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# Digitizing Financial Regulation: Regtech As A Solution for Regulatory Inefficiency and Ineffectiveness

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**DIGITIZING FINANCIAL REGULATION:**

**REGTECH AS A SOLUTION FOR REGULATORY INEFFICIENCY AND INEFFECTIVENESS**

***Fourth in a series of six papers on Regulation Innovation by Jo Ann Barefoot***

*Note: This is the fourth in a series of papers arguing that traditional regulation intended to promote consumer financial protection and inclusion has largely failed and should be redesigned to leverage new digital technology that can make both finance and financial regulation better and less costly. For the previous papers in the series, see here.*

*Please note also that the author in 2020 will publish a longer paper entitled, "A Regtech Manifesto: A Request for Comments on Transforming Financial Regulation to Digitally-Native Design."*

Both finance and financial regulation have always presented intractable problems that have persisted, despite best efforts of policymakers, for decades and sometimes even centuries. In both realms, the thorniest of these problems are now being attacked by innovators using new technology. Paper 3 in this series explained how fintech has the potential to transform finance to make it more inclusive, fair, and innovative. This paper explores a parallel opportunity for regtech to revolutionize financial regulation to make it vastly more effective, and efficient, at the same time.

It is said today that "data is the new oil." At the heart of the regtech challenge is the need for regulators to gain complete and real-time visibility into what is happening in the rapidly evolving financial world and to analyze it using powerful artificial intelligence. If they cannot do this, they will, in effect, run short on the fuel they will need to supervise the system.

> *"If data is the new oil, financial regulators will soon run low on fuel."*

The section below broadly describes the challenges intrinsic to financial regulation and how regtech can address them. This is followed by sections explaining what regtech is (including how it differs from past regulatory technology), the global regtech landscape, and early use cases. The paper's final section describes how a digitally native regtech system would be designed.

## The Promise of Regtech

As discussed in Papers 1 and 2, finance is essential to healthy economies and societies. When it works well it provides economic stability, fairness and inclusiveness, and people thrive. When the financial system fails, people are hurt, sometimes on a very large scale as with the Great Depression or the 2007 financial crisis. As a result, finance is very heavily regulated throughout the world. Policymakers use regulation to pursue four basic goals: [1]

- A stable financial system that supports economic prosperity
- Customer protection
- Financial inclusion
- Deterrence of money laundering and financial crime

The record of regulation in meeting these objectives is mixed. In the U.S., systemic stability efforts have generally been effective for long periods, although, as noted above, serious failures still occur. For the other three goals, as discussed in depth in Paper 2 in this series, regulatory efforts have produced high rates of failure. Consumer protection regulation does not prevent millions of people from being harmed by financial services. Financial inclusion efforts have not prevented tens of millions of Americans from being unable to access the mainstream financial system. On anti-money laundering, the record suggests outright failure, with less than one percent of financial crime being caught.

With rare exceptions, the weaknesses in the system are not the fault of regulators. Rather, the problems are inherent in the challenge of overseeing these complex markets. At the heart of that challenge

[1] Paper 1 in the Regulation Innovation series looks in depth at how the current financial regulatory system is structured and operated, especially regarding consumer financial protection and inclusion

is the fact that regulators do not have enough information. The same is true of the risk managers and compliance personnel in the financial industry, whose jobs mirror that of regulators in seeking to assure adherence to rules and risk standards. Financial companies and financial markets are enormous, complicated, and dynamic. Understanding them, at full scale and in real time, has always been difficult.

Today, that difficulty is mushrooming because of the pace at which technology is reshaping the industry. As discussed in Paper 1, technology change advances at exponential speed. Since the 1960's, it has followed the pattern predicted by Intel Cofounder Gordon Moore in Moore's law – that computing power would double every two years.[2] As this growth doubles, and then doubles again, and then again, and again, the compounding effect changes the nature of the underlying situation. While some experts believe this rate has begun to slow, other factors are turbocharging the pace of change even further. For example, venture capitalist and *Unscaled* author Hemant Tanejo argues that the combination of exploding volumes of data and artificial intelligence, as discussed in Paper 3,[3] will produce unprecedented acceleration.

Like most people confronting these trends, regulators are seeking to address exponentially-based challenges while equipped only with "linear" models and "analog" era information and tools that were developed before the Digital Age. Futurist Ray Kurweil has written about the gap between the two, saying, "If I take 30 steps linearly, I get to 30. If I take 30 steps exponentially, I get to a billion."[4]

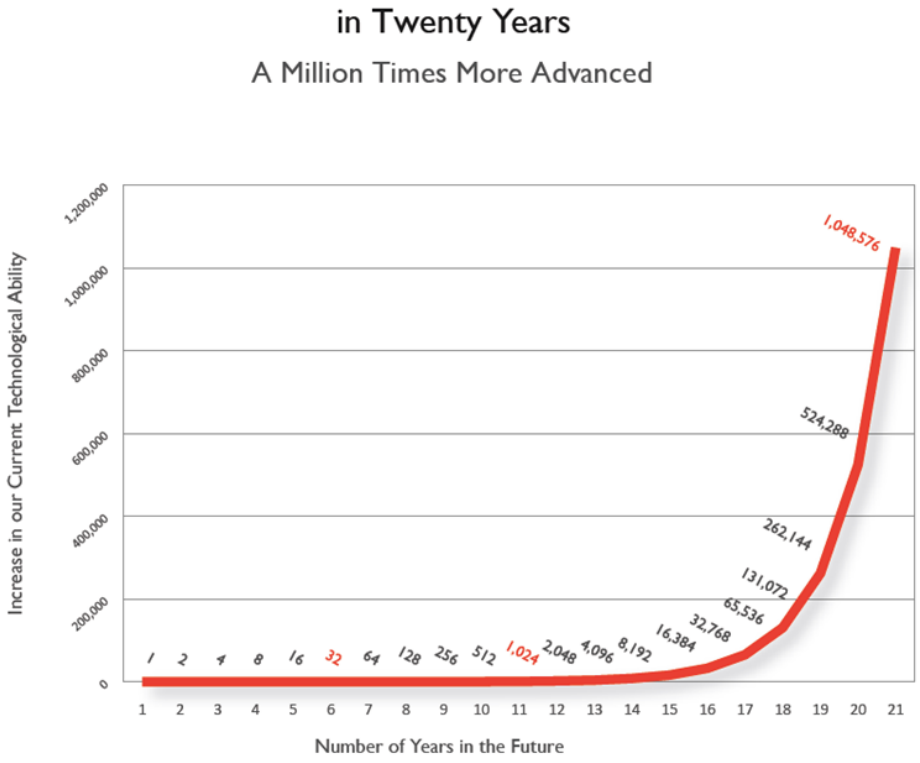
> *"If I take 30 steps linearly, I get to 30. If I take 30 steps exponentially, I get to a billion."*

Situations presenting exponential change can be deceptive and therefore dangerous. They appear to be developing gradually for long periods. Then, suddenly they hit an inflection point at which the acceleration curve turns toward the vertical in a hockey stick pattern, as illustrated below. If this rapid

[2] https://www.intel.com/content/www/us/en/silicon-innovations/moores-law-technology.html
[3] https://www.amazon.com/Unscaled-Generation-Upstarts-Creating-Economy/dp/1610398122
[4] https://www.kurzweilai.net/the-law-of-accelerating-returns

change requires a complex response from people and institutions impacted, they can find themselves unable to catch back up. The delta between the curve of linear change versus exponential change fills rapidly with rising risk.

**Figure 12**




*Source: Niv Dror, Medium, February 21, 2015.*

A major driver of this challenge is the sheer explosion of data. CIO magazine summed it up this way in 2019.[5]

*In 1982, futurist and inventor R. Buckminster Fuller estimated that up until 1900, human knowledge doubled approximately every century, but by 1945 it was doubling every 25 years. And by 1982, it was doubling every 12-13 months. In retrospect, this may sound a little quaint since experts now estimate that by 2020, human knowledge will double every 12 hours.*

[5] https://www.cio.com/article/3387637/thriving-in-a-world-of-knowledge-half-life.html

Responding to these forces, Bank of England Governor Mark Carney made a speech in 2019 discussing the need to use artificial intelligence in financial regulation. He said the Bank receives 65 billion pieces of information annually from the companies it oversees, and explained that reviewing it all would be "the equivalent of each supervisor reading the complete works of Shakespeare twice a week, every week of the year."

> *Reviewing the data received from financial companies would require "the equivalent of each supervisor reading the complete works of Shakespeare, twice a week, every week of the year."*
>
> Mark Carney, Governor of the Bank of England

As the information in the financial system digitizes, regulators will have to digitize too. As the financial system changes exponentially, regulators will have to find ways to evolve at exponential rates, themselves. This cannot be done by scaling up existing models. It will require regtech.

Regtech has the potential to solve for three enormous problems at once. First, it can address this acceleration problem, which, if unresolved, will pose an existential threat to the system. Second, it can improve on the current performance of the regulatory system, fixing problems that were beyond the reach of older technologies. And third, it can drive down costs to both industry and government, with all the ancillary benefits that reduced expense would generate in market efficiency, competitiveness, innovation, improved affordability of services, and widened access.

## What is Regtech?

The term "regtech," sometimes spelled "RegTech," entered common parlance in the U.S. in 2016 but is still unfamiliar to some in the financial world. The word is used with two meanings, referring both to new technology that helps industry comply with regulations and to "regtech for regulators," meaning use of new technology by regulatory bodies themselves. The latter is also sometimes called "sup-tech" or

"supertech," meaning technology for financial supervisory agencies such as those that oversee banks. Other sub-terminologies are sometimes used, such as "comply-tech."

This paper will use the term "regtech" to refer to all versions of new digital technology that aim to modernize either the government or the industry side of regulatory work – both the activities of regulatory agencies and the compliance efforts of regulated businesses. As will be discussed, these public and private technologies should evolve together to be, essentially, two sides of the same coin.

Regtech can apply conceptually to any industry but the term evolved in the financial arena, perhaps because finance is arguably the most pervasively and complexly regulated industry in the world. It seems likely that many of these innovations will develop in finance and then be adapted to other regulatory realms. There is also interest in importing regulation innovation concepts into finance from the medical sphere, another very highly regulated sector that is being transformed by technology.

In finance, regtech and fintech are distinct but overlapping realms of innovation. Not all fintech regulatory challenges call for regtech solutions, and regtech covers many regulatory challenges that do not involve fintech. Still, the two realms are intertwined. Regtech is being driven by the same six technology trends described in Paper 3 as fueling fintech (big data, artificial intelligence and machine learning, cloud computing, blockchain and distributed ledgers, mobile technology and to a lesser extent, voice interface). Furthermore, much of the impetus for regtech is coming from fintech innovators who entered finance from the technology sector and, discovering the pre-digital processes and information flows that dominate regulatory work, resolved to improve it.

It can be useful to think of regtech as following in the wake of fintech, often developing faster than fintech did because the latter blazed a trail with key audiences that are now familiar with the technology.

At the same time, regtech is aiming to change a very different realm – not the financial sector, but rather government. Regtech pioneers are seeking to blend two worlds – financial regulation and high tech -- that, until recently, barely connected. The challenge might be thought of as trying to bridge the gaps in

attitudes and norms between Washington DC and San Francisco on factors like culture, risk-aversion, and pace of change.

## What is Digitally-Native Technology?[6]

Many people find the term "regtech" confusing because financial regulation and compliance work is already replete with technology. Regulators have always been active adopters of technology and have continuously embraced innovation.

Current regulatory technologies, however, have been built on top of an underlying system of information and processes that were all originally designed on paper in the pre-digital, or "analog," age. Some of them are, in their essence, centuries old. As a result, they are built around the constraining assumptions of the analog era, namely that information is scarce and expensive to obtain, and so is computing power. The system relies on analog information and work flows which, even when they have had some automation layered on top of them, still carry the old analog design.

In practice, this means that most information is not accessible to regulators through the processes, and at levels of expense, that can realistically be applied in the system. Information is "locked up" in analog forms like reports and files and databases that are difficult to look at quickly and comprehensively. Regulatory systems still rely on submissions of periodic reports, some of which lag behind real time by months, or even a year. In banking, for example, the "call report" that forms the basis of most regulatory risk monitoring, is submitted quarterly. Regulatory activities also rely heavily on partial information, including sampling of records to try to detect signs of noncompliance and risk that should be investigated by looking more widely at similar material.

[6] The term derives from the phrase "digitally-native" to describe people in the millennial generation or younger, who grew up with digital technology and therefore did not have to learn it as a "digital immigrant" or "as a second language," as did most older people. Being digitally native is an advantage in the digital age, in comparison with people, and systems, that are rooted in older technology. https://www.investopedia.com/terms/d/digital-native.asp

Even before today's explosion of information and technology, this opaqueness has been the source of most regulatory failures. As the system accelerates today driven by new technology, that risk is rising sharply.

The solution is to convert the system to a format that is "digitally-native" -- i.e., designed from scratch, using digital technology. The digital age has reversed the constraints of the analog world, making both information and computing power abundant and inexpensive, rather than scarce and costly. This enables an entirely new approach.

To illustrate the difference, one can consider the analogy of a traditional camera, versus a digital one. The analog camera produces the image in a form that is cumbersome to work with. It must be developed, which takes time and expert skills and equipment and costs money. If revisions to it are desired, these too require paying for expert manipulation for editing, enlargement, copies and the like. With a digital camera or smartphone camera, in contrast, the device converts the image into digital information. Once in this form, the pictures can be endlessly put to use at virtually no cost, instantly, and with little or no need for expertise or equipment. They can be copied and embedded in other material. They can be printed. They can be shared via a wide range of media. They can be edited. They can be scanned to record and analyze features. They can be combined with large volumes – in fact, unlimited volumes -- of other images, and subjected to artificial intelligence techniques that can find patterns and generate analysis that would be otherwise impossible for humans to perceive.

*This digital process is not an evolution of the analog tool that preceded it. It is entirely different technology.*

A concomitant leap will occur in how regulatory information will be captured and used. The shift will drive up the effectiveness of regulatory functions and drive down costs.

In both fintech and regtech, entities and activities that were "born digital" have an advantage in working with these digital tools over their counterparts that originated in analog form and must go through the work of converting. The difference parallels the contrast between digitally-native individuals (usually young people) who intuitively grasp technologies, versus "digital immigrants," who tend to be

older and to find this technology challenging. Born-digital entities like tech startups typically have better technology, better data, better user experience, and better ability to adapt quickly to new technology and other kinds of change.

Regulatory systems that were "born analog" -- as essentially all of them were -- will be extremely difficult to convert to digital design. In fact, financial regulatory systems are extremely difficult to change in all circumstances, even without the need to transform their technology. Paper 6 in the Regulation Innovation series discusses practical strategies for navigating how to shift the full financial regulatory system over time.

## The Regtech Landscape

Again, regtech has two halves – activity by regulators themselves, and activity applying new technology to the financial industry's regulatory compliance functions.[7] The field is evolving organically, without central organization, as both governments and private companies (large and small) identify a myriad of opportunities to apply regtech to specific problems. One regulator has advised that the best place to start is to find shared "pain points" between regulators and regulatees, where there may be appetite to try new solutions and invest in development.

This section describes how this landscape is taking shape. The subsequent section describes leading use cases being pursued by both public and private sector players.

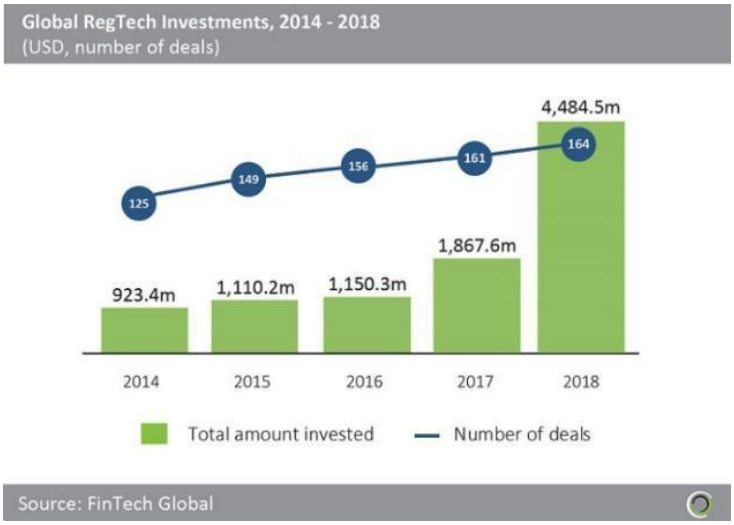
In reviewing these, it is worth recalling the point discussed in the previous paper under "Technology Meets Demography," regarding the emergence of millennials as the largest generation in world history. They are also the first digitally-native generation, which means they will have a higher propensity than their predecessors to adopt not only fintech innovation, but regtech innovation as well. As of 2020, the front edge of the millennial generation has reached age 39. Increasingly, this cohort will be replacing digital-immigrant baby boomers and Gen Xers in leadership roles at regulatory agencies and financial companies. This will be likely to accelerate technology adoption.

[7] As regtech grows, many private vendors are adopting the label even though they still rely on analog technology.

**Regtech for industry compliance:**

On the industry side, as with fintech, private investment is rising sharply, amounting to nearly $10 billion since 2014 and more than doubling between 2017 and 2018.[8]

**Figure 13**




This private venture investment omits the substantial resources being directed into regtech by large companies, including large banks and major tech firms like IBM.[9] For example, some of the large bank "accelerators" and "incubators" that have been set up to cultivate fintech innovation, as described in Paper 3, are also experimenting with regtech concepts. As discussed later in this section, most large banks also have projects underway in use of blockchain technologies to improve operations, some of which overlap with regtech.

[8] https://fintech.global/more-than-9-5bn-has-been-invested-in-regtech-companies-globally-over-the-last-five-years/

[9] https://www.ibm.com/blogs/insights-on-business/banking/how-promontory-and-ibm-are-reshaping-financial-services-through-ai/

The growth of regtech activity is also suggested by the fact that in June 2017, two separate international organizations formed in Europe to promote and shape it. One is the RegTech Council, or RTC, [10] and the other is the International Regtech Association, or IRTA.[11]

There has also been a proliferation of regtech research and reports by major think tanks, consultancies, and academic entities, focusing on both private and public regtech issues. For example, the Milken Institute published a report in July 2018 entitled, "RegTech: Opportunities for More efficient and Effective Regulatory Supervision and Compliance."[12] In June of 2019, the Cambridge Centre for Alternative Finance and the Big Four firm EY jointly issued "The Global RegTech Industry Benchmark Report," based on an international survey of regtech activity.[13] It projected annual growth rates approaching 25 percent for the sector for 2018-2023.

**Regtech for regulators:**

In 2018, Oliver Wyman issued a study called "Supervising Tomorrow," based on a global survey of financial regulators.[14] They asked, "Which trends do you expect to be most important in driving changes in financial supervision in your jurisdiction by 2020?" On a five-point scale, forty percent of respondents gave a 5 rating to "Increased penetration of FinTechs and diversity of players." Eighty percent rated "Increased data volume, quality, types of data" as a 4 or a 5.

The report summed up the research results by saying:

> *The overall finding of our survey is clear: the need to change (driven by the industry) combined with the ability to change (enabled by advances in technology and analytics) will result in transformed supervisory models by 2025.*

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[10] https://regtechfs.com/regtech-council/

[11] https://regtechassociation.org/

[12] https://assets1b.milkeninstitute.org/assets/Publication/Viewpoint/PDF/RegTech-Opportunities-White-Paper-FINAL-.pdf. I was interviewed for this paper and serve on the Institute's fintech advisory committee.

[13] https://www.jbs.cam.ac.uk/faculty-research/centres/alternative-finance/publications/the-global-regtech-industry-benchmark-report/#.XgzGf0dKguU, page 11

[14] https://www.oliverwyman.com/our-expertise/insights/2019/mar/supervising-tomorrow.html

In the realm of regtech innovation by regulators, the widely recognized leader globally has been the Financial Conduct Authority in the United Kingdom,[15] often in collaboration with the Bank of England. In 2015, the FCA launched an initiative called Project Innovate, aiming to explore how best to regulate emerging fintech. The program included establishment of a "regulatory sandbox" in which innovators can conduct experiments and demonstrations relating to regulatory impact – an innovation that has now been emulated in several dozen countries.[16]

In 2016 the FCA added a small regtech unit to its innovation program. This team began innovating about how to bring technology into the agency's regulatory function, itself.

The key invention of the FCA's regtech unit is what they call "tech sprints." Designed in the format of a tech hackathon,[17] these events convene teams of regulatory experts matched with technologists and have them compete to write computer code that can help solve a given regulatory problem. As of early 2020, the FCA has conducted seven of these events. The first one, in 2016, focused on data issues in consumer access. The second was on regulatory reporting and "digitizing" the agency's handbook of regulatory guidance which, as FCA official Christopher Woolard noted, constitutes a stack of paper over two meters high.[18] [19]

Several of these sprints have produced breakthrough results, which will be discussed in the following section on regtech use cases.

Uniquely in the world, the FCA in 2019 elevated its innovation program to the level of a major division.[20] The function has a headcount of approximately 200 people, a high percentage of which are

[15] In 2020, the nonprofit I cofounded in 2019, the Alliance for Innovative Regulation, or AIR, will publish a case study on the FCA's innovation model. It will be available at www.regulationinnovation.org.
[16] https://www.aspeninstitute.org/publications/modernizing-digital-financial-regulation-evolving-role-reglabs-regulatory-stack/
[17] https://www.rasmussen.edu/degrees/technology/blog/what-is-a-hackathon/
[18] https://www.fca.org.uk/firms/regtech/techsprints
[19] https://www.cgap.org/sites/default/files/Working-Paper-Regulatory-Sandboxes-Oct-2017.pdf
[20] https://www.fca.org.uk/firms/innovation

data scientists, as well as a strategy of embedding innovation resources in other units.[21] The group has two sections, one containing the Innovate program on fintech innovation, including the sandbox, and the other focused on regtech and data science. The former head of the regtech unit, Nick Cook, became the first head of the new division.

On the regtech side, this organization has grown from having two people only a few years ago, to being a major function of one of the world's leading financial regulatory agencies. Its potential as a model will be discussed further in Paper 6.[22]

The FCA also conceived and has helped launch the Global Financial Innovation Network, or GFIN, to build international cooperation and coordination on regtech and regulation of fintech.[23]

Another leading government in regtech has been the Monetary Authority of Singapore (MAS), whose chief executive Ravi Menon launched a fintech and regtech initiative in 2015. MAS's Chief Fintech Officer, Sopnendu Mohanty, leads an effort that includes a fintech sandbox and hub and also initiatives in which the MAS and banks "co-create" regulation in areas that can benefit from a public/private collaborative effort. MAS hosts an annual Fintech Festival that in 2019 drew more than 45,0000 people to Singapore from throughout the world. Much of the conference agenda is devoted to regtech.

Many other governments have active regtech programs underway. One example is Australia's use of big data and machine learning algorithms to detect patterns of possible manipulation and insider trading in securities markets. Gregory Medcraft, former Chairman of the Australian Securities and Investment Commission (ASIC), instituted a system in which the agency collects extensive data from

[21] https://www.jsbarefoot.com/podcasts/2019/10/15/t5ot8ywrc8h32gcjvnd1usyaz7bw29

[22] In the spring of 2020, the nonprofit I have founded, the Alliance for Innovative Regulation, will publish a report examining the evolution, design and results of the FCA's innovation programs.

[23] https://www.fca.org.uk/firms/global-financial-innovation-network

regulated companies and combines it with external "big data" to mine for patterns that could indicate misconduct.[24]

While the U.S. has not been at the forefront of most regtech innovation, its agencies have launched numerous initiatives in the last few years. In a June 2017 speech, SEC Deputy Chief Economist Scott Bauguess described his agency's use of AI to monitor securities markets (and noted that, only two years prior, he had needed to Google the term "machine learning" to prepare for a presentation).[25] Similarly, the U.S. Financial Industry Regulatory Authority, or FINRA, uses robust AI and massive volumes of data to detect signs of broker-dealer misconduct.[26]

Also in the U.S., the Commodity Futures Trading Commission, or CFTC, has been a leader through its LabCFTC program, which addresses both fintech and regtech. Former Chairman Christopher Giancarlo has said that the top priority of every regulatory body should be to "digitize the rulebook."[27]

In 2019 the U.S. Financial Crimes Enforcement Network, or FinCEN, launched an innovation program that is largely focused on exploring regtech methods to improve detection of money laundering.

All of the federal financial regulatory agencies in the U.S., and a number of states, have launched innovation programs in recent years. Generally speaking, these focus more on understanding and overseeing fintech innovation than on regtech. Many of these agencies have established separate groups focused on the regtech side of the coin, typically called "suptech." However, as noted earlier, fintech and regtech are sister activities, driven by the same underlying technologies, and the two realms are increasingly connecting. [28]

[24] https://www.afr.com/companies/financial-services/asic-to-use-ai-to-target-misleading-advertising-20190303-h1bx8f

[25] https://www.sec.gov/news/speech/bauguess-big-data-ai

[26] https://www.finra.org/media-center/finra-unscripted/how-cloud-has-revolutionized-finra-technology

[27] https://www.jsbarefoot.com/podcasts/2019/6/25/glko26jp3qq6rp7xptxjmoq20ve1kh

[28] It is worth noting that the FCA uses the term "regtech" to cover suptech, and that it has, again, combined fintech innovation activities and regtech in a single, major unit.

## Regtech Use Cases[29]

Many areas are attracting regtech interest by regulators, industry, or both. In some, the boundary between the tools used by regulators and industry is already porous. Going forward, much of it may be erased. Regulators and industry will be increasingly likely to work with the same data, often at the same time, and with substantial – although limited -- transparency in both directions.[30] Especially for challenges like monitoring compliance and risk, both parties perform similar activities, looking for similar things, but currently do so through separate processes. As regtech permits more data sharing and analysis in real time, this work will tend to merge.

Accordingly, while some of the use cases discussed below currently skew toward either government regtech or private regtech, this paper does not break them out in those categories. Most are already a mix.

The following section describes regtech use cases that aim to address specific laws, regulations, and regulatory mandates. The subsequent section will look at regtech use cases focused on regulatory processes that cross-cut policy siloes. Note that for both, some use cases overlap the solutions that were outlined in Paper 3 on fintech benefits to consumers. Innovation that benefits consumers will, in turn, enhance regulatory outcomes and, conversely, improving regulatory outcomes will produce gains for consumers. Again, the same digital technologies underpin all of it.

**Consumer protection and financial inclusion:**

Among champions of global financial inclusion, there is a growing recognition that full inclusion will never be achieved without regtech. As discussed in Paper 3, hundreds of millions of people are entering the financial services marketplace through cell phone access. This welcome trend offers the opportunity to empower most of the world's poor by connecting them to the mainstream economy.

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[29] For a longer list of use cases focused especially on global large bank regulatory challenges, see the March 2016 report entitled *Regtech in Financial Services: Technology Solutions for Compliance and Reporting* issued by the Institute of International Finance https://www.iif.com/Portals/0/Files/private/iif-regtech_in_financial_services_-_solutions_for_compliance_and_reporting.pdf?ver=2019-01-04-142943-690

[30] One concern often raised by regulators is that having full access to company's data could shift responsibility to the regulator in the event of problems and failures. This will have to be addressed as regtech develops.

However, the speed and scale of this shift has the potential to overwhelm traditional regulatory infrastructure. That infrastructure – at virtually all regulatory bodies – involves severe resource constraints and relies mainly on human effort and paper or minimally-automated records. It simply is not scalable fast enough to meet the burgeoning need.

Regtech is increasingly recognized as the solution.

For example, 2016 saw the launch of the Regtech for Regulators accelerator, or R2A,[31] [32] which received backing from the Bill & Melinda Gates Foundation and the Omidyar Network and support from USAID. The project undertook design of bespoke regtech solutions in two countries – the Philippines and Mexico – to address major regulatory challenges. These included new modes of AML reporting and creation of "chatbots" through which consumers can report complaints about digital financial products directly to regulators, on the same cell phone through which the product is being delivered (see the section below on complaints).

Importantly, regtech innovation in the developing world often exceeds that in the major economies. One reason is that many emerging countries never built the complex regulatory infrastructure that is commonplace today in regions like North America and Europe. This creates an opportunity to start with a comparatively clean slate, using today's best technology rather than layering new requirements on top of yesterday's systems.

In the United States, regtech work is opening financial inclusion in other ways. Paper 3 on fintech innovation discussed the potential for big data and machine learning to finetune assessment of customer risk profiles in both credit decisioning and in KYC screening, thus giving more consumers access to the financial system and to loans. The industry will not be able to move to widespread adoption of such techniques unless regulators become comfortable with them. To do so, they will have to deploy regtech that can evaluate whether these systems are reliable and fair.

[31] https://www.r2accelerator.org/
[32] https://www.r2accelerator.org/what-is-r2a

New solutions are also emerging to automate analysis of lending patterns for compliance with fair lending laws and the Community Reinvestment Act,[33] aimed at enhancing financial inclusion.

In addition, of course, the substantial potential of regtech to reduce compliance costs, and risks, will expand financial inclusion by making services more affordable and widely available, and by helping to foster more fintech innovation that generates other consumer benefits as outlined in Paper 3.

**Credit discrimination and UDAAP**

As will be discussed in Paper 5, there is clearly risk that new technologies could exacerbate bias and unfair practices in the financial system, intentionally, unintentionally, or both. However, empowering regulators with massively more data and the techniques of artificial intelligence, if properly done, also has the opposite potential. Patterns of bias and unfair treatment that currently go undetected will become considerably easier to catch.

Papers 1 and 2 explored the challenges of preventing these problems in today's regulatory system. Federal law bans lending discrimination on the basis of factors like race, sex, and religion.[34] It also prohibits financial companies from engaging in Unfair, Deceptive or Abusive Acts and Practices, known as UDAAP.[35] Both mandates involve difficult efforts to detect and to analyze impacts of problematic patterns of activity. Both rely on considerable subjective judgment in distinguishing illegal activities from others that are legally permitted, a fact that can sometimes make compliance difficult even for companies that are working assiduously to follow the rules.

Regtech can bring to bear the power of more data and AI analytical tools on solving these challenges. It could equip regulators to detect and prove violations more easily. It might also enable them to issue more clear and concrete guidance, including more sophisticated standards on statistical modeling, to help industry avoid discrimination and UDAAP noncompliance. That in turn could help industry more

[33] An example is http://www.asurity.com/riskexec/

[34] https://www.justice.gov/crt/equal-credit-opportunity-act-3

[35] https://www.cfpaguide.com/portalresource/Manual%20-%20UDAAP.pdf

effectively self-police activities that might be problematic, thereby reducing regulatory risks and also better serving their customers.

New methodology could also help risk managers identify possible problems early. This could greatly reduce scenarios in which undetected noncompliance accumulates over months and years and ultimately triggers large fines, spending for customer remediation, and reputation damage.

At the same time, these techniques could help new startups and tech companies entering the financial sector establish high-quality compliance tools from the outset, rather than relying on less effective traditional methods.

One concept under discussion is the potential for running multiple algorithms on a given set of loan decisioning data, with one model optimized for accurately predicting risk of nonpayment and others optimized for minimizing biased outcomes. Regulators could provide guidance on how to use such tools in ways that, if properly performed, will result in reliable compliance, thus reducing the subjective uncertainty that, as discussed in Paper 2, often discourages lenders from trying to reach "underserved" markets.

U.S. regulatory agencies are in an early stage of exploring these kinds of regtech innovations.

**Anti-money laundering:**

Arguably the most advanced regtech use case globally is anti-money laundering, or AML. As discussed in some depth in Paper 2, AML compliance currently costs the industry an estimated $50 billion per year in the United States alone and is, according to UN estimates, catching less than one percent of the $1.6 to $2 trillion in annual financial crime. Meanwhile, law enforcement agencies lament that the data they receive today is low in value, containing too much unimportant information and lacking queriable formats that could help them readily find key material and detect patterns of crime.

Numerous governments and companies are working on bringing better technology into this space. They are seeking to improve and ease customer identification (discussed under Know Your Customer,

below), strengthen monitoring of transactions for patterns of crime, and automate and ease investigation processes.[36]

In 2018 and 2019, the FCA held two international tech sprints aimed at solving problems relating to money laundering. The 2018 sprint[37] highlighted the need to develop safe methods to enable regulators and law enforcement to share information much more fully, in order to detect growing, global networks of crimes like terrorism and illegal trafficking in weapons, drugs, looted antiquities, endangered wildlife, and human beings. It is estimated that 40 million people are held captive today in modern slavery, including 10 million children, of whom a million are enslaved for sexual exploitation.[38] These crimes are hard to detect through traditional law enforcement – hence the 99% failure rate cited above. However, because financial companies are required to collect and track comprehensive information on financial transactions, there is an opportunity to turn the tide against these activities through regtech.

Building on insights from the 2018 sprint, the FCA's 2019 event focused on "Privacy-Enhancing Technologies," or PET's, that can enable data to be encrypted and otherwise masked so that it can be widely shared and subjected to machine-learning analysis in search of patterns of crime, without jeopardizing the privacy of the customers involved. If the AI finds patterns matching crime typologies, it can alert authorities to trigger the appropriate due process steps to permit unmasking the full data.

The 2019 sprint was a trans-Atlantic event held in parallel with one in Washington DC,[39] which was hosted by the Alliance for Innovative Regulation, or AIR (of which I am cofounder and CEO).[40] The two events engaged hundreds of people and many scores of regulators in innovative ways both to combat financial crime and to pursue regulatory innovation.[41]

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[36] Examples of companies in this space are https://alloy.co/, https://www.giantoak.com/, and www.ibm.com/watson/financial-services /. The author is cofounder of another, https://hummingbird.co/

[37] https://www.fca.org.uk/events/techsprints/aml-financial-crime-international-techsprint

[38] https://www.ilo.org/wcmsp5/groups/public/---dgreports/---dcomm/documents/publication/wcms_575479.pdf

[39] See video: https://www.regulationinnovation.org/tech-sprints

[40] https://www.regulationinnovation.org/

[41] In the US, the sprint was keynoted by FDIC Chairman Jelena Mc Williams, who also served as a judge and invited the teams to present to U.S. federal agency heads. The teams have also presented their work to the Director of the Financial Such problems could be sharply reduced, and so could costs, through new technology and rapid, wide scale

As noted earlier, AML innovation is also underway at the U.S. Financial Crimes Enforcement Network, or FinCEN. In 2012, the agency automated the Suspicious Activity Report form that must be submitted when financial companies detect possible money laundering, by converting it to a PDF. Previously these reports were filed on paper, so this was a big step toward efficiency. However, the PDF format is an example of the rigidity that arises when old systems are automated without digital redesign. The agency has subsequently moved to allow batch filing through an API. It has also launched an innovation program through which agency officials meet with private entities exploring technology solutions.

On December 3, 2018, FinCEN joined with the four U.S. federal prudential financial regulators to issue a shared statement encouraging use of innovative technology to combat money laundering. The action was significant both in its proactive position on technology and in the fact that it was released jointly by five federal agencies.[42]

The U.S. Department of the Treasury has also been very active in exploring better technology to combat terrorism and financial crime. Assistant Treasury Secretary Marshall Billingslea spoke at the 2019 London FCA tech sprint mentioned above, where he announced plans for Treasury to hold a sprint of its own in 2020.

By its nature, money laundering is an interconnected global problem. Treasury serves on the international Financial Action Task Force, or FATF, which also has many of these topics on its agenda.[43] The United Nations has launched a software tool called GoAML. It is available to member countries, customizable to their specific needs, and designed to interface with international law enforcement entities like Interpol.[44] Many other countries have initiatives underway among financial regulators and law enforcement bodies.

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data sharing of data for both Know-Your-Customer identification and pooling of typologies on money laundering techniques. Crimes Enforcement Network.

[42] https://www.fdic.gov/news/news/press/2018/pr18091a.pdf

[43] https://www.fatf-gafi.org/publications/fatfgeneral/documents/fatf-position-fintech-regtech.html

[44] https://www.unodc.org/unodc/en/global-it-products/goaml.html

**Know Your Customer:**

A related issue in countering financial crime is a robust effort by both public agencies and private entities to digitize methods for complying with the AML requirement that financial companies must validate the identity of their customers. These mandates aim to exclude corrupt parties from the system and to enable tracking of illegal flows of funds. Known as the Know-Your-Customer, or KYC, rules, these efforts, in turn, intersect with a wider movement toward shifting the financial system (and economy) away from analog methods of personal identification, in favor of a move to digital identity.

Under legacy AML compliance systems, each financial company gathers and verifies KYC information on its own. While there are some regulatory provisions enabling companies to check with each other and share limited data,[45] the system is nevertheless highly siloed, inefficient and ineffective, wasting resources and also contributing to the high levels of successful crime described earlier. These failures were highlighted in a 2019 report issued by the consulting firm Protiviti and the International Regtech Association (IRTA) entitled, "An Urgent Call for KYC Optimization: A Global Market Study Calling for KYC Innovation and Collaboration."[46] Among its recommendations is:

> *Regulators need to clear the path for innovation by developing consistent regulatory standards and mandating the development of common data models to support KYC optimization, including enabling secure information sharing. Key activities include adapting existing regulatory frameworks and mechanisms and creating new shared industry assets to support KYC optimization.*

Extensive policy efforts are underway to permit easier sharing of identity information. This not only can eliminate the need for every financial company to duplicate identity verification steps that others

[45] https://www.fincen.gov/section-314b

[46] https://www.protiviti.com/US-en/insights/urgent-call-kyc-optimization-protiviti-study

have already performed, but can also enable more accurate and rapid detection of risk, using machine learning and pattern recognition to spot signs of deception, fraud, and laundering.

The KYC problem is being tackled by numerous private companies, both startups and major firms, using powerful new information searches and analytics to find and verify customer identity. [47]

**Digital identity and privacy:**

The problems with legacy KYC processes reflect a larger problem with how identity is proven, and protected, in the U.S. and globally. As discussed under fintech innovation in Paper 3, this problem takes two basic forms.

First, many people lack traditional identity documents. In the U.S., this often includes new immigrants. Globally, the problem especially impacts people with social and legal status disadvantages, often, especially, women.

Second, in developed countries where most people do have ID's, their private information today is very likely to be compromised. A high percentage of identity data has been hacked into and is offered for sale on the dark web.[48] Analog information like name, address, social security number, and mother's maiden name is widely available. [49] This vulnerability has been spotlighted by high profile data breaches like those at the federal Office of Personnel Management[50] and the Equifax credit reporting bureau.[51]

As discussed in Paper 3 on fintech, many parties are working on migrating identity systems away from reliance on these weak and selective analog data items and toward use of digital identity based on electronic records and "attestations." Such information can be generated by activity and connections in consumers' mobile phones, through which people can prove, with much more robustness, who they are.

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[47] Examples of companies working on these are https://alloy.co/, https://tradle.io/, https://www.trulioo.com/, www.merlonintelligence.com/, and https://global.id/

[48] https://www.experian.com/blogs/ask-experian/heres-how-much-your-personal-information-is-selling-for-on-the-dark-web/

[49] One compliance person interviewed for this paper said that criminals are actually more likely to enter identity information correctly than are real customers, because the latter sometimes make typos.

[50] https://www.wired.com/2016/10/inside-cyberattack-shocked-us-government/

[51] https://www.ftc.gov/enforcement/cases-proceedings/refunds/equifax-data-breach-settlement

As a regtech issue, this shift is at a nascent stage in the U.S. and is currently driven mainly by startups. However, their efforts are converging with regulators' concerns on KYC and fraud, which makes them likely to migrate into regulators' regtech work. The same is true for the potential of digital ID to help with privacy protection, especially when combined with the Privacy Enhancing Technologies discussed earlier. See Paper 3, Privacy Protection, for a fuller discussion.

**Synthetic identity fraud:**

Many anti-money laundering regtech solutions arose out of technology developed by the financial industry to identify fraud. Those efforts, long-established among large banks and the major credit card chains, have taken on added urgency, and new technology, as consumer lending activities have shifted to functioning mostly online, where fraud rates are comparatively high.

For example, one anti-fraud method fueling regtech interest is the growing use of synthetic identities. These are created by combining real customer information with fake data in a series of steps that can fool normal detection systems, but can often be caught by regtech analysis using more data and machine learning.[52]

**"Policing the perimeter:"**

Regulators in the UK have developed a bot that crawls over the web searching for signs of unauthorized or unlicensed financial offerings. Human reviewers do not have the bandwidth to read this high volume of data, while a robotic tool can flag potentially problematic claims, thereby enabling efficient targeting of human scrutiny.[53]

This information can also help regulators understand where their rules may be unclear or difficult to access, in areas such as what kinds of companies and financial functions require formal government authorization to operate.

**Preventing "cockroaching" and "phoenixing:"**

[52] https://legal.thomsonreuters.com/en/insights/articles/synthetic-identity-fraud. Examples of firms in this field are Thompson Reuters and https://www.sentilink.com/

[53] https://www.fca.org.uk/news/press-releases/fca-publishes-first-annual-report-perimeter

A related challenge in regulatory licensing work is the difficulty of tracking parties that have been barred from operating in the financial system. Governments shut down illegal entities, imposing fines and sometimes banning their principals from future financial activities. A chronic problem, however, is that many of these players rise again, phoenix-like, doing business under a new name and resuming illegal activities until caught again. They tend to inhabit the margins of the industry, in shadowy spaces that are difficult for regulators to see into. Better regtech that uses more data can shine light into these corners of the system.

**Monitoring conduct risk and illegal practices:**

Certain regulatory areas are overseen to determine whether companies and individuals are "conducting" themselves within the spirit and letter of the law. In the securities market, as noted earlier, both regulators and industry are increasingly using AI-based technology to run market surveillance aimed at detecting signs of financial misconduct, such as insider trading. Using a combination of reported data and "big data," these algorithmic techniques seek out patterns such as aberrant behavior by brokers. [54] Both the SEC and FINRA are using these techniques extensively today in the U.S.

More broadly, both regulators and financial companies are expanding use of regtech and similar tools to scrutinize "conduct," rather than (or in addition to) compliance with prescriptive rules. In the wake of the financial crisis, the UK reorganized its financial regulatory structure and created a new agency called the Financial Conduct Authority, which uses principles-based standards to monitor industry activities. In 2018, ASIC chair James Shipton challenged an Australian conference audience by calling for more adoption of and investment in regtech for these purposes, to restore trust in the system by emphasizing conduct. He said:

[54] An example is http://sybenetixnews.site/ , which was acquired by Nasdaq https://www.cnbc.com/2017/07/25/nasdaq-acquires-sybenetix-a-firm-that-uses-ai-to-sniff-out-rogue-traders.html

*"There needs to be more investment in management systems and processes to capture, diagnose and remediate conduct issues earlier, quicker and more efficiently. This includes the adoption of emerging RegTech solutions…In my observation, there has not been enough investment in these systems and processes to date, with the result that it takes far too long for management to meaningfully address conduct problems."*[55]

In the United States, similarly, banks are increasingly looking to ethics programs to prevent regulatory and reputation risk. Some have begun to appoint Chief Ethics Officers (CXO's) and Chief Conduct Officers.[56]

Regtech is emerging to assist in this conduct focus by identifying not only illegality, but also indicators of potential ethics lapses and weaknesses in culture. These can range from aberrations and inconsistencies in the behavior of traders or lenders, to activities that can suggest efforts to evade scrutiny, such as emails containing language like, "let's discuss this by phone."[57]

Such alerts are not used to prove fault, but rather can focus scarce resources on examining red flag areas more closely. Importantly for risk managers, these techniques can also operate as an early warning system, detecting potential problems that call for retraining or clarified policies, before major legal and regulatory problems can develop.

**Complaint management:**

Many regulators have the responsibility to receive complaints directly from the public. These can be time-consuming to investigate and answer (some agencies do not routinely do so, unless the matters involved suggest trends that may warrant enforcement action). High volumes of complaints are also difficult to analyze for indicators of patterns of consumer difficulty.

[55] https://istart.com.au/news-items/theres-big-money-regtech/
[56] https://www.forbes.com/sites/insights-intelai/2019/03/27/rise-of-the-chief-ethics-officer/#3011f8835aba
[57] file:///C:/Users/jo/Downloads/regtech_in_financial_services_-_solutions_for_compliance_and_reporting.pdf

This work is particularly challenging for regulators in emerging markets that have undergone a rapid influx of millions, or tens of millions, of new financial customers who have gained accesses to the financial system through mobile phones. These customers are often inexperienced with finance, making them vulnerable to scams and other exploitation.

Scaling up traditional staffing models to address this rapid change is not possible, in terms of either resources or process. Few regulators are positioned to run large call centers to take oral complaints, or to review and analyze written ones.

An innovative solution to this has been pioneered by the government of the Philippines, which used the R2A program discussed earlier to create a complaint chatbot.[58] It can receive complaints, provide customers with basic information, and analyze trends that can help target where to devote greater human attention.

## Converting Financial Regulation to a Digitally-Native Regtech System

The previous section looked at regtech for improving regulation and compliance regarding specific laws and rules. This section examines areas where regtech solutions are emerging to improve regulatory processes broadly, either to enhance outcomes or reduce costs, or both. Here again, we look at initiatives by, and for, both regulators and industry.

While each of the initiatives described below addresses a specific aspect of regulatory work, they are evolving as nodes of digitally-native reform that are positioned to grow, connect, and merge in the coming years, within agencies and across agencies and countries, yielding a new system over time. Paper 6 in the Regulation Innovation series will address practical strategies for building out that system.

**"Machine-executable" regulation issued in the form of computer code:**

Arguably the most mold-breaking concept in regtech has been pioneered by the UK Financial Conduct Authority and the Bank of England. In November 2017, they held a two-week tech sprint on the

[58] https://www.r2accelerator.org/chatbot-prototype-1

feasibility of creating "model-driven, machine-executable regulatory reporting."[59] The exercise explored the question of whether some regulation could be issued in the form of computer code and thus could become, essentially, self-implementing.

The test was successful and evolved into a project that has produced implementation of the concept in certain areas of FCA regulation.[60]

As discussed earlier, traditional systems for implementing major regulatory change require literally years of work. A code solution, in contrast, could be applied quickly. In the 2017 experiment, the test produced a correct report in just 10 seconds.

A machine-executable system could also be updated instantly and continuously as rules and situations change. For further exploration of the concept, see the sections below on both DRR and on interoperability and platforms.

**Digital Regulatory Reporting (DRR)**

The FCA has built on its work in machine-executable regulation to explore how regtech could revolutionize regulatory reporting. In January 2020, the agency issued a paper laying out analysis of the potential for widescale adoption of this strategy.[61] Called Digital Regulatory Reporting, or DRR, this work could revolutionize both regulatory reporting and, more broadly, how financial companies are supervised by oversight bodies.

The DRR report includes a deep analysis of viability, including potential costs and benefits, of converting mortgage reporting to a DRR system.[62] The agency is seeking further public input on the topic, including on the pros and cons of undertaking incremental change versus more sweeping overhaul of the system. This is probably the most ambitious regtech project underway in the world today.

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[59] https://www.fca.org.uk/publications/feedback-statements/call-input-using-technology-achieve-smarter-regulatory-reporting

[60] https://www.fca.org.uk/digital-regulatory-reporting

[61] https://www.fca.org.uk/innovation/regtech/digital-regulatory-reporting

[62] https://www.fca.org.uk/publication/discussion/digital-regulatory-reporting-pilot-phase-2-viability-assessment.pdf

**API-based regulatory reporting:**

On a less ambitious level than full DRR, extensive work is also ongoing at regulatory agencies in the U.S. and throughout the world on enabling regulatory reports to be submitted via application program interface, or API.

Given the analog-era history of today's regulatory systems – again, rooted in the outdated assumption that data is scarce – most regulatory reporting today is done periodically, which by definition means it presents information that is not current. As noted earlier, for instance, banks are required to provide their regulators with "Call Reports" containing their financial statements and information on loans, deposits, and investments, as well as changes in capital and other updates. These critical reports are submitted once per quarter. With these kinds of reporting cadences, regulators are almost always looking at information that is out of date. This backward-looking analysis may have been effective when the financial system itself was changing more slowly. Today, it raises risk that regulators will discover serious problems only after it is too late to address them effectively.

In addition to this time lag problem, analog-style reporting generally gives regulators a very limited line of sight into the system, because most of the information they see is incomplete. They generally get access to summary data, or data in forms that are difficult to analyze. Bank examination information, similarly, is based on drawing limited samples of files. Thus the picture presented is both out of date and fragmentary.

There is also a problem with regulators receiving incorrect information. Errors in many kinds of reports are common.[63] This is partly because, as discussed earlier, most banks have aging and siloed IT systems that break at the "joints" between databases and systems that have accumulated over years and decades. Lyn Farrell, a compliance attorney who authored the American Bankers Association manual on

[63] https://www.financedigest.com/how-banks-can-avoid-regulatory-reporting-mistakes-with-a-good-dose-of-automation.html

consumer financial protection regulation for two decades, has described these IT systems as being held together with "bailing wire."[64]

Responding to these issues, numerous regulatory agencies are exploring or deploying an alternative approach in which they can plug directly into regulated companies through an API, gaining access to certain kinds of data in real time and with 100 percent coverage. Regulators can then create algorithms to analyze patterns that raise issues and create new ways of remediating problems.

One example of such a regtech system in the U.S. is modernization of processes under the Home Mortgage Reporting Act. As discussed in Paper 1, HMDA requires most mortgage lenders to submit extensive data on the locations and attributes of their loans, to help regulators and other watchdogs check for patterns of potential credit discrimination and evaluate performance under the Community Reinvestment Act. In 2017 the CFPB modernized its reporting process to require that HMDA data be submitted through a uniform portal. The innovation has massively reduced errors and workloads that previously characterized the HMDA process, which traditionally involved very extensive back-and-forth communications between regulators and lenders, working on data problems and mistakes.

Another example, as mentioned earlier, is FinCEN's adoption of an API-based batch reporting system for Suspicious Activity Reports.

While transition to API systems can be complex for regulators and regulated firms alike, it offers great benefits to both. Regulators gain fuller visibility into industry activity and are able to see and analyze this information in real time, enabling early detection of patterns, even industry-wide, that could indicate violations or emerging risks to individual companies or to the system. For example, such a process might have been able to detect the softening of subprime mortgage quality early enough to have prevented the financial crisis.

[64] http://www.jsbarefoot.com/podcasts/2017/4/30/heroic-compliance-treliants-lyn-farrell

For the industry, API-based reporting systems can eliminate billions of dollars in annual costs for preparing reports, checking them, and correcting errors, in addition to enabling companies to identify regulatory concerns before they become serious and widespread and therefore, probably costly.[65]

**New models for monitoring:**

Shifting the system to DRR and API reporting may ultimately eliminate the entire concept of regulatory "reporting," itself. The word "report" reflects an analog-age assumption that a financial company must prepare and submit actual reports from time to time. In a digital regtech system, regulators will have better ways to access information, enabling them to see full data, in real time.

In such a system, there will be a set of information that is always visible to regulators. This would include basic data on core risk metrics, as well as information that is not highly sensitive but is useful to regulators seeking to analyze industry trends and patterns.

There would also be a set of information that regulators would not see at all times, but that they would be able to "call" at any time, under rules specifying justification and limited access. This information would be complete and current, easily accessed via API at low cost to both sides.

Such a system would need to establish rules and protocols to protect information from misuse by regulatory personnel and for exposure to data leakage. Regulators would be limited in their ability to see consumers' personally-identifiable information (pii) and to retain information beyond specified time periods or usage needs. Access permissions would be built to assure that only authorized regulators could see sensitive material.

Regulators would combine this company-specific monitoring information with external data and would use artificial intelligence on these data sets to identify trends in risks and problems in the system. Some of this scrutiny would be company-specific and some would enable powerful analysis of cross-industry patterns.

[65] https://www.ft.com/content/e1323e18-0478-11e5-95ad-00144feabdc0

This system would have to be designed to fix points of responsibility between industry and regulators, so that liability for problems would not shift, legally or de facto, from companies to regulators on the theory that the latter "should have known" about them.

These same full and continuous monitoring tools would also be used by industry itself to achieve immediate indicators of problems and risks. This process can make it possible essentially to *prevent* most compliance problems from occurring at all. Data-driven compliance systems would be designed to run tests for errors and to benchmark risks against standards and norms and other diagnostics. Done in real time and with complete information, these tools could enable companies to find a budding problem instantly, before it can impact even one customer or permit even one improper decision. Such a system would massively reduce the industry's costs of regulatory "lookbacks" and penalties for problems that, today, often grow undetected for long periods and are a major source of compliance expense.

As a compliance strategy, this approach is not conceptually different from what is done today. Financial companies already use IT and software extensively in their processes for generating correct and compliant customer accounts, loan documents, regulatory reports, and the like. The old generation of this technology however, allows many errors to occur anyway, for the reasons discussed in these papers. A newer system in which the information is in readily-accessible digital form, and is constantly analyzed in complete scope and in real-time, could massively cut the costs and burdens of compliance for industry, as well as the harm that compliance mistakes inflict on customers.

**The "traveling algorithm:"**

Leading regtech thinkers argue that monitoring systems like those described above should be designed to avoid centralization of sensitive regulatory data. Instead, the information should remain decentralized, housed by the companies involved. This has been described as "taking the technology to the data, instead of bringing the data to the technology." Gary Shiffman, CEO of the tech firm Giant Oak,

has dubbed this strategy "the traveling algorithm."[66] Such a design would avoid creation of centralized "honey pot" data repositories that attract hackers and cyber-attacks.

**Digitized rulebooks and monitoring regulatory change:**

Regulators and private innovators are also moving to make regulatory rule-sets easy to search and interpret electronically. The FCA has done work on this, as has the U.S. Commodity Futures Trading Commission, whose former Chairman Christopher Giancarlo has said that moving rules from "analog to digital" formats is the most important challenge facing all regulators, including those in finance.[67] These efforts involving adding an "electronic tag" to regulatory text, to enable it to be machine-readable. Numerous companies are working on tools that facilitate this kind of automated regulatory search and monitoring.[68]

**Regulatory interoperability and platforms:**

In June of 2017, I convened an international roundtable conference at Harvard University[69] called: "Regulation Innovation: Can regulation be redesigned through technology?" The event drew academics, technology and financial regulatory and legal experts, and government officials to explore whether technology can fundamentally reshape financial regulation.[70] In particular, we examined two mold-breaking ideas. One was the concept of machine-executable regulation discussed above. The other was whether some regulatory activity could be transitioned from fragmented and linear processes into technology "systems" and "platforms."

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[66] https://www.jsbarefoot.com/podcasts/2019/6/7/fighting-financial-crime-with-science-giant-oak-geo-gary-shiffman

[67] http://www.jsbarefoot.com/podcasts/2017/7/18/from-analog-to-digital-regulation-cftc-acting-chairman-christopher-giancarlo

[68] An example is https://www.compliance.ai/

[69] I was a Senior Fellow at that time in the Mossavar-Rahmani Center for Business and Government in the Harvard John F. Kennedy School of Government. I am now a Senior Fellow Emerita at the Center, which sponsored the event.

[70] https://www.hks.harvard.edu/centers/mrcbg

On the former, the answer appears to be yes. As noted, the FCA and Bank of England ran their successful experiment on this concept just five months later, and the resulting work has moved into implementation.

On the second concept there is less evidence of concrete progress, but active discussion is underway. The idea is that some realms of regulation might function more or less as an app store does. Regulators would create an open platform and standards for entities that wanted to attach to it, such as by requiring auditability. By way of analogy, a developer who wants to create an app for the Apple Store downloads a software development kit (SDK) that contains specifications for standards and compatibility. An app written to the specifications of the kit will, by definition, be compatible with Apple products and meet basic requirements. Conceivably, financial regulation might evolve to a similar format.

If regulatory compliance tools migrated to a platform design, they could more readily be made interoperable. It could become possible to evolve a modular compliance system in which solutions from different sources could easily interact with each other. Financial companies would be able to select the best solution, or multiple, redundant solutions if desired, to meet their needs. If a given vendor fell behind competitors in innovating or maintaining quality, the regulated company could swap it out for a better solution, keeping data intact with minimal conversion costs.

Among other things, this approach would address the risk of "vendor capture," a phenomenon in which a small group of companies dominate a given regulatory (or other) activity using "walled garden" systems that bind their clients to them. These systems, almost by definition, are rigid in ways that make innovation difficult.

For example, the *American Banker* reported in 2013 that four core IT processing vendors accounted for 96 percent of the U.S. banking market.[71] Solutions like these have played a valuable role in banking operation and compliance over the years. In the digital age, however, further gains can be

[71] https://www.americanbanker.com/news/can-big-four-core-banking-vendors-oligopoly-be-broken

secured through migration of the market, including the major vendors, toward modular, interoperable, "plug and play" tools that can help the industry innovate, improve performance, and reduce costs.

**Open source code:**

A key element of many regtech reforms will be adoption of widespread use of open computer code. Traditionally, the technology industry maintained proprietary code and used it to seek competitive advantage. In recent years, the tech sector has shifted to a strong preference for open code in many areas. Major companies like Google and Microsoft have converted huge swaths of code to open source.[72]

One benefit is efficiency and interoperability, as commonly used open code is adopted as building blocks in many solutions. Another advantage is that widely used code becomes robustly vetted for bugs and vulnerability, sometimes by large communities looking for problems. Weaknesses become well-understood and can be fixed.

Code writers register their open code on repositories like GitHub,[73] and other developers build on top of their work, recording their changes as well. This makes it possible to know the genesis and genealogy of the code.

The FCA has created some of its regtech in the form of open code. Wider use of this system could prevent regulators from having to reinvent the wheel each time one agency needs to undertake a task that others have already tackled.

The regtech world will likely evolve with a layer of open source code facilitating many basic functions, and with proprietary code built on top of that foundation, by both government and industry, to solve specific problems and, for the industry, generate value.

**Continuous updating:**

Related to the concepts of platform-based regulation and machine-executable regulation is the potential for regulatory mandates, and compliance enhancements, to be updated continuously. As noted earlier, implementing regulatory changes of any significance normally requires years of work, first by the

[72] https://opensource.google/docs/releasing/preparing/
[73] https://github.com/

regulators, and then by the vendors and IT staffs, and then by the rest of the companies impacted. Much of the cost of compliance arises from these conversion costs. Much resistance to changing regulatory requirements arises from it too, even when revised rules have potential to be clearly superior. Small, incremental improvements are eschewed for this reason.

In innovative companies, by contrast, such constant enhancement is at the very heart of competitive success. If banks, in particular, cannot adopt nimble innovation strategies due to regulatory constraints, they are likely to struggle to compete with technology companies, small and large, that offer financial services that constantly improve.

In a modernized regulatory system, one can imagine regulators and vendors being able to issue a compliance update much as a consumer today receives an automated IOS update to her Iphone. Problems are fixed, vulnerabilities are patched, features are added, at no cost and with no effort by the user.

One compliance expert interviewed for this paper described the contrast between his experience with low-tech versus high-tech compliance technology design. He gave the example of attending a multi-day training session while working for a consulting firm, and having the trainer – who represented a dominant, analog era compliance tool -- repeatedly say, "I know this doesn't make sense, but this is how you have to do it." The company involved typically issues software updates every few years, which means that over time, problems accumulate. In contrast, the person we interviewed found himself several years later heading compliance at a fintech firm. There, he said, if someone had reported that a compliance technology process didn't make sense, the company's engineers would have "fixed it that day."

Regulation and compliance will never work really well in the digital age, unless they can undergo continuous innovation.

**Measuring outcomes:**

As regtech brings improved data and powerful analytics into financial regulation and compliance, it can enable a shift, in some areas, to evaluating industry compliance based on outcomes.

As discussed in some depth in Paper 2, most financial regulatory policies are not expressed in terms of quantifiable objectives. Instead, goals tend to be set with an emphasis on process, with little focus on whether the processes are producing successful results. Are AML regulations working if the industry largely complies with the rules but 99 percent of financial crime goes uncaught? Are current levels of financial inclusion adequate, even though millions of people cannot access mainstream providers? Are disclosure requirements successful if industry complies with them, but customers do not read or grasp them?

These kinds of questions are rarely asked because, again, it has traditionally been difficult or impossible to measure actual results.

Regtech creates the potential to change that. With more data, and with development of standards and controls to assure regulator confidence in the information, it will become possible in some areas for financial companies to demonstrate compliance and satisfactory risk profiles through data that is complete, up to date, and open to analysis to determine whether performance is hitting objective benchmarks. Such a system could greatly improve policy outcomes, and again, reduce costs as well.

**Efficiency:**

Financial regulation is difficult to streamline, and related compliance costs are hard to reduce. "Paperwork reduction" projects are a hardy perennial of regulatory reform efforts, with policymakers engaging in periodic efforts to overhaul rules and reduce burden. In general, these efforts have only marginal effect and/or prove to be transient when they are undertaken through the traditional means, which basically amount to pruning and weeding out rules and processes. Those tend, over time, to grow back.

A digitally-native regtech system would offer the possibility of breakthrough gains in efficiency for both business and government. By leveraging the ability of digitization to make things work "better, cheaper and faster," these strategies have the potential to bring massive cost reductions, and/or to generate massive gains in effectiveness without the need to spend more.

Both regulators and industry are undertaking many technology upgrades aimed at improving operations, including compliance. An example is efficiency strategies that use blockchains and distributed ledger technology (DLT) to streamline processes and record-keeping. As discussed in Paper 3, this technology was developed by the founders of Bitcoin and enables multiple parties to post transactions or chains of records on a single "distributed ledger," in real time, in ways that cannot be altered and that are transparent to all parties. This approach can remove the need to engage "trusted intermediaries" whose role is essentially to vouch for the parties to the agreement and to set up the contractual arrangements to protect each party's interests. DLT can obviate the need for this because the trust is built directly into the technology itself. DLT is also being explored as a means to verify customer identity and to eliminate delays in areas like settlement,[74] which currently require banks to hold capital against the risks caused by time lags that occur before funds actually clear.

Other companies are also using DLT to streamline and strengthen efforts to verify customer identity for purposes of AML Know-Your-Customer rules and data security.[75]

Regtech is so new that few studies have yet appeared to quantify the potential gains, but the promise of savings is widely recognized.[76] One important cost/benefit study is the one referenced above, released by the FCA in January of 2020 relating to its Digitized Regulatory Reporting initiative, or DRR.[77]

These are only a few of the possibilities being opened by regtech, a young field that is just beginning to generate innovation. Could the industry create systems whose compliance functions are verifiable, efficient, flexible, and modular? Could sample-based, backward-looking testing and periodic reporting be replaced with real-time data interfaces and pattern analysis that prevents problems at

[74] An example is http://www.digitalasset.com/ and http://www.jsbarefoot.com/podcasts/2016/7/5/cost-cutting-with-the-blockchain-blythe-masters-ceo-of-digital-asset-holdings
[75] An example is https://tradle.io/
[76] https://istart.com.au/news-items/theres-big-money-regtech/
[77] https://www.fca.org.uk/publication/discussion/digital-regulatory-reporting-pilot-phase-2-viability-assessment.pdf

inception? Could agencies and countries create interoperable standards to ease regulation rollouts? Could they share data to eliminate most financial crime? Are there regulatory areas where government could measure public policy outcomes instead of compliance inputs? Could governments introduce new approaches through alternative regulatory channels that enable rapid learning? Could these channels be voluntarily adopted by the industry?

From a technology standpoint, the answers to these questions are yes. From a practical standpoint, the picture is much more complex. Converting to a digitally-native regulatory system will require years of work and the solving of very difficult problems. Paper 6 in this series will offer thoughts on concrete and realistic ways to move forward.

First, however, Paper 5 in the series will address the many downside risks of the technology innovations emerging in both fintech and regtech.

Whether these risks will be averted, and whether the upside gains described in Papers 3 and 4 will ever be realized, will depend mainly on how well the explosive technology change ahead is regulated.

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