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**The Emergence of Regtech 2.0:
From Know Your Customer to
Know Your Data**

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Financial Technology

The Emergence of Regtech 2.0: From Know Your Customer to Know Your Data

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Abstract

The regulatory changes and technological developments following the 2008 Global Financial Crisis are fundamentally changing the nature of financial markets, services, and institutions. At the juncture of these two phenomena lies regulatory technology or "RegTech" – the use of technology, particularly information technology, in the context of regulatory monitoring, reporting, and compliance. RegTech to date has focused on the digitization of manual reporting and compliance processes, for example in the context of know-your-customer requirements. This offers tremendous cost savings to the financial services industry and regulators. However, the potential of RegTech is far greater – it could enable a close to real-time and proportionate regulatory regime that identifies and addresses risk while also facilitating more efficient regulatory compliance. We argue that the transformative nature of technology will only be captured by a new approach that sits at the nexus between data, digital identity, and regulation. The development of financial technology ("FinTech"), rapid developments in emerging markets, and recent pro-active stance of regulators in developing regulatory sandboxes, represent a unique combination of events, which could facilitate the transition from one regulatory model to another.

INTRODUCTION

Regulatory and technological developments are changing the nature of financial markets, services, and institutions in ways completely unexpected prior to the 2008 Global Financial Crisis (GFC).[2] "FinTech," which refers to the use of technology to deliver financial solutions, is one aspect of these fundamental changes. The rapid evolution of FinTech demands a similar evolution of RegTech.[3] "RegTech" is a contraction of the terms "regulatory" and "technology," and describes the use of technology, particularly information technology (IT), in the context of regulatory monitoring, reporting and compliance.[4] Automation of processes allows for better and more efficient risk identification and regulatory compliance.[5]

Recently, two painful pressure points have come to bear on the financial services industry, which support our vision. On the expense side, post-crisis fines have exceeded U.S.$200 bln,[6] and the ongoing cost of regulation and compliance has become a primary concern industry-wide.[7] On the revenue side, competition from FinTech companies is expected to put U.S.$4.7 tln of revenues at risk.[8] These factors are driving the development of RegTech. As with FinTech,[9] the GFC represented a turning point in RegTech development.[10] However, the factors underlying, and the beneficiaries of, RegTech are quite different. FinTech growth has been led by start-ups (now increasingly partnering with, or being acquired by, traditional financial institutions),[11] while RegTech developments are primarily a response to the huge costs of complying with new institutional demands by regulators and policy-makers.[12]

For the financial services industry, the cost of regulatory obligations has dramatically increased, such that 87% of banking CEOs in one survey consider these costs a source of disruption.[13] This provides a strong economic incentive for more efficient reporting and compliance systems to better control risks and reduce compliance costs. Furthermore, massive increases in the volume and types of data reported to regulatory authorities[14] represent a major opportunity for the automation of compliance and monitoring processes. For the financial services industry, the application of technology to regulation and compliance has the scope to massively increase efficiency and achieve better outcomes.

For regulators, RegTech provides the means to move towards a proportionate risk-based approach where access to and management of data enables more granular, effective supervision of markets and market participants.[15] This provides the opportunity to minimize the risks of the regulatory capture witnessed in the run-up to the GFC, as well as being a natural response to the increasingly digital nature of finance.[16] Furthermore, applying technology to regulation facilitates the monitoring of financial market participants that are becoming increasingly fragmented by the emergence of new FinTech start-ups.[17]

Enhanced reporting accuracy and decreased compliance costs are not new incentives.[18] However, as the financial services industry becomes increasingly digitized, the gap between the accuracy and costs of manual and automatic compliance and monitoring is widening. Combined with recent advances in data science and analytics, RegTech's growth can be understood as process automation to substantially decrease both compliance costs as well as potential for regulatory fines.[19]

Regulation is benefiting from automation of reporting and compliance processes. This trend is enabling substantial cost savings for industry and superior monitoring by regulators. Indeed, early signs of real-time, proportionate regulatory regimes that identify risks and enable more efficient regulatory compliance are emerging.[20] However, the automation and streamlining of regulatory processes is only an incremental evolution toward a better and more efficient regulatory framework.

2   See Arner, D. W., J. Barberis, and R. P. Buckley, "The evolution of FinTech: a new post-crisis paradigm?" Georgetown Journal of International Law (forthcoming 2016); Buckley, R. P., and D. W. Arner, 2011, "From crisis to crisis: the global financial system and regulatory failure," University of Hong Kong Faculty of Law Research Paper No. 2012/002

3   See Institute of International Finance, 2016, "RegTech in financial services: technology solutions for compliance and reporting 5-8, March.

4   See Christophe Chazot quoted in Institute of International Finance, 2015, "RegTech: exploring solutions for regulatory challenges," 2, October.

5   See Fernandez de Lis, et al., 2016, "RegTech, the new magic word in FinTech," 1, BBVA Research, March.

6   See Cox, J., 2015, "Misbehaving banks have now paid $204B in fines," CNBC, October 30, http://cnb.cx/1Q3HGSd

7   See Thomson Reuters, 2015, "Thomson Reuters annual cost of compliance survey shows regulatory fatigue, resource challenges and personal liability to increase throughout 2015," Thomson Reuters, May 13, http://tmsnrt.rs/1QhKyYo.

8   See The Economist, 2015, "The FinTech revolution," May 9, http://econ.st/1H2hwbP.

9   Arner et al. supra note 2.

10 See Institute of International Finance, 2015, "RegTech: exploring solutions for regulatory challenges," 2, October, at 1.

11 See Finextra, 2016, "Banks rushing to collaborate with FinTech startups," September 16, http://bit.ly/2cD26Rb; EY, 2015, "FinTech: are banks responding appropriately?" Ernst & Young LLP; Meola, A., 2016, "1 in 5 European banks would buy FinTech startups," Business Insider, July 17, http://read.bi/2cPsbfn.

12 See Roberts, G., 2016, "FinTech spawns RegTech to automate compliance," Bloomberg, June 28, http://bloom.bg/2dNjzMi.

13 Fernandez de Lis et al., supra note 5: at 1.

14 See generally Institute of International Finance, supra note 4: at 5-8.

15 See Gulamhuseinwala, I., S. Roy, and A. Viljoen, 2015, "Innovating with RegTech - turning regulatory compliance into a competitive advantage," 10, Ernst & Young LLP, http://bit.ly/24SGCnl.

16 See Arner, D., and J. Barberis, 2015, "FinTech in China: from the shadow?" Journal of Financial Perspectives 3(3).

17 See GPFI, 2016, "G20 high-level principles for digital financial inclusion," 12.

18 Institute of International Finance, supra note 10: at 1; supra note 7.

19 Deloitte, 2015, "RegTech is the new FinTech: how agile regulatory technology is helping firms better understand and manage their risks," 4, http://bit.ly/1QXnsIY.

20 See Institute of International Finance, supra note 4: at 9.

REGTECH DRIVERS

The GFC and post-crisis financial regulatory reforms transformed the way financial institutions operate, reducing their risk-taking, profitability, and spectrum of their operations.[21] The mass of new post-crisis regulation has dramatically increased the compliance burden on financial institutions, in addition to the direct cost of regulatory penalties.[22]

These changes were the intent of the post-crisis regulatory reform agenda.[23] This new regulatory environment is a major driver behind the emergence of RegTech.[24]

With this dramatically altered regulatory, operating, and compliance environment has come the rapid evolution of FinTech. While FinTech as a term has only gained popularity in the past three years,[25] the interaction between finance and technology has a long history.[26]

Today, FinTech impacts every area of the financial system globally, with the most dramatic impact perhaps in China, where technology firms such as Alibaba, Baidu, and Tencent ("BATs") have transformed finance and raised new challenges for regulators and regulation.[27] Furthermore, since 2016 regulators in countries including the U.S., Australia, Singapore, and the U.K. have been actively engaged in better understanding FinTech market dynamics and developing new regulatory approaches.[28]

In the near future, the application of technology to monitoring and compliance offers massive cost savings to established financial companies and potentially massive opportunities to emerging FinTech start-ups, IT and advisory firms.[29] RegTech enables the prospect of continuous monitoring that would improve efficiency by both liberating excess regulatory capital,[30] and, from a regulator's perspective, making it faster to investigate a firm following a compliance breach.[31] RegTech, however, offers more: the potential of continuous monitoring capacity and close to real-time insights, through deep learning and artificial intelligence filters, which look forward to identify problems in advance rather than take enforcement action after the fact.

In the long run, while FinTech has an inherently financial focus, RegTech has the potential for application in a wide range of contexts, from monitoring corporations for environmental compliance to tracking the global location of airliners on a real-time basis. As our financial system moves from one based on know-your-customer (KYC) principles to a know-your-data (KYD) approach, an entirely new regulatory paradigm to deal with everything from digital identity to data sovereignty, and that will extend far beyond the financial sphere, must likewise evolve.

From a market dynamic perspective, FinTech since 2008 has grown organically as a bottom-up movement led by start-ups and IT firms, whilst RegTech has grown in response to top-down institutional demand. RegTech, therefore, encompasses three distinct, but complementary, groups of participants.

RegTech development to date has primarily been driven by the financial services industry wishing to decrease costs,[32] especially given regulatory fines and settlements have increased 45-fold.[33] The next stage is likely to be driven by regulators, seeking to increase their supervisory capacity. We can, therefore, expect RegTech to focus more on business-to-business ("B2B") solutions in contrast to the FinTech sector which focuses on business-to-consumer ("B2C"), as well as B2B, solutions.[34]

21 See generally Buckley, R. P., 2016, "Reconceptualizing the regulation of global finance," 36 Oxford Journal of Legal Studies 242.

22 See Cox, supra note 6.

23 See Financial Stability Board, 2016, "Implementation and effects of the G20 financial regulatory reforms: report to the G20," August.

24 See Buckley & Arner, supra note 2; Buckley, R. S., E. Avgouleas, and D. W. Arner, 2016, Reconceptualising global finance and its regulation, Cambridge University Press

25 See Google Trends, 2016, "FinTech: interest over time," Google Trends, http://bit.ly/2dGfeGs (accessed September 19, 2016).

26 See Arner et al., supra note 2; Lo, A., 2016, Moore's Law vs. Murphy's Law in the financial system: who's winning?" Bank for International Settlement, Working Paper No. 564, May.

27 See Zhou, W., D. W. Arner, and R. P. Buckley, 2015, "Regulation of digital financial services in China: last mover advantage," 8 Tsinghua China Law Rev. 25; Arner & Barberis, supra note 16.

28 See ASIC, 2016, "FinTech: ASIC's approach and regulatory issues," 10-12, Paper submitted to the 21st Melbourne Money & Finance Conference, July; ASIC, 2016, "Further measures to facilitate innovation in financial services," consultation paper no. 260, June.

29 Shedden, A., and G. Malna, 2016, "Supporting the development and adoption of RegTech: no better time for a call for input," Burges Salmon 2, January, http://bit.ly/2cPvEuA.

30 Citigroup, 2013, "Comment letter on regulatory capital rules: enhanced supplementary leverage ratio standards for certain bank holding companies and their subsidiary insured depository institution," 3, Comment letter from Citigroup, October 21, http://bit.ly/2dpa57b; See Heltman, J., 2016, "Long-term liquidity plan is costly and redundant, banks argue," American Banker, August 12, http://bit.ly/2daTdio.

31 Gutierrez, D., 2014, "Big data for finance – security and regulatory compliance considerations," Inside big data, October 20, http://bit.ly/2dG7F71.

32 See Institute of International Finance, supra note 10: at 1.

33 Kaminski, P., and K. Robu, 2016, "A best-practice model for bank compliance," McKinsey & co., exhibit 1, January, http://bit.ly/2drDAVB.

34 See generally Mead, W., R. Iferenta and R. Hibbert, 2016, "A new landscape: challenger banking annual result," KPMG, May, http://bit.ly/1YjmJUi.

THE EMERGENCE OF REGTECH

Traditional financial institutions, particularly large global banks, have been the major drivers of the post-2008 evolution of RegTech, stemming from their appetite for efficient tools to deal with new and complex regulatory and compliance demands. Financial institutions began applying technology intensively to risk management and compliance in the 1990s, with regulators relying heavily on such systems. However, the GFC fundamentally altered the paradigm. Since the crisis, regulators globally have implemented far-reaching, extensive regulatory reforms that have driven the evolution of IT and compliance in major financial institutions worldwide. Global firms are developing global centralized risk management and compliance functions to address the changed regulatory and compliance environments.[35]

The history of global financial regulation is the story of regulatory initiatives in response to crisis. For example, the extensive financial liberalization and deregulation of the 1970s was followed by the Developing Country Debt Crisis of 1982, which in turn provided the impetus for the first Basel Accord on capital adequacy in the late 1980s.[36]

From the standpoint of financial institutions, the late 1960s to the GFC was a period of continual expansion in scope and scale, culminating in huge global financial conglomerates.[37] This occurred through organic growth and mergers and acquisitions, with the merger of Travelers and Citibank to form Citigroup in 1999 being paradigmatic.[38]

As financial institutions expanded their scope and scale across jurisdictions and sectors, they faced increasing operational and regulatory challenges. This led to a major expansion of risk management and legal and compliance activities, particularly throughout the 1990s and 2000s. From the 1980s, risk management was achieved using financial technology, as finance became increasingly quantitative and IT increasingly powerful. This combination was reflected in the emergence of financial engineering and Value-at-Risk (VaR) systems in major financial institutions.[39] These systems were a major element of the transformation of finance pre-GFC, but also one of the greatest risks and failures underlying the crisis itself.[40] By the early 21st century, the financial services industry had become overconfident in its ability to manage and control risks through the application of quantitative finance and IT.[41]

Regulators too became overconfident in the ability of this quantitative IT framework to manage risks, as is demonstrated in the heavy reliance by the Basel II Capital Accord on quantitative internal risk management systems.[42] Essentially, regulators outsourced major aspects of financial regulation to the internal risk control mechanisms of the largest industry participants.

Reliance on quantitative risk management systems by industry and regulators was the first iteration of RegTech – a sort of RegTech 1.0. This pre-crisis partnership between the financial industry and its regulators, based on quantitative internal risk management systems, provided a false sense of security and confidence that the GFC shattered.

IMPACT OF THE 2008 GFC

To date, traditional financial institutions and their risk management and compliance needs have been the primary driver of, and market for, RegTech solutions. While the financial services industry has long been a major user of automated reporting and compliance tools, increased regulatory costs since 2008 have enhanced the incentive to quickly adopt digitization and automation of processes as the default method of meeting regulatory obligations.

The emergence of RegTech can be largely attributed to the complex, fragmented, and ever-evolving post-GFC global financial regulatory regime. Overreliance on complex, prescriptive, and lengthy regulations led to massive compliance and supervision costs for regulators and the regulated. Carrying out financial supervision, in response to growing regulatory complexity, inevitably required greater granularity, precision, and frequency in data reporting, aggregation, and analysis.[43]

35   See EY, 2014, "Centralized operations - the future of operating models for risk, control and compliance functions," Ernst & Young LLP, February, http://bit.ly/1IQ3ubx.
36   Federal Reserve Bulletin, 2003, "Capital standards for banks: the evolving Basel Accord, September, http://bit.ly/2cPwCaj.
37   See Buckley, R. P., 2016, "The changing nature of banking and why it matters," Buckley, R. S., E. Avgouleas, and D. W. Arner, 2016, Reconceptualising global finance and its regulation, Cambridge University Press 9-27
38   Let's Talk Payments, 2014, "How 37 banks in 1990s became 4 banks in 2009, mega consolidation in US," http://bit.ly/2dnMNln, citing Federal Reserve; GAO.
39   See Nocera, J., 2009, "Risk management – what led to the financial meltdown," New York Times, January 2, http://nyti.ms/2dADA7b.
40   The VaR model is unreliable in many ways. See Shojai, S., and G. Feiger, 2010, "Economists' hubris - the case of risk management," Journal of Financial Transformation 28, 25-35; Johnson, S., and J. Kwak, "Seduced by a model," New York Times Economix Blog (Oct. 1, 2009), http://nyti.ms/2cOY251; Krause, A., 2003, "Exploring the limitations of value at risk: how good is it in practice?" 4 Journal of Risk Finance, 19.
41   Overreliance on financial technology (like VaR) that allowed hugely complex risks to be modelled may have destroyed Wall Street: Salmon, F., 2012, "The formula that killed Wall Street," 9 Significance 16.
42   See Benink, H., and G. Kaufman, 2008, "Turmoil reveals the inadequacy of Basel II," Financial Times, February 28, http://on.ft.com/2dG9LUG; Staffs of the International Monetary Fund and The World Bank, "Implementation of Basel II – implications for the World Bank and the IMF," International Monetary Fund, July 22, http://bit.ly/2dG8AEt.
43   Institute of International Finance, supra note 4: at 5-8.

Examples can be found in capital and liquidity regulations under Basel III, stress-testing, and risk assessments in the U.K., U.S., E.U., and elsewhere, and the reporting requirements imposed on OTC derivatives transactions resulting from Group of 20 (G20)/Financial Stability Board (FSB) agreed approaches and as implemented – in conflicting fashions – in the context of Dodd-Frank or the E.U.'s EMIR.[44] Compliance costs rose significantly due to the increasing regulatory burden that made innovative technologies a natural and promising solution to compliance requirements.[45] As reported by Let's Talk Payments, "[t]he annual spending by financial institutions on compliance is estimated to be in excess of US $70 billion."[46] In this situation it is no wonder the industry turned to RegTech for cost-effective solutions.

Second, deepening regulatory fragmentation has given rise to an additional layer of compliance burdens for financial institutions. Despite policy-makers pushing for similar post-crisis reforms, the rules for implementing these reforms range from being slightly different to significantly dissimilar between markets. Regulatory overlaps and contradictions led financial institutions to turn to RegTech to optimize compliance management.[47]

Third, the rapidly evolving post-crisis regulatory landscape introduced uncertainty on future regulatory requirements, placing a premium on financial institutions enhancing their adaptability in regulatory compliance.[48] The use of RegTech may have taught financial institutions how to ensure compliance in a changing environment through iterative modeling and testing.

Finally, regulators themselves are becoming motivated to explore the use of RegTech to ensure financial institutions comply with regulations in a responsive manner.[49] RegTech can add value to regulators by helping them understand, in closer to real-time, innovative products and complex transactions, market manipulation, internal fraud, and risks.[50]

Essentially, RegTech embodies technological solutions to improved regulatory processes and related compliance. New technological developments (such as AI and machine learning) additionally allow for new forms of market monitoring or reporting processes.[51] As noted, this was initially driven by post-crisis regulatory reforms, with the application of technology the enabling factor. Examples include anti-money laundering (AML) and KYC compliance requirements and prudential regulatory reporting and stress-testing compliance requirements.

Clearly, we are still at an early stage in this process but its evolution is developing rapidly. As one example, in 2014, Goldman Sachs established a new campus in Bangalore (Bengaluru), India, with capacity for 9,000 staff.[52] Bangalore is already Goldman's second largest office. Other major financial institutions, including JP Morgan,

Citibank, Morgan Stanley, Barclays, Deutsche Bank, HSBC, and Standard Chartered, have large proportions of their staff in centralized support operations in India, especially Bangalore, Mumbai, New Delhi, and Chennai. These are no longer primarily traditional back office or call center operations but are increasingly focused on integrated global risk management and regulatory compliance. In the context of customer on-boarding/account opening and KYC operations, these functions may be centralized in India (or elsewhere) for the entire operations of a global financial services firm.[53]

Similarly, in the context of the extensive reporting requirements of prudential regulators worldwide, financial institutions now look to centralized operations to gather the necessary data globally on a real-time basis so that, in the first instance, the institution and its management has a clearer picture of operations and risks, and in the second instance, the information can be repackaged as necessary to meet the requirements of regulators.[54] Ironically, these operations resemble pre-2008 trading floors, with rows of desks with telephones and multiple screens to allow continuous monitoring and communication across the institution.

From a regulatory standpoint, these operations are interesting: generally, they are separately incorporated subsidiaries and are not regulated as banks in their host jurisdiction, as they are not conducting "banking" activities requiring licensing and regulation. Rather, they are often subject to the domestic outsourcing rules of the jurisdictions of the group entities for which they provide support.[55]

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44 Id. For discussion in the context of the U.S., see Financial Stability Oversight Council, 2016, "Study on the effects of size and complexity of financial institutions on capital market efficiency and economic growth," carried out at the direction of the Chairman of the Financial Stability Oversight Council," March, http://bit.ly/2dNtI0W.

45 See Hill, E., 2016, "Is RegTech the answer to the rising cost of compliance?" FX-MM, June 13, http://bit.ly/2dGjENJ; Cornell, A., 2016, "AgTech, ResTech, RegTech, FinTech – actual solutions or techno-babble?" ANZ Blue Notes, February 23, http://bit.ly/2dnOLCs; Eyers, J., 2016, "Welcome to the new world of RegTech," Financial Review, June 20, http://bit.ly/2dAH5dZ.

46 Kate, 2016, "A report on global RegTech: a $100-billion opportunity – market overview, analysis of incumbents and startups," Let's Talk Payments, April 18, http://bit.ly/2dAFMfe.

47 See Hill, supra note 45.

48 See id.

49 Some financial regulators are embracing innovative regulatory techniques. See Eyers, supra note 45.

50 See Augur, H., 2016, "Regtech: the 2016 buzzword is turning heads," Dataconomy, May 3, http://bit.ly/2dOzuGr.

51 See Institute of International Finance, supra note 4: at 11-14.

52 See Times of India, 2014, "Goldman Sachs to invest Rs 1,200 Crore in Bangalore," September 25, http://bit.ly/2dXiG2L.

53 See Bearing Point, 2011, "Survey: shared services industry specifics and trends in the European FS market," 7-10.

54 See EY, supra note 35

55 See Deloitte, 2011, "Shared services handbook: hit the road," http://bit.ly/2cPBwnr.

The result is the emergence of an entirely different way of addressing compliance – one driven by technology and regulatory change and comprising the most sophisticated level of RegTech today, the first element of a new post-crisis RegTech 2.0. The increasing prevalence of RegTech in industry requires regulators to adapt and adopt technology within their own internal processes, which comprises the second element of post-crisis RegTech 2.0.

THE SECOND COMPONENT OF REGTECH 2.0: REGULATORS

Regulators are commonly viewed as under-resourced in terms of human capital and budgets, especially when it comes to acquiring and implementing technology. While this is generally one of the main barriers to RegTech development within the regulatory community, regulators have had notable successes in the context of technology and regulation.[56]

Relative to the private sector, there has been a lag in regulator adoption of RegTech. Nonetheless, large market incidents have prompted regulatory (re)action. Regulators have actively used technology since the 1980s to monitor and enforce market integrity in exchange-traded securities markets, with the U.S. Securities and Exchange Commission (SEC) leading globally.[57] Additionally, regulators and the financial industry have long worked closely in the evolution of robust technological and regulatory solutions to issues regarding cross-border electronic payment systems as well as securities trading and settlement systems. However, with the growing amount of information reported to regulators and new technology such as AI and deep learning, there is great potential for more to be done in terms of automating market supervision, consumer protection, and prudential regulation.[58] Regulators are also being challenged by the pace of FinTech innovation.

RegTech's evolution in the financial industry, particularly in large global financial institutions and infrastructure providers, such as payment systems and securities exchanges and clearing and settlement systems, has been rapid. However, there remains a wide gap between IT-enabled systems in the industry and the lack of IT-enabled solutions among regulators. Regulators are becoming increasingly aware of this due to their need to deal with the masses of reports and data which post-GFC regulatory changes have required.[59] Given these data streams are designed to ensure financial stability and market integrity, regulators need to develop systems to appropriately monitor and analyze these datasets.

Big data: matching reporting with analytical tools
AML/KYC has so far provided a fertile area for RegTech development and the information produced by the financial services industry – particularly suspicious transactions reports – is an area where regulators are beginning to consider technological solutions for monitoring and analysis.

Failure by regulators to develop the IT capabilities to use the data provided in response to reporting requirements will severely impact the achievement of the policy objectives of such requirements.[60] This also provides an important opportunity for collaboration between regulators and academia (particularly quantitative finance and economics academics with highly developed capabilities in analyzing datasets). Such collaboration offers great potential benefit to regulators in supporting financial stability, market integrity, and a greater understanding of market behavior and dynamics.[61]

An area where regulators have successfully used technology to monitor and analyze markets over the past twenty years is public securities markets. Today, regulators rely heavily on trade reporting systems of securities exchanges to detect unusual behavior, which can serve as a trigger for regulatory investigation and enforcement;[62] for instance, trading on inside information before a major corporate event. Securities exchanges maintain data on all trades so it is simple to search for unusual trading activity prior to an announcement of a merger or acquisition. Such activity is then investigated for possible misconduct, which may form the basis of an enforcement action. These systems illustrate the use of RegTech 1.0 in the pre-crisis period.

Since the crisis, such systems have been shown to be limited by their lack of information on activities taking place off the exchange.

56 See Brummer, C., 2015, "Disruptive technology and securities regulation," 84 Fordham Law Review 977.

57 See e.g., SEC, 1997, "Report to the Congress: the impact of recent technological advances on the securities markets," U.S. Securities and Exchange Commission; See also Technical Committee of the International Organization of Securities Commissions, 2011, "Regulatory issues raised by the impact of technological changes on market integrity and efficiency," October.

58 See Najafabadi, M. M., F. Villanustre, T. M. Khoshgoftaar, N. Seliya, R. Wald, and E. Muharemagic, 2015, "Deep learning applications and challenges in big data analytics," 2 Journal of Big Data 1.

59 See UK Government Chief Scientific Adviser, 2015, "FinTech futures - the UK as a world leader in financial technologies," 48, March, http://bit.ly/1FCBDgS.

60 Kalakota, R., 2013, "RegTech – regulatory/risk data management, AML and KYC analytics," Practical Analytics, January 17, http://bit.ly/2doX0M1; See also KPMG, 2015, "Ten key regulatory challenges facing the banking & capital markets industry in 2016," 2, http://bit.ly/2dNwRIJ; U.K. Government Chief Scientific Adviser, 2015, "FinTech futures - the UK as a world leader in financial technologies," at 52, March, http://bit.ly/1FCBDgS.

61 See U.K. Government Chief Scientific Adviser, supra note 60: at 52.

62 The Board of the International Organization of Securities Commissions, 2012, "Technological challenges to effective market surveillance issues and regulatory tools: consultation report," 14-15, August.

This is a clear concern given that the majority of trading in many major securities markets now occurs off-exchange via ECNs and "dark pools."[63] Regulatory changes in the U.S. and E.U. are set to change this by mandating reporting of all transactions in listed securities, whether or not those transactions take place via a formal exchange or an off-exchange electronic system. Such reporting requirements must likewise be matched with IT systems within regulators to monitor and analyze the information.

Regulators must apply this approach across their regulatory roles. This is the second element of an emerging RegTech 2.0. We see further examples emerging in the context of cybersecurity and macroprudential surveillance.

Cybersecurity
The question of cybersecurity in finance highlights the necessity of further regulatory development.[64] Indeed as the financial services industry continues to evolve into a digitized data-based industry, there is an increasing risk of attack, theft, and fraud. Likewise, the GFC highlighted the public good and public order role of the financial sector, so that the financial sector and financial stability are not only economic issues but also national security issues.

Not surprisingly, this focus area for regulators is increasingly at the center of international attention from organizations such as the FSB and Basel Committee.[65] This is in addition to the natural attention on the issue by financial institutions themselves: cybersecurity is one of the most significant risks faced by the financial industry.[66] Likewise for new FinTech start-ups, cybersecurity should be a key concern as these data intensive companies often have a limited comprehension or perceived need of security as they live in a digital world with an abundance of data. Whilst the scarcity of money drove the development of secure vaults and payment systems, data abundance may not create the right incentive for firms (beyond reputational risks) and can clearly harm consumers.

Macroprudential policy
Prior to the GFC, the focus of prudential and financial stability regulation was on the safety and soundness of individual financial institutions. This was premised on the idea that if each bank was financially safe and sound, then the financial system as a whole would likewise be stable. The GFC fundamentally altered this view and there has since been a new focus on macroprudential policy, with the G20 tasking the IMF, FSB, and BIS to focus on the development of early warning systems to prevent the build-up of risks that lead to financial crises, with the overall intention of preventing crises from happening or at ameliorating their severity. Macroprudential policy focuses on the stability of the entire financial system, by a holistic analysis focusing on interconnections and evolution over time.[67]

As a result of this new focus, an increasing number of jurisdictions have implemented new institutional frameworks to support macroprudential policy, including the Financial Stability Oversight Council (FSOC) in the U.S. and the European Systemic Risk Board (ESRB) in the E.U. These new institutional frameworks have been tasked — along with the IMF, FSB, and BIS — to develop and implement macroprudential policies to support financial stability. Macroprudential policy thus seeks to use the massive amounts of data being reported to regulators in order to identify patterns and reduce the severity of the financial cycle.

Some progress is being made in identifying potential leading indicators for future financial instability.[68] The progress to date involves quantitative analysis of large volumes of data searching for interconnections and implications. The data being reported by financial institutions and financial infrastructure providers is ever increasing and can feed into these analytical processes. Already, major central banks, such as the Federal Reserve, the European Central Bank, and the Bank of England, are beginning to use data "heat maps" to highlight potential issues arising from automated analyses of the masses of data (such as stress tests) being produced.[69]

While these efforts remain at an early stage, they do highlight the likely future direction of RegTech in macroprudential policy. At the same time regulators are continually identifying needs for yet more data.[70] This results in ever increasing reporting requirements for financial institutions, further driving the need for RegTech processes and centralized support services to collect and produce the required data at the required frequency and in the required format. In particular, the Basel Committee (in the so-called "BCBS 239") has set requirements for risk data aggregation and reporting that are driving

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63 Public Statement, U.S. SEC Commissioner Luis A. Aguilar, 2015, "Shedding light on dark pools," November 18, http://bit.ly/2dGe5mJ.

64 See Financial Stability Oversight Council, 2016, "FSOC 2016 annual report."

65 See e.g., The Board of the International Organization of Securities Commissions, 2016, "Cyber security in securities markets – an international perspective."

66 See Dahlgren, S., 2015, "The importance of addressing cybersecurity risks in the financial sector," Speech at the OpRisk North America Annual Conference, New York City, March 24.

67 See International Monetary Fund, Financial Stability Board, and Bank for International Settlements, 2016, "Elements of effective macroprudential policy," August.

68 Id. See BIS Committee on the Global Financial System, 2016, "Experiences with the ex-ante appraisal of macro-prudential instruments," CGFS paper no. 56, July; Gadanecz, B., and K. Jayaram, 2015, "Macroprudential policy frameworks, instruments and indicators: a review," BIS Irving Fisher Committee on Central Bank Statistics, Paper, December.

69 See IMF, FSB, and BIS, supra note 67.

70 See Financial Stability Board and International Monetary Fund, 2016, "The financial crisis and information gaps: second phase of the G-20 Data Gaps Initiative (DGI-2) – first progress report, September.

internal processes in financial institutions and regulators, with an increasing focus on near real-time delivery, with near real-time analysis hoped to follow.[71] Significantly, the FSB and IMF have identified the need for harmonization of reporting templates for systemically important financial institutions (SIFI) in order to make data analysis more straightforward.[72]

While these important developments are the first important steps on the way to better regulation through technology, they highlight challenges for other regulators regarding expertise, access to technology, and financial constraints. They also set the stage for the application of more sophisticated big data tools including deep learning and AI.

LOOKING FORWARD

As FinTech gradually moves from digitization of money to embrace the monetization of data, the regulatory framework for finance will need to be rethought so as to cover notions previously unnecessary, such as data sovereignty and algorithm supervision. At this stage, the sustainable development of FinTech will need to be built around a new framework, namely RegTech. This will require a sequenced approach.

Technologically, RegTech development is not a major challenge.[73] The primary limitation may instead come from the regulators' own ability to process the increased amount of data thereby generated.[74] The U.K.'s Financial Conduct Authority (FCA) seems cognizant of this, as it is currently restricting access to its regulatory sandbox to a limited number of applicants with a detailed testing plan.[75] Financial regulators, therefore, need to take a coordinated approach to support RegTech development. Harmonization of financial markets and regulations has a long history, and seems increasingly important given the mobility of new FinTech start-ups.

RegTech 2.0 is largely about streamlining and automating regulatory compliance and reporting; and developed in a different technological context than that which is rapidly evolving today. There is a progressive alignment underway in how FinTech and RegTech are evolving, with each sharing data-centricity. This represents a paradigm shift from a KYC approach towards a KYD paradigm, which, while profound, remains a few years away. Until then, the design and implementation of proportionate, data-driven regulation should enable proactive regulators to handle innovation without compromising their mandate.

As one example, the U.K. government is seeking to promote the design of a regulatory framework able to adapt dynamically to new rules and regulations.[76] The argument for cost reduction within compliance is very strong, and RegTech looks particularly beneficial for firms and regulators alike. Indeed, RegTech should enable firms to better control risks and costs, and regulators to benefit from more efficient monitoring tools and simulation systems to evaluate the consequences of future legislative reforms.

Yet, balance is needed in assessing what is currently feasible when it comes to fully automating regulatory and compliance systems.[77] Furthermore, the RegTech sector will continue to reinvent itself. While post-2008 regulatory requirements are still evolving, going forward we expect the next financial crisis to add extra layers of requirements and to see companies develop new business models, in turn generating unexpected risks.

In conclusion, for the past 50 years the application of technology within regulation has changed dramatically. The pre-2008 evolution we have defined as RegTech 1.0, a paradigm severely damaged by the GFC. Since 2008, the combination of new regulatory obligations and technology has formed the first element of a new RegTech 2.0; the use of technology to facilitate and streamline compliance. The second element of RegTech 2.0, involving regulators using technology to improve their supervision and regulation, is emerging but still at an early stage.

Looking forward, the truly transformative potential of RegTech will be for it to be used to re-conceptualize the future of financial regulation by leveraging new technology. We are beginning to see certain elements of this new RegTech 3.0 emerge, with technological progress changing both market participants and infrastructure, with data as the common denominator. The practical consequences of this shift will mean undergoing a transformation from a KYC mindset to a KYD approach.

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71 The Basel Committee, 2013, "Principles for effective risk data aggregation and risk reporting, January.

72 Id.

73 See U.K. Government Chief Scientific Adviser, supra note 60: at 53.

74 Id. at 48.

75 See Moyle, A., and F. Maclean, 2016, "World-first regulatory sandbox open for play in the UK," Latham & Watkins 1, May, http://bit.ly/2dXr7Lv.

76 See U.K. Government Chief Scientific Adviser, supra note 60: at 47.

77 Cyras, V., and R. Riedl, 2009, "Formulating the enterprise architecture compliance problem," http://bit.ly/2db4izR.

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