hurdles to deployment:

- **Fintegration** – Fintegration is the ability to integrate emerging, innovative technologies with existing operating systems. Many financial institutions have legacy technology that has been in operation for years. It would be cost inefficient to replace all systems at once, as well as logistically impossible, since firms cannot halt trading completely and indefinitely to perform an all-system upgrade. Therefore, firms need to upgrade to new technologies while integrating with existing systems, with a focus on maintaining operational resiliency. It is imperative that new and old systems can communicate with each other and exchange relevant information. The ability and time to synch up systems in such a manner will vary across technologies.

- **Multiple Market Participant Usage** – While some technologies can be implemented on a single firm basis – such as RPA to automate a firm's own back office processes – others may involve participation by multiple market participants. And others will need to involve the entire capital markets ecosystem. For example, wide scale DLT implementation needs collaboration: DLT platform needs to interact with a bank's back office; bank systems must speak with each other; and market infrastructures must work across platforms. Or, for a golden source of data, the market needs authentication of accuracy of and authorization to share the data. This involves multiple players, which brings challenges in gathering and automating the data consistently into a single system. For technical integration, the system can only be as successful as the lowest common denominator. Individual firms building out new technologies alone cannot solve all issues, rather market participants of all types must embrace the technology together. Systems need to be interoperable, with common data formats and APIs to allow information to move efficiently across systems both within individual firms and between multiple firms.

  Industry-wide projects can bring operational efficiencies for all parties, but this requires the willingness to collaborate. Historically, there was a reluctance to collaborate, as proprietary systems were considered competitive advantages to win and hold onto clients. This has shifted in recent years, with more and more firms now supportive of increased technology standardization to increase operational efficiencies. The level of industry cooperation will dictate time to market and will vary across technologies.

- **Regulatory Context** – Financial services is a highly complex and also heavily regulated industry. As such, new technologies may face regulatory constraints. At the same time financial institutions are testing fintech options, regulators are working with the industry to understand these innovations themselves. Regulators understand it is important for the industry to convert innovations into next generation processes, as well as the potential benefits for market monitoring and surveillance for themselves. However, they need to understand how emerging technologies – particularly those developed outside of the regulated system at a fintech startup – will interact in the capital markets ecosystem. It is therefore an evolving regulatory landscape. The time for regulators to fully understand risks and rewards will vary across technologies.

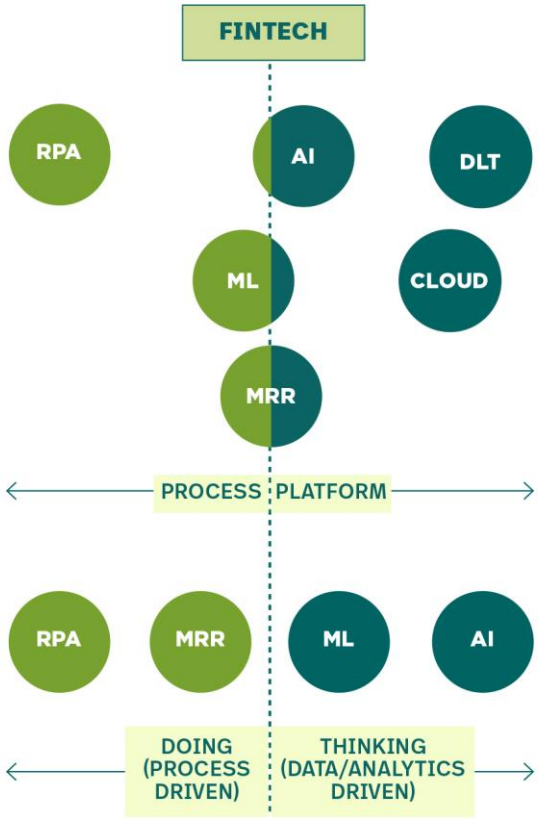
Time to Implementation

In order to determine time to implementation, a firm has to think about the objective of the technology. Is the technology meant to transform processes or platforms? You can scale the ease of integration and time to implementation with this method. Process, which can be done in house to improve user experiences, can be brought to full utilization faster. Platform, where all participants across the capital markets value chain must participate as you change the entire ecosystem, will take longer.

- **Robotic Process Automation (RPA)** is fully on the process side of the spectrum
- **Machine Learning (ML) and Machine Readable Rulebooks (MRR)** are on the process side of the spectrum, bleeding into platform
- **Artificial Intelligence (AI)** is on the platform side of the spectrum, with some process
- **Distributed Ledger Technology (DLT)** is fully on the platform side of the spectrum

Next, one must assess the level of doing versus thinking. The doing is more process driven, for example automating manual or repetitive tasks. Thinking is more data and deductive analytics driven, where the system is thinking or learning (intelligent systems). Doing systems will have less time to implementation than thinking ones.

- **RPA and MRR** are on the doing side of the spectrum
- **ML and AI** are on the thinking side of the spectrum



Analyzing & Deploying Fintech

In this section, we provide definitions on select fintech applications, noting not all will be discussed in the case studies portion of this section. We also provide some examples of general case studies in capital markets, as well as more specific examples from The Depository Trust & Clearing Corporation (DTCC), a key financial market infrastructure in the U.S.

Select Fintech Definitions

- **Artificial Intelligence (AI)** – AI is a branch of computer science that replicates or simulates human intelligence in a machine. In the 1950s, the fathers of the AI field, Marvin Minsky and John McCarthy, described AI as "any task performed by a program or a machine that, if a human carried out the same activity, we would say the human had to apply intelligence to accomplish the task". Some examples include: planning, learning, reasoning, problem solving and decision making.
    - AI can be broken out into several ***types***: (1) Reactive AI has limited capabilities, emulating a human's ability to respond to different kinds of stimuli, with no memory based functionality (the machine cannot use gained experience to inform current actions); (2) Limited Memory AI is capable of learning from historical data to make decisions, with the vast majority of current day AI applications in this category (chatbots, virtual assistants, self-driving cars); (3) Theory of Mind AI is in concept stage and will be better able to understand the entities it is interacting with by discerning needs, emotions, beliefs and thought processes (the machines will understand humans); and (4) Self Aware AI, a hypothetical stage of AI, will be so evolved as to be akin to the human brain, including the machines possessing self-awareness and having emotions.
    - AI can also be broken out into several ***classifications***: (1) Artificial Narrow Intelligence (ANI), which represents all current AI forms in practice today (even deep learning), enables systems to only autonomously perform specific tasks for which they were programmed (note: ANI relates to reactive and limited memory AI); (2) Artificial General Intelligence (AGI) will represent the ability of a machine to learn, perceive and understand, replicating human's multi-functional capabilities; and (3) Artificial Superintelligence (ASI) will be the most capable form of AI and will supersede human capabilities (greater memory, faster processing and analysis skills, quicker decision making abilities).

- **Cloud Computing (Cloud)** – Cloud is the delivery of computing services (servers, storage, databases, networking, software, analytics and intelligence) over the Internet, or the cloud. Moving from on-site IT systems to software residing in a separate cloud data center enables faster innovation, flexible resources and economies of scale. Firms pay only for the cloud services utilized, thereby lowering operating costs, increasing infrastructure efficiencies and allowing for scale as business needs evolve.
    - ***Public*** clouds are owned and operated by third-party cloud service providers. All of the hardware, software and other infrastructure is owned and managed by the cloud provider, with the user accessing their account via a web browser.
    - ***Private*** clouds are used exclusively by a single firm and maintained on a private network. They can be located on the company's on-site data center, or firms can utilize a third-party service provider to host it.
    - ***Hybrid*** clouds combine public and private features and are linked by technology, enabling data and applications to be shared between them. They provide greater flexibility and more deployment options, as well as work with a firm's internal infrastructure, security and compliance.
- **Distributed Ledger Technology (DLT)** – DLT, of which blockchain is one type, is the technological infrastructure and protocols that allows simultaneous access, validation and record updating in an immutable manner across a network encompassing multiple entities or locations. Distributed represents the decentralized nature of the database (not a centralized silo/no central authority). Ledger represents the database of records. And technology represents the skills, methods, protocols and processes used to enable the database.
- **Machine Learning (ML)** – ML is a form of AI where computer algorithms can learn from data without specifically being programmed, i.e. autonomously learning or getting better over time at identifying issues or options.
- **Machine Readable Rulebooks (MRR)** – MRRs put out rules which are written by humans in ways that can be fully and unambiguously interpreted by machines.
- **Natural Language Processing (NLP)** – NLP is a form of AI using computational linguistics that allow parsing and semantic interpretation of text. This enables the system to learn, analyze and understand human languages.
- **Regulatory Technology (Regtech)** – Regtech is the utilization of technology, such as advanced analytics or machine learning, to aid in compliance, reporting and other regulatory requirements.
- **Robotics** – Robotics is an interdisciplinary branch of science and engineering (computer science, mechanical engineering, electrical engineering) involving the development, programming and use of robots, or computer systems, that can operate autonomously to substitute for humans or replicate human actions. It is frequently used in dangerous situations in industrial, manufacturing or other industries to prevent human harm (ex: manufacturing, bomb deactivation). Of note, most securities industry discussions around robotics are really referring to RPA, as discussed on the next page.

- **Robotic Process Automation (RPA)** – RPA is a type of rules-based process automation technology based on the notion of software robots mimicking the actions of humans in carrying out a specific task. It is meant to take the repetitive out of routine tasks, freeing up employees to focus on higher value assignments. It increases process efficiency by automating formerly manual tasks, which not only enables the task to be performed faster and more efficiently but also removes the potential for human error.
- **Smart Contracts** – Smart contracts are computer protocols intended to digitally facilitate, verify or enforce the negotiation or performance of a contract. They can be carried out among disparate, anonymous parties without the need for a central authority, legal system or external enforcement mechanism (self-executing contracts). Terms of the agreement are directly written into lines of code, which exist on a DLT network. The code controls the execution, and transactions are trackable and irreversible.

General Capital Markets Case Studies

As capital markets firms continue to analyze and deploy fintech solutions, the goal remains transforming legacy systems to modern ones, while keeping the economics in place and not disrupting client services. Modernization of operations can be end-to-end updating of systems and processes or developing individual tools which are not end-to-end. In the capital markets fintech maturity ladder, not all technologies are on the same rung:

- **Short Term** – Currently implementing process while testing platform applications; implementing doing processes – most firms are digitizing (doing: RPA, robotics); some firms are testing cloud technology (platform)
- **Medium Term** – Currently implementing single firm platform applications to scale; implementing thinking applications – larger scale usage of cloud technology is further out
- **Long Term** – Currently implementing multiple market participant platform applications – DLT is even further out in time to large-scale implementation

The industry has made progress implementing some applications, and focus has shifted to prioritizing others. The ABCDs of fintech (as trademarked by Broadridge) – AI, blockchain (DLT), cloud and data digitization (discussed further on in this report) – and other applications continue to develop:

- **AI** – AI has been in use at financial institutions for many years, for example: using it for credit scoring in retail banking; using it in CCAR/stress testing to forecast and view changes in results under different macro variables; using it in call centers, where evidence has shown query resolution increases significantly; and other, more simple processes. To continue to grow usage, firms are exploring how to embed AI into the workflow or decision process, for example: KYC/AML monitoring to automate the closing out of cases; or trader conduct surveillance to predict behavior before it happens. Since AI is the technology in the raw, firms need to consider where the data came from and how the model operates, understand how to supervise it and ensure AI is working with professional decision making, not replacing it. Now firms are moving these simpler data analytics examples to advanced use cases involving picking securities for investment portfolios.

- **DLT/Blockchain** – Firms are working to integrate existing systems with this new technology. As scale is not quite there, most use cases are in electronifying paper rather than transactional based. However, there are some transactional use cases in repo, syndicated loans, custody and settlement, etc. One of the more high-profile examples is ASX Group's, a top ten global exchange, project to replace its CHESS operating system with DLT technology. The firm knew from the beginning that there would be hurdles, including how to: maintain confidentiality of client transactions; secure data; work with regulators; and roll out on day one without alienating market participants. The timeline for this project has been delayed as they work through these aspects. Additionally, market participants note that this is not a true test of the scale capabilities of DLT. ASX's CHESS maintains custody value of A$2.0 trillion ($1.4 trillion), versus $54 trillion at DTCC, which processes 1.5 million settlement-related transactions per day.

- **Cloud** – Initial use cases were to gain raw computing power. Now, firms use clouds to access and utilize data in real time in a flexible and efficient manner. Firms can use multiple cloud sources together while controlling how they interact, with many financial institutions using three to four private and public clouds. Financial firms are inching into the use of public clouds, remaining conservative given they hold sensitive client data and move client money. Cloud architecture in its various forms has become a bigger focus of financial institutions. However, last year at the SIFMA Ops Conference, we learned we still have a long way to go: only 20% of workloads in financial services have moved to cloud technology. We expect the uptake of cloud to continue, as firms work out the future of the architecture (secure, fast, real-time access) balanced against resiliency and risk management.

- **RPA and Robotics** – RPA is meant to take the repetitive out of routine tasks and free up employees to focus on higher value assignments, such as those involving client interactions. It benefits employees and employers, by decreasing time it takes to perform tasks, and clients, by improving straight through processing and other procedures, all while increasing transparency and reducing operational risk. While RPA is already implemented by many capital markets firms across multiple areas, it continues to gain traction as the technology matures. Last year at the SIFMA Ops Conference, we learned we still have a long way to go: (a) the current automation scope is only 3%-7%, out of a 40%+ potential to automate; (b) four million bots are expected by 2021, versus the over one thousand bots in production currently. We, therefore, expect the uptake of robotics/RPA to continue.

DTCC Case Studies[1]

Short Term – Robotic Process Automation

- Billing – DTCC's Finance Revenue Cycle team used to use two different legacy systems for billing, requiring end-of-month reconciliation. Given a lack of human capacity to reconcile each invoice, staff sampled 10% of the total to check overall reconciliation rates. By utilizing RPA, capacity constraints disappeared, and every single invoice is now reconciled. Staff were freed up to focus on analysis and resolving cases that fail to reconcile. Clients benefit from more accurate invoicing.
- Onboarding – In an ongoing project, DTCC is working to automate some of its Global Trade Repository's complex onboarding workflow (operating in multiple regulatory jurisdictions; 6,000+ client base). When a new client submits onboarding forms, staff review the forms and move them into a Salesforce queue if the information is deemed valid. Then a bot processes the application and either funnels it into an exception handling queue (for non-standard or questionable data) or marks it successfully completed. The goal is to reduce the complexity and time of the onboarding process. However, even small changes in the other systems (ex: Salesforce) can cause the robotic process to fail. DTCC has, therefore, discovered that developing standards and utilizing an open-source model provides for structure as the bots are developed.

Medium Term – Artificial Intelligence and Machine Learning

- Mutual Funds – In June 2017, DTCC implemented an automation initiative incorporating AI and ML to strategically enhance Mutual Fund Profile II, a central repository maintaining prospectus and operational processing rules for 27,000 mutual fund securities. By applying AI-driven enhancements, DTCC automated data sourcing and boosted the number of data points (minimum/maximum sales charges, underwriting fees, social codes, etc.) covered by the database to 5 million from 4 million, streamlining clients' collection and sharing of this data. The repository now captures higher-quality information with increased frequency and faster speed to market. If discrepancies arise as a fund updates its data points, the application automatically generates a notification prompting a data review and prevents the system from being updated with incomplete information.

Long Term – Distributed Ledger Technology

- Post-Trade Infrastructure – DTCC continues to test DLT applications, yet the technology needs to be proven to be considered enterprise-ready or widely adopted by the industry. In other words, the technology is still evolving. As DTCC experiments, it continues to develop its internal capabilities with the technology to drive advancements in post trade processing for the industry. Moving DLT's capabilities forward for real world financial transactions will take scalability, interoperability and governance.
- Trade Information Warehouse – DTCC is moving its Trade Information Warehouse from a traditional database to distributed ledger and leveraging cloud computing to enhance scalability, improve flexibility, optimize performance and reduce costs. Additionally, they are using this project as a means to test the technology's potential and its limitations.

[1] Please see the SIFMA Insights note: https://www.sifma.org/wp-content/uploads/2019/05/SIFMA-Insights-Spotlight-DTCCs-Important-Role-in-US-Capital-Markets.pdf

Don’t Forget About Regtech

Ripe for Technology

One subset of fintech that has received a lot of attention – and an area ripe for technology – is the regulatory technology (regtech) space. Coming out of the global financial crisis, market participants faced an enormous amount of new rules and regulations. In the beginning, firms attempted to cope with this by adding more staff to the compliance department. The focus then shifted to increasing investments in regtech to automate the compliance workflow. Regtech applications can reduce the cost of compliance and create opportunities to use information more effectively across the entire firm.

With increased regulation comes additional reporting requirements. And capital markets are global, subjecting many firms to multiple and duplicative regulatory reporting requirements across jurisdictions, all examining the same process or control procedure. Many view the scale and duplicative nature of this as an inefficient and unnecessary use of resources. This is time, money and people that could be better spent serving clients, developing stronger cybersecurity capabilities, etc., and many see opportunities to unlock efficiencies in reporting requirements.

That said, currently market participants are focused on adding fintech applications to existing compliance systems. This is easier to implement versus big transformational projects like moving processes onto DLT platforms. DLT has been cited as a potential global solution for KYC, as it would enable clients to be vetted one time instead of multiple times across firms and departments.

As with all aspects of financial services, hurdles remain for full adoption of regtech solutions. For example, as regulators like to control data in their own region, information sharing issues could prevent the gain of full technology efficiencies. The number of regulations, and lack of global harmonization, is preventing technology from driving efficiencies in regulatory reporting. Additionally, market participants indicate the need for standardization before moving into optimization, a longer-term strategy. Unfortunately, compliance teams have been firefighting rather than dedicating more time to proactively find regtech solutions, given Brexit, CAT, MiFID II, the LIBOR transition and now Covid-19.

Some examples of regtech opportunities being analyzed and deployed by capital markets firms include:

- Robotics can be used to vet data, with an AI overlay to sort through it
- NLP can automate changes to legal documentation
- Chat collaboration platforms can share information across multiple parties, while monitoring for compliance
- Gather disparate types of data from multiple source to meet regulatory reporting requirements
- Re-negotiate legal agreements with market participants to meet new regulations, for example uncleared margin rules
- Improve employee monitoring

- Expedite the sign off processes for legal documents in the onboarding process
- Capture which platforms count as a systematic internalisers (MiFID II regulation), eliminating double reporting or under reporting
- Move away from the old and less efficient process of emailing counterparties and getting back a spreadsheet for trade confirmation
- Prevent firms from reporting the same data multiple times, for example MiFID II requires multiple pieces of information to trade into Europe, with the same trades then requiring reporting in multiple jurisdictions

A Regulator’s Perspective

FINRA continues to increase the amount of automation for clients. Some of the fintech capabilities FINRA is now incorporating include:

- **Data Storage** – With the migration from data centers to cloud starting in 2013, the vast majority of data has moved. Cloud storage increases capacity 10x and enables continuous technology refreshment, which should decrease costs to users and increase data availability.
- **Registration System** – FINRA replaced its web-based CRD with a cloud-based platform, which should decrease duplicative tasks, increase automation and, therefore, reduce industry compliance burden and costs. (5,500+ individual, 50% of firms registered)
- **Digital Experience** – FINRA continues its digital experience transformation. This should end fragmentation across FINRA divisions and increase the amount of self service, which should be faster than waiting on the phone to speak with a human. The estimated benefit is >$100 million in savings per annum for the industry.
- **Innovation** – FINRA Createathon, which begin four years ago, is an annual two-and-a-half-day event where cross-disciplinary teams generate ideas and present solutions (NLP, ML, AI, etc.). In 2018, 57 teams and 500 participants across 6 categories led to 12+ ideas advanced to the R&D stage. Idea stats: 57 feed ideas, 29 initiated, 12 developed, 9 presented for rating, 6 selected for funding and 1 completed and to be presented for business case funding.

Keep Singing That Song

Cyber Remains Top of Mind

Continuing with the ABCDs[2] theme, let's take a look at how the "s" has evolved. Originally, it was just to indicate plural usage. However, one of the only constants in capital markets is that themes always evolve. We are seeing that now with cybersecurity. Since it remains top of mind, we now capitalize the "S" in the ABCDS to include cybersecurity.

Cybersecurity is a concern across most industries, but financial services is critical to the U.S. economy and therefore a top target. Resiliency of individual firms and the financial ecosystem as a whole is crucial and always on the top of management teams' agendas, to ensure resources (money and talent) are dedicated to the fight. Cyber defense is about establishing resiliency for systems and preparing a game plan for recovery should there be an attack. Financial services is a global industry, and all market participants are interconnected as part of the same ecosystem. Firms must therefore work together to prepare and protect the system. The mindset is not if there will be an attack, rather ensuring firms have a plan for when there is an attack.

System breaches are often easier in emerging technology environments, thereby increasing cybersecurity concerns as firms continue to automate more processes and adopt new technologies. Financial institutions use and store extremely sensitive client data, and there are people (criminals, bad actors, nation states) constantly trying to exfiltrate or compromise this data. Yet, cybersecurity is no longer just about stealing data that can be quickly and easily monetized, the scope has expanded. Bad actors are now also looking to disrupt businesses via malware that corrupts critical data. For example, a threat garnering heightened attention today is destructive malware which corrupts data (attacking the I in CIA, or the three parts of data security: confidentiality, integrity and accessibility).

Players involved with financial market infrastructure remain key targets. This makes the cybersecurity fight a 24-hours-a-day, 7-days-a-week, 365-days-a-year war firms wage to protect their systems, capital markets infrastructure and client data.

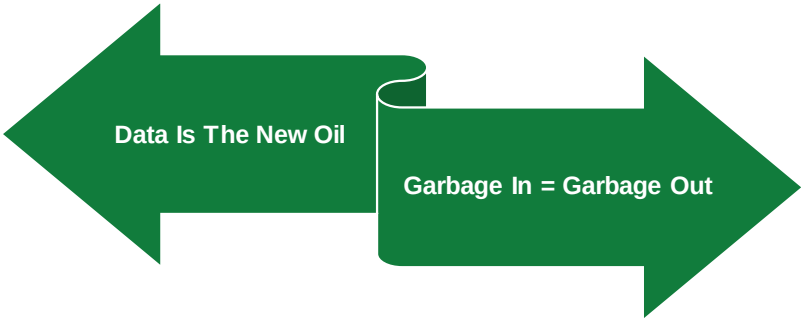
A Culture of Cyber Awareness

The key to mitigating cyber risk is having everyone in the organization concerned about cyber awareness. While the cost of data breaches can be in the millions, it is harder to measure the cost of reputational risk in the aftermath of a cyber incident. This industry is built on trust, which can be lost with a cyber breach. Therefore, it is important to build cyber resiliency into a firm's culture. Preventing cyber incidents must run across the organization, with final oversight by senior management and the Board. As such, financial institutions have built a culture of cyber awareness from the top down, i.e. a leadership-driven culture. The messaging is simple: cyber resiliency awareness is an important part of the firm's success. Security is not just IT or compliance's problem, it is everyone in the organization's problem.

By reminding people that customer service could be disrupted with a cyber incident, which negatively impacts everyone across the organization, a culture of cyber awareness is continuously nurtured.

[2] Trademarked by Broadridge

We're Only as Good as Our Data



Let's get the two clichés out of the way right up front: (1) data is the new oil; and (2) garbage in leads to garbage out. More data is becoming available than ever before – firms are drowning in data – and data can solve problems it could never solve before. Data is key but often needs cleaned up to be useful.

Firms can now standardize data, with opportunities to join disparate data sets across business units. Often around 75% to 80% of the problem is solved by moving data around, or data wrangling, yet other data sets need cleansed. In order to leverage the power of data, it is important to turn unstructured data into structured data.

- **Unstructured** – Data that is not as easily searchable (audio, video, social media posts, etc.); more challenging for big data programs to confront
- **Structured** – Clearly defined data types, with patterns that make them easily searchable; easily digestible by big data programs

Firms continue to explore ways to bring together data from disparate systems and increase efficiencies in gathering, cleansing and analyzing data. Firms are using fintech solutions to extract data from many sources – trading activity, legal agreements and risk management systems – and combine the data in new ways to yield better insights and smarter decision making capabilities. These solutions include not only advanced data analytics but also the digitization of documents and the storage of data in the cloud.

Given the importance of data governance and protection are key. How secure is it? Who/how many can access it? What are you doing with it? Market participants believe financial services firms will be held accountable for how client data gets accessed and used, or worst-case scenario breached.

Appendix: Terms to Know

Financial Technology (Fintech) – An emerging industry involving technologies and innovations to improve (decrease costs, increase efficiencies) traditional financial services across multiple products, markets and business segments.

Fintech	Financial Technology
Regtech	Regulatory Technology
Cyber	Cybersecurity
ABCDs	AI, Blockchain, Cloud & Data*
ABCDS	AI, Blockchain, Cloud, Data & Security
CIA	Confidentiality, Integrity & Accessibility
AI	Artificial Intelligence
AR	Augmented Reality
Bot	Computer programs that speak like humans
Chatbot	Software engaging in natural language dialogues
Cloud	Internet-based computing (servers, storage, applications)
DLT	Distributed Ledger Technology*
IT	Information Technology
IoT	Internet of Things
ML	Machine Learning
MRR	Machine Readable Rulebook
NLG	Natural Language Generation
NLP	Natural Language Processing
OCR	Optical Character Recognition
PII	Personally Identifiable Information
RPA	Robotic Process Automation
Robotics	Robots substitute or replicate human actions
VR	Virtual Reality

*Blockchain is one type of DLT

*ABCDs are trademarked by Broadridge

FINRA	Financial Industry Regulatory Authority
DTCC	The Depository Trust & Clearing Corporation
CRD	Central Registration Depository
AML	Anti-Money Laundering
KYC	Know Your Customer (Client)
CCAR	Comprehensive Capital Analysis & Review

Appendix: SIFMA Insights Research Reports

SIFMA Insights Reports: www.sifma.org/insights

- Spotlight: DTCC's Important Role in US Capital Markets
- Spotlight: Building Resilience with a Culture of Cyber Awareness

SIFMA Insights Market Structure Primers: www.sifma.org/primers

- Global Capital Markets & Financial Institutions
- Electronic Trading
- US Capital Formation & Listings Exchanges
- US Equity
- US Multi-Listed Options
- US ETF
- US Fixed Income
- SOFR: The Transition from LIBOR

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