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Regulatory Technology (Regtech) – Construction of a New Regulatory Policy and Model

G. A. WALKER*

The use of technology in banking and financial markets has grown substantially in recent years.¹ Financial technology (FinTech) has resulted in substantial innovation.² This has led to the need for new forms of financial technology regulation (FinReg) to create a corresponding enhanced and embedded control framework. One specific area of this consists of the use of regulatory technology (RegTech) through which technology can be used to support regulation and supervision in modern financial markets.³ RegTech has then evolved through various iterations with RegTech 1.0, 2.0, and now the beginning of 3.0.⁴

Financial markets have been shocked by financial instability and crisis in the period following the Global Financial Crisis beginning in 2007 and

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1. George A. Walker, *Financial Technology Law—A New Beginning and a New Future*, 50 INT'L LAW. 137, 151 (2017).

2. *Id.*

3. Regulatory technology (RegTech) is a complex, combination or contestable concept. A number of different meanings can be distinguished. RegTech can refer to the use of technology generally for control purposes in utility and other markets, or in the financial services area specifically. It may refer to using regulation for control or direction purposes (ControlTech), supervision (SuperTech), or both. It may refer to the tools or techniques used by firms for internal business (FirmTech) or for compliance (CompTech) purposes. Different types of RegTech may also be distinguished including regulatory policy (PolicyTech), supervision technology as noted (SuperTech), resolution technology (ResTech), market support technology (SupTech), and macro-prudential or macro-technology oversight (MacroTech). RegTech is generally understood in this paper to correspond with ControlTech which includes narrower PolicyTech, SuperTech, FirmTech, and CompTech as well as ResTech, SupTech, and MacroTech. RegTech may be considered to constitute an essentially contestable concept which is one with more than one meaning which includes some evaluative or qualitative element. See generally Walter Bryce Gallie, *Essentially Contested Concepts*, 56 PROC. ARISTOTELIAN SOC'Y 167 (1956).

4. RegTech 1.0 is generally concerned with simple data collection before the global financial crisis beginning in 2008. RegTech 2.0 involves the use of data for regulatory and supervisory reporting between 2008 and around 2018. RegTech 3.0 represents a new phase or iteration with the dynamic or creative use of data including through machine learning and artificial intelligence (AI). See *infra* Section IV; see *infra* text accompanying note 289; see also Douglas W. Arner et al., *FinTech, RegTech, and The Reconceptualization of Financial Regulation*, 37 N.W. J. INT'L L. & BUS. 371, 388, 397, 407 (2017).

2008.⁵ A substantial new regulatory framework has been constructed, much of which is data-based (DataTech) with a new focus on trade and transaction data reporting, electronic identification, personal data protection, account data mobility, and data protection and cyber security (DataReg). Several important measures have, in particular, been adopted in these areas at the international level and within the European Union which have since been implemented at the national level.⁶

It is against this background that technology has undergone substantial advances in recent years, especially in terms of computing and telecommunications capability and digital data collection and management with further advances in decentralisation, distributed ledger technology (DLT), and blockchain to follow. Massive technological change brings substantial potential benefit and advantage, although this also creates significant new or aggravated risks. New forms of technological, information, and data risks arise that have not been properly identified or managed before (FinRisk and RiskTech with DataRisk and DataTech). A recent phenomenon has also been the movement by large technology companies (BigTech) into the financial area (referred to as TechFin) such as with the continuing advance of such businesses as Alipay and WeChat in Asia, Apple, Google, Amazon, and Microsoft in the West and Facebook's announcement of the creation of its digital Libra Coin.⁷

Authorities have responded to technological progress through the construction of new forms of support arrangements, such as the Project Innovate initiative in the United Kingdom.⁸ This includes a Regulatory Sandbox, Advice Unit, Direct Support facility, and RegTech and Engagement facilities.⁹ The Financial Conduct Authority (FCA) has also been instrumental in constructing a Global Financial Innovation Network (GFiN) to bring together financial authorities and related organisations across the world involved with FinTech and RegTech.¹⁰ These initiatives specifically support new start-up platforms and businesses although issues remain with regard to maintaining financial stability and security at the national and international levels.

We live in exciting but challenging times that require informed and progressive solutions. A new financial environment and data system, ecosystem, or data biome has been created with the convergence of market

5. George A. Walker, *UK Financial Services Reform*, in FINANCIAL SERVICES LAW 3, 18 (George A. Walker & Robert Purves, eds., 3d ed. 2013); George A. Walker, *Financial Markets and Exchanges*, in FINANCIAL MARKETS AND EXCHANGES LAW 3, 5 (Michael Blair, George Walker, & Stuart Willey, eds., 2d ed. 2012).

6. See discussion *infra* Section III.

7. George A. Walker, *BigTech, Stabletech, and LibraCoin: New Dawn, New Challenges, New Solutions*, 53 INT'L LAW. (forthcoming 2020).

8. See discussion *infra* Section IV.

9. *Id.*

10. *Global Financial Innovation Network (GFiN)*, FIN. CONDUCT AUTH., (Aug. 21, 2020), <https://www.fca.org.uk/firms/innovation/global-financial-innovation-network> [<https://perma.cc/6TEK-WHBW>].

and social change and regulatory reform and with technological advance and new technological threats. This has come together with a significant confluence of factors and forces. More traditional approaches to financial regulation and legacy instruments have become increasingly inefficient and ineffective. It is against this background that a new regulatory policy and control model or agenda has to be constructed.

A number of general principles or approaches can be identified to attempt to ensure that regulation can contain technology-specific exposures while allowing markets to enjoy continuous innovation and development more generally.¹¹ This can be understood in terms of some of the key lessons and regulatory innovations adopted in response to the global financial crisis. These can specifically be considered to include improvements in enhanced financial regulation,¹² financial supervision,¹³ financial resolution,¹⁴ financial market support,¹⁵ and macro-prudential oversight.¹⁶ Regulation must become increasingly interactive or live and data sensitive with DataTech and DataReg becoming an increasingly important component within this. New forms of RegTech and RiskTech can then be designed, which are adaptive, collaborative, interactive, resilient, and emergent. Firm systems (FirmTech) and compliance (CompTech) can also be improved to be more reflexive, responsive, modular, sustainable, and supportive.

The purpose of this paper is to outline some of the principal changes that have occurred in financial market conditions and possible future demands and requirements. The future of finance is considered in terms of the principal trends and challenges that arise. The potential impact in the

11. William D. Eggers et al., *The Future of Regulation: Principles for Regulating Emerging Technologies*, DELOITTE CTR. FOR GOV'T INSIGHTS, 11–18 (2018), https://www2.deloitte.com/content/dam/insights/us/articles/4538_Future-of-regulation/DI_Future-of-regulation.pdf [<https://perma.cc/G9NW-FWTB>] (arguing that a series of new regulatory principles has to be adopted in response to emerging technologies based on adaptation, regulatory sandboxes, outcomes, risk weighted (rather than one-size-fits-all), and collaborative regulation); see discussion *infra* Section V (explaining the design of a new regulatory approach and methodology).

12. Regulation is a control concept and refers to the imposition of specific obligations on firms to manage risk and prevent collapse. GEORGE A. WALKER, *INTERNATIONAL BANKING REGULATION LAW, POLICY AND PRACTICE*, 1 n. 1 (2001).

13. Supervision is a review or oversight function which either refers to monitoring the stability of markets more generally or compliance with specific regulations imposed. *Id.*

14. Resolution is concerned with crisis management and the recovery or closure of a specific financial institution. George A. Walker, *Financial Crisis: U.K. Policy and Regulatory Response*, 44 *INT'L LAW* 751, 776 (2010).

15. Support refers to the provision of funding or other assistance to institutions in markets to prevent individual or wider collapse. This specifically includes traditional forms of Lender of Last Resort (LLR). George A. Walker, *Conglomerate Law and International Financial Market Supervision*, 17 *B. U. ANN. REV. BANKING* 287, 289–91, 327, 328 (1998).

16. Macro-prudential oversight is concerned with the monitoring of a financial system or economy as a whole to detect any possible source of risk or instability, in particular, that is not covered by micro-prudential supervision within a particular sector. George A. Walker, *U.K. Regulatory Revision: A New Blueprint for Reform*, 46 *INT'L LAW*, 787, 788 (2012).

growth of BigTech and TechFin is discussed. The nature of new data driven financial markets and post-crisis data driven regulatory responses are reviewed with DataTech and DataReg. The nature and recent development of RegTech is examined in further detail. The significance of such new initiatives as Project Innovate in the United Kingdom and the use of Regulatory Sandboxes and global sandboxes are explained and analysed (with a new ProjectTech). The potential future value of RegTech is considered with the construction of a series of new RegTech taxonomies and an enhanced and embedded new RegTech policy and policy approaches. Several provisional conclusions are drawn with some closing comments on the future development and importance of RegTech and RegTech 3.0 in modern financial markets.

I. Market Future

Financial markets have been subject to radical change in recent decades with further transformations expected to follow.¹⁷ A number of organisations monitor developments in the markets including the Bank for International Settlements (BIS), International Monetary Fund (IMF), and Organisation for Economic Cooperation and Development (OECD) with national central banks and regulatory authorities publishing regular reviews in this area.¹⁸

The Bank of England released a specific paper on the *Future of Finance* in June 2019 which examines the outlook for the U.K. financial system.¹⁹ This reviews the future of the financial system in the United Kingdom and its impact on the Bank of England's agenda, toolkit, and capabilities.²⁰ The Governor of the Bank had announced a medium term review as part of his Mansion House speech on "New Economy, New Finance, New Bank" in June 2018.²¹ A review team was set up under Huw van Steenis²² to consider the forces that impact the economy and the implications of this on finance

17. Walker, *BigTech, CoinTech and Facebook LibraTech*, *supra* note 7.

18. Owen Evans et al., *Macroprudential Indicators of Financial System Soundness*, INT'L MONETARY FUND, Occasional Paper 192 (Apr. 2000), <https://www.imf.org/external/pubs/ft/op/192/OP192.pdf> [<https://perma.cc/A9XC-NNTB>].

19. See generally Huw van Steenis et al., *Future of Finance: Review on the Outlook for the UK Financial System: What It Means for the Bank of England*, BANK OF ENG. (June 2019), <https://www.bankofengland.co.uk/-/media/boe/files/report/2019/future-of-finance-report> [<https://perma.cc/XJ4K-M9W4>].

20. *Id.* at 2.

21. Mark Carney, Governor of the Bank of Eng., Annual Address Before the Mansion House (June 21, 2018), in *New Economy, New Finance, New Bank*, BANK OF ENGLAND (June 21, 2018), <https://www.bankofengland.co.uk/-/media/boe/files/speech/2018/new-economy-new-finance-new-bank-speech-by-mark-carney.pdf?la=EN&hash=F362C661810257FE779E3D5BCA17144EC65E8C63> [<https://perma.cc/BF9Y-RAZR>].

22. The review was conducted during the last quarter of 2018 and first two quarters in 2019. A number of round tables and meetings were held with over 300 entrepreneurs, financiers, technology firms, investors, consumer groups, charities, policymakers, and business leaders in the United Kingdom and abroad. Van Steenis et al., *supra* note 19, at 2.

and for the Bank.²³ Twelve key forces shaping the economy were identified.²⁴ The nine sets of recommendations made for reform are structured in terms of serving the digital economy,²⁵ supporting major transitions,²⁶ and increasing the resilience of financial markets.²⁷ Authorities have to consider the effects of the need to integrate emerging markets in global systems, the move towards constructing low carbon economies, and the impact of demographic changes on financial markets.²⁸ The United Kingdom could continue to carry out an influential role in financial market development with the recommendations set out in the review intended to deliver benefits to U.K. consumers and businesses and support the

23. *Id.* at 5.

24. The identified forces were: (1) A shift to digital markets (19 percent of retail sales were online compared with 11 percent five years previously); (2) A platform based economy (83 percent of small and medium sized enterprises (SMEs) used a mobile banking application); (3) The growth of the Gig and sharing economy (one third of U.K. adults were expected to be self-employed by 2025 which was a 20 percent increase from 2019); (4) BigData (the U.K. data economy would be worth £95 billion by 2025 up from £73 billion in 2016); (5) Automation and machine learning (up to 30 percent of U.K. jobs would be automated by 2030); (6) Integrating emerging markets (emerging markets' share of external financial assets globally would rise from 10 percent to 33 percent by 2030); (7) Low carbon economy (the transition to a low carbon economy would require over £90 trillion in infrastructure investment over the next decade); (8) Demographic change (3 million people would be over fifty-five in the United Kingdom by 2025); (9) Unbundling of business models (over forty percent of financial services would be cloud hosted within a decade); (10) Cyber crime (global cyber premia were predicted to rise from U.S.\$4.8 billion to U.S.\$8.2 billion by 2020); (11) New laws and regulations (post-crisis regulatory reforms had resulted in the Basel Committee on Banking Supervision (BCBS) publishing twice as many regulatory standards between 2009–2017 than in the twenty previous years); and (12) Technology driven efficiency (machine learning would increase efficiency by twenty percent in financial firms' performance). *Id.* at 7.

25. (1) Manage the future payment system (produce a roadmap for payment options, develop next generation payment regulation, and develop necessary infrastructure to support cross-border payments on a more efficient and cheaper basis); (2) Enable innovation through the construction of a modern financial infrastructure (build and innovate payment infrastructure to allow alternative payment methods, support trusted digital identification, embrace safe cloud usage, and support an "air traffic control" of major projects); and (3) Support the data economy through the production of standards and protocols (promote the responsible use of machine learning and AI and support better credit files for SMEs). *See id.* at 18–20, 25–66.

26. (4) Promote global standards for finance (champion global standards, engage on the evolving needs of emerging markets, and develop future financial services initiatives); (5) Promote the smooth transition to a low carbon economy (advance the adoption of climate change disclosure and embed climate risk management); and (6) Adapt to the needs of a changing demographic (consider forces determining security in retirement and support wider investment choices). *Id.* at 21–22, 67–101.

27. (7) Safeguard the financial system from evolving risks (ensure regulation and infrastructure follow innovative business models, foster a dynamic and responsible regulatory regime, and contribute to the adoption of an Open Banking policy framework); (8) Enhance cyber risk protection (enhance data recovery, conduct cyber exercises, and encourage better information sharing); and (9) Embrace digital regulation (consult on a new digital data strategy and enhance risk monitoring through digitalisation of supervision). *See id.* at 23–24, 102–43.

28. *See id.* at 67–101.

construction of a more resilient, effective, and efficient wholesale and retail financial system.²⁹

This is a useful report in highlighting key trends and necessary adjustments. The three-part structure is valuable in summarising the changes involved and their impact on financial markets and the Bank's functions and priorities. This draws together a number of key pressures within the financial system and wider society, highlights their impact, and identifies valuable policy responses. This creates a structured framework for financial market reform which forms a key part of any modern society. These specific points are examined in further detail below. The new measures required to respond to these continuing pressures and demands can collectively be referred to as MarketTech for the purposes of this paper.

A. NEW SOCIETY

The Bank's review highlights the importance of the growth of the Gig and Sharing economy. This forms part of the wider transformation in societal structures following World War II. Countries have generally moved from an earlier Consumer society to Digital, Information, and Knowledge societies,³⁰ then to a Risk society,³¹ and Gig,³² or Application,³³ Sharing,³⁴

29. See discussion *infra* Section III.

30. Information is defined for the purposes of this text to refer to any statement of fact, opinion, or law. Data forms structured or controlled information collected within specific parameters or constraints. Knowledge represents understood, processed, or applied information or data generally to secure some specific purpose. George A. Walker, *Digital Information Law: Meaning, Challenge, and Future*, 53 INT'L LAW. (forthcoming 2020).

31. ANTHONY GIDDENS & CHRISTOPHER PIARSON, MAKING SENSE OF MODERNITY: CONVERSATIONS WITH ANTHONY GIDDENS 209 (1998). Risk Society reflects concerns with the growth in modernity and potential damage arising through continuing social change and adjustment. This may include dealing with "hazards and insecurities induced and introduced by modern[s]ation itself." ULRICH BECK, RISK SOCIETY, TOWARDS A NEW MODERNITY 21 (1992).

32. The Gig Economy either refers to temporary employment, such as on seasonal or zero-hour contracts (without any minimum working hours), or to the use of self-employed staff within a structured delivery system, such as with Uber. See John Frazer, *How the Gig Economy Is Reshaping Careers for the Next Generation*, FORBES (Feb. 15, 2019, 9:40 PM), <https://www.forbes.com/sites/johnfrazer1/2019/02/15/how-the-gig-economy-is-reshaping-careers-for-the-next-generation/#5988788949ad> [<https://perma.cc/ALG8-8PM6>].

33. An Application Society refers to one based on or driven by new forms of computer applications on computers, telephone, and other mobile platforms and devices, including social media programmes. See IEEE INDUSTRY APPLICATIONS SOCIETY, <https://ias.ieee.org/> [<https://perma.cc/93RC-FMH7>] (last visited Sept. 22, 2020).

34. The Sharing Economy refers to an economic model based on the exchange (such as through lending, renting, swapping, gift, or barter) rather than sale of goods and services on a peer-to-peer (P2P) basis. This may also be referred to as the Access Economy. See Giana M. Eckhardt & Fleura Bardhi, *The Sharing Economy Isn't About Sharing at All*, HARV. BUS. REV. (Jan. 28, 2015), <https://hbr.org/2015/01/the-sharing-economy-isnt-about-sharing-at-all> [<https://perma.cc/BQZ7-VHK5>].

and Caring society.³⁵ These changes have most recently been followed by a rise in Populism across many parts of the world with the perceived rejection of control by elite or minority groups by the majority.³⁶ This has been accompanied by the growth in protest movements, such as with the Occupy Wall Street or London and the wider Occupy movement,³⁷ and more recent climate protection Extinction Rebellion (ER) pressure group,³⁸ with community development and communication supported by the growth in social media in recent years. Much of this can be understood in terms of a social media post-modernism or post-modernity.³⁹

B. NEW TRENDS

Financial markets have also been impacted by other more specific trends: digitalisation, disintermediation,⁴⁰ dematerialisation,⁴¹ monetisation,⁴² and

35. The Caring Economy refers to an economic model based on substantial elements of social care with value measured in terms of human wellbeing rather than consumption, income, or wealth. See Tania Singer & Dennis J. Snower, *Caring Economics*, INST. FOR NEW ECON. THINKING (Apr. 2015), https://www.ineteconomics.org/uploads/papers/CaringEconomics_SingerSnower_44121.pdf [<https://perma.cc/RE9T-LJY5>]. See also TOBY USNIK, *THE CARING ECONOMY: HOW TO WIN WITH CORPORATE SOCIAL RESPONSIBILITY (CSR)* 9 (2018) (focusing on people, profit, and the planet).

36. Populism dates from *populares*, or the courting of the people, by Senators in Ancient Rome. See MARGARET CANOVAN, *POPULISM* 160 (1st ed. 1981).

37. See Occupy Solidarity Network, *Facts About Occupy Wall Street*, OCCUPY WALL ST. (Oct. 28, 2019, 11:58 AM), <http://occupywallst.org/> [<https://perma.cc/Q4RC-NZNE>].

38. See EXTINCTION REBELLION, <https://rebellion.global> [<https://perma.cc/7U8H-HVEJ>] (last visited Sept. 22, 2020).

39. Post-modernism is generally concerned with the adoption of new approaches in art and culture, while post-modernity referring to changes in society and politics. See Gary Aylesworth, *Postmodernism*, STAN. ENCYCLOPEDIA PHIL. (Feb. 5, 2015), <https://plato.stanford.edu/entries/postmodernism/> [<https://perma.cc/T7UF-JBWW>]; Mattias Frey, *Postmodernism*, ENCYCLOPEDIA.COM (Sept. 17, 2020), <https://www.encyclopedia.com/literature-and-arts/art-and-architecture/architecture/postmodernism> [<https://perma.cc/QC7D-YBT8>]; William A. Gorton, *Postmodernism*, INTERNET ENCYCLOPEDIA PHIL., <https://www.iep.utm.edu/soc-sci/#SSH2cii> [<https://perma.cc/43W2-R663>] (last visited Sept. 1, 2020). See also *infra* Section VII.A.

40. Disintermediation refers to removing unnecessary middlemen or intermediaries due to online resources. See Will Kenton, *Disintermediation*, INVESTOPEDIA (Sept. 17, 2019), <https://www.investopedia.com/terms/d/disintermediation.asp> [<https://perma.cc/T3GQ-GFU6>].

41. Dematerialisation refers to the issuance of financial and other documents in an electronic rather than paper form. See Mitchell Grant, *Dematerialization (DEMAT)*, INVESTOPEDIA (Aug. 26, 2020), <https://www.investopedia.com/terms/d/dematerialization.asp> [<https://perma.cc/88WW-SB38>].

42. Monetisation refers to the attachment of value to new products and services as part of a process of the commodification of previously unvalued or undervalued assets. This may use formal monetary measures including currency or new monetary assets such as Bitcoin and other cryptocurrencies. This can be considered to form part of a new Value Net which involves the development of alternative value systems on the internet such as with digital currencies or other forms of community or social tokens or reward systems. This can also be referred to as the Value Web. See CHRIS SKINNER, *VALUEWEB: HOW FINTECH FIRMS ARE USING MOBILE AND BLOCKCHAIN TECHNOLOGIES TO CREATE THE INTERNET OF VALUE* 422 (2016).

decentralisation.⁴³ Retail and consumer markets can also be considered to have been impacted by other factors including the mobilisation, personalisation, socialisation, localisation, and democratisation⁴⁴ of many services, products, and relations. These have all substantially increased accessibility and choice as well as cost and efficiency in service provision.

C. NEW TECHNOLOGY

The review refers to important new technologies including big data, automation, and machine learning.⁴⁵ Such new technology (referred to as NewTech for the purposes of this paper) or future technology (FutureTech)⁴⁶ can be considered to include core or infrastructure related innovations (InfraTech) and other new areas of application (AppliedTech). These can all be considered to constitute specific forms of social technology which refer to any type of tool used for the purposes of social organisation or function or to secure a particular set of social objectives.⁴⁷

InfraTech would include recent improvements in micro, parallel, and supercomputing with new sharing capability made available through cloud computing and decentralised facilities with fog⁴⁸ and edge computing.⁴⁹ Further substantial changes are expected with the growth of quantum

43. Decentralisation refers to technology allowing investors to deal directly with each other instead of using a centralised exchange, streamlining the process. See Carla Tardi, *Decentralized Market*, INVESTOPEDIA (Aug. 25, 2020), <https://www.investopedia.com/terms/d/decentralizedmarket.asp> [<https://perma.cc/8DUX-YU8J>].

44. Democratisation refers to the countries or organisations using democratic (all people can vote) methods of decision making. See *Democratization*, CAMBRIDGE DICTIONARY, <https://dictionary.cambridge.org/us/dictionary/english/democratization> [<https://perma.cc/SER2-YMWA>] (last visited Sept. 26, 2020).

45. See Van Steenis *supra* note 19, at 16 (n 14).

46. NewTech refers to technology currently under development and FutureTech to further innovations over time. See generally Walker, *BigTech, CoinTech and Facebook LibraTech*, *supra* note 7.

47. See, e.g., Bettina Leibetseder, *A Critical Review on the Concept of Social Technology*, 1(1) MYKOLAS ROMERIS U. SOC. TECH. 7, 8 (2011) (considering inter alia that social technology forms the basis of governmental decisions and allows the use of technical social expertise to secure government and public functions).

48. Fog computing provides localised data, processing, storage, and application services on a local proximate basis which reduces latency or delay and increases Quality of Service (QoS). See Maher Abdelshkour, *IoT, from Cloud to Fog Computing*, CISCO BLOGS (Mar. 25, 2015), <https://blogs.cisco.com/perspectives/iot-from-cloud-to-fog-computing> [<https://perma.cc/7JWP-FNCY>].

49. Edge computing refers to the more general decentralisation of computer functionality and localisation of data collection and processing close to source. See Kaya Ismail, *Edge Computing vs. Fog Computing: What's the Difference?*, CMS WIRE (Aug. 14, 2018), <https://www.cmswire.com/information-management/edge-computing-vs-fog-computing-whats-the-difference/> [<https://perma.cc/46CJ-ETGK>].

computing.⁵⁰ Digital connections and telecommunications have continued to improve. DLT principally uses blockchain at this stage, although further advances are expected in the area of graph technology, which allows direct transaction chains to be created without the need for slower block formation.⁵¹ Further reforms are also being made to the underlying operation of the internet and the world wide web with the movement to net and WWW 1.0, 2.0, 3.0, 4.0, and 5.0.⁵²

AppliedTech would consist of further advances in the areas of biometrics (including fingerprint, iris, vein, and face recognition and palm print and hand geometry identification), digital coding and automation (including algorithmic trading and smart contract formation), big data analytics, applied robotics, nanotechnology and other forms of biotechnology, machine reading, machine learning and machine sentience,⁵³ and Artificial Intelligence (AI). A large number of other sub-fields are developing within each one of these areas.

D. NEW RISK

The Bank's review refers to new forms of risk, particularly in terms of cybercrime.⁵⁴ FinTech markets can be considered to generate a number of specific new forms of risk (FinRisk) including inter alia information, data, technology, cyber security, and heightened systemic risk.⁵⁵ These are considered further below.⁵⁶ Specific difficulties arise with regard to complex causation in new technology driven markets and the possible speed of lost transmission and collapse. This may also be considered in terms of emergence or complex dynamic causation.⁵⁷ It is also difficult to attempt to maintain market integrity and stability while promoting financial innovation

50. Quantum Computing refers to the area of computing that is based on quantum theory and the behavior of energy and matter. See Jake Frankenfield, *Quantum Computing*, INVESTOPEDIA (Dec. 3, 2019), <https://www.investopedia.com/terms/q/quantum-computing.asp>.

51. This includes using Directed Acyclic Graphs (DAGs) which allow one directional transaction change to be formed without any looping. DAGs are used by IOTA with its "Tangle" coin model. See *What Is Iota?*, IOTA FOUND., <https://www.iota.org/get-started/what-is-iota> [<https://perma.cc/DZ9K-WHRB>] (last visited Sept. 23, 2020).

52. See generally Celin Smith, *Evolution of the World Wide Web from Web 1.0 to Web 5.0*, GEEKS WITH BLOGS (Apr. 9, 2018), <http://geekswithblogs.net/Xicomtech/archive/2018/04/09/244669.aspx> [<https://perma.cc/7TDE-K3YT>].

53. Machine Sentience refers to a machine's ability to experience emotions. See *Sentience*, CAMBRIDGE DICTIONARY (2020), <https://dictionary.cambridge.org/us/dictionary/english/sentience> [<https://perma.cc/FML2-UQEZ>].

54. See Van Steenis *supra* note 19, at 118.

55. See *id.* at 123.

56. See *infra* Sections IV and VII.C.

57. Complexity is concerned with the interaction between separate elements within a larger system with unpredictable results. See M. MITCHELL WALDROP, *COMPLEXITY: THE EMERGING SCIENCE AT THE EDGE OF ORDER AND CHAOS* 11 (1st ed. 1992). Emergence refers to properties or results separate from the component parts. *Id.* at 242.

within a clear set of policy directions.⁵⁸ FinTech markets are potentially more unstable due to the use of new data, automation, and fragmentation or disentanglement.⁵⁹ FinTech markets also arguably allow private actors to create new forms of financial asset and leverage dealing while limiting the ability of officials to manage the systemic threats created.⁶⁰

Substantial changes have also occurred in the nature of financial risks and exposures. More traditional types of risks, including specifically financial, operational, legal, management, and wider environmental risks, have remained or been aggravated. A number of new specific types of exposure have then increased especially with technology risk, information risk, data risk, and cybersecurity risk. These have created a significant number of new challenges that have to be addressed in early course. Unfortunately, legal and regulatory systems have not been sufficiently adapted to understand and contain these new threats. This has resulted in the formation of new types of SocialTech. New forms of RiskTech have to be constructed in early course to contain these exposures.

Financial markets have continued to be disrupted by continuing innovative engineering and re-engineering in the FinTech arena. Further disruption is then expected as large technology companies (BigTech) move into the financial services area. Major technology firms, such as Apple, Google, Amazon, and Facebook in the West and Alibaba, Alipay, Tencent, and Baidu in the East, have expanded substantially and amassed enormous client bases. Almost all of these companies have financial services related components which have begun to expand and compete with incumbent

58. New regulatory responses include providing informal guidance, pilot studies, and licenses and the use of regulatory sandboxes. See Chris Brummer & Yesha Yadav, *FinTech and the Innovation Trilemma*, 107 GEO. L.J. 235, 282–96 (2019).

59. Brummer and Yadav explain this in terms of a policy “trilemma” with market integrity, financial innovation, and rules simplicity. It is argued that FinTech represents a distinct phenomenon from earlier eras of innovation using new forms of data never available before, automation and disentanglement or disintermediation. Specific risks arise through a lack of international coordination, inadequate domestic inter-agency coordination, and an absence of private governance of new technologies. Progress may be possible through domestic agency cooperation, international standard setting and coordination, and private monitoring and industry codes of conduct. See *id.* at 242, 254–55 (identifying FinTech 1.0 as involving the adoption of computers and new technology with market liberalisation during the 1980s and 1990s).

60. Omarova explains this in terms of the breakdown of a traditional “New Deal settlement” under which profit-seeking private actors retain control over allocating capital and generate financial risks with public authorities assuming responsibility for maintaining systemic stability. FinTech enabled private actors continuously to synthesise tradeable financial assets, scale up trading activities, and undermine the public’s ability to manage the resultant system-wide risks. New technologies, including digital currencies, distributed ledgers, digital crowdfunding, and robo advice amplified the effects of these destabilising mechanisms and exacerbated tensions and imbalances within financial markets and the wider economy. See Saule T. Omarova, *New Tech v. New Deal: Fintech As A Systemic Phenomenon*, 36 YALE J. ON REG. 735, 749, 770 (2019).

financial institutions and service providers.⁶¹ While monetary and regulatory authorities are already attempting to deal with the new challenges created by exponential growth in FinTech, the parallel incursion of BigTech in the FinTech arena creates additional competition and policy threats that have to be managed.

A substantial amount of new regulation has been adopted in recent years especially following the Global Financial Crisis beginning in 2007 and 2008.⁶² This has resulted in the imposition of substantial additional costs and obligations on financial firms. It is reported that over 50,000 new regulations were adopted within G20 countries between 2009 and 2010 with 50,000 regulatory updates having to be produced in 2015.⁶³ The financial industry spent over \$100 billion in regulatory costs in 2016⁶⁴ with fifteen to twenty percent of “run the bank costs” and forty percent of “change the bank costs” being consumed by Governments Risk and Compliance (GRC).⁶⁵ The Wall Street and Consumer Protection (Dodd Frank) Act cost \$36 billion to implement in the United States⁶⁶ and the Markets in Financial Instruments Directive (MiFID) II costing _2.5 billion to give effect in the European Union.⁶⁷ Forty-five new regulatory documents were issued across the world every week.⁶⁸ Much of the new regulation specifically is data driven, such as with the EU MiFID II,⁶⁹ new identification requirements,⁷⁰ personal data rules under the General Data Protection Regulation (GDPR),⁷¹ account transferability under the Payment Services Directive 2 (PSP2),⁷² and new cybersecurity measures.⁷³ All of this has resulted in an explosion in new data related compliance technology (DataTech and data specific CompTech).

61. See *id.* at 56; see also Jon Frost, et al., *BigTech and the Changing Structure of Financial Intermediation*, (BIS, Working Paper No. 779, April 8, 2019), <https://www.bis.org/publ/work779.pdf> [<https://perma.cc/GRK6-VAAK>]; Dennis Ferenzy, *A New Kind of Conglomerate: BigTech in China*, INST. INT'L FIN. (IIF) 1, 13 (Nov. 2018), https://www.iif.com/Portals/0/Files/chinese_digital_nov_1.pdf [<https://perma.cc/3KKP-FD65>].

62. See Walker, *Financial Markets and Exchanges*, *supra* note 5, at 5–6.

63. See Tom Butler, et al., *A New Paradigm for Regulatory Change and Compliance: A Whitepaper by the RegTech Council*, REGTECH COUNCIL 4 (Mar. 28, 2018), <http://jwg-it.eu/wp-content/uploads/2018/03/RTC-New-Initiatives-White-Paper-2018-Final.pdf> [<https://perma.cc/A7VG-BWMJ>].

64. See *id.* at 5.

65. See *id.*

66. The Dodd Frank Act consisted of 1,602 articles which resulted in 22,000 pages of regulations, compared to the Federal Tax Code's 74,000 pages. See *id.* at 4–5.

67. *Id.* at 5–6 (demonstrating that MiFID II consists of articles which resulted in 30,000 pages and 1.5 million paragraphs of text).

68. *Id.*

69. See discussion *infra* Section III.A.

70. See discussion *infra* Section III.B.

71. See discussion *infra* Section III.C.

72. See discussion *infra* Section III.D.

73. See discussion *infra* Section III.E.

E. NEW SOLUTIONS

Technology is never static, and further opportunities and challenges arise from continued innovation and advancement in the technology sphere. The future of technology (FutureTech) can be understood in terms of both core infrastructure (InfraTech) related developments and wider new technology applications (AppliedTech).⁷⁴ InfraTech includes the switch from micro, parallel, and supercomputing to cloud, fog, and edge computing, as well as quantum computing.⁷⁵ Further innovation is evident through continued improvements in digital networks and telecommunications, the growth in blockchain technology and new graph technology, the expansion of DLT and further revisions and improvements in the internet and world wide web (WWW) 1.0, 2.0, 3.0, 4.0, and 5.0.⁷⁶ Massive further change is also expected in terms of AppliedTech. This includes biometrics and biosecurity; digital coding and automation, including algorithmic trading and smart contract formation; BigData analytics; applied robotics, nano technology and other biotechnology; machine reading, machine learning, and machine sentience; and narrow and general AI.⁷⁷

All of this will have a significant impact on the structure and operation of banking and financial markets and related risks and exposures. A fundamental regulatory and technology gap will then arise to the extent that existing laws and regulations cannot effectively respond to or contain these new threats.⁷⁸ Significant regulatory objectives may also conflict where authorities are attempting to promote innovation and competition while maintaining market control and stability.⁷⁹ Regulatory and supervisory processes will be undermined through continued business and platform fragmentation, which will damage and dilute the effectiveness of current practices.⁸⁰ A whole series of new technology, information, data, and cybersecurity risks will also arise as noted. The underlying technology itself will then massively increase the danger of complex and dynamic causation of emergence in increasingly sophisticated and interdependent financial markets.⁸¹ A new social and technological landscape has been created within which a parallel new set of oversight and control frameworks have to be constructed.⁸² This is the challenge and opportunity that RegTech can respond to in realising the full potential benefits of FinTech and SocialTech in a managed, controlled, and sustainable manner.

74. See discussion *supra* Section I.C.

75. See *id.*

76. See *id.*

77. See *id.*

78. Gary Marchant, *The Growing Gap Between Emerging Technologies and the Law*, in *THE GROWING GAP BETWEEN EMERGING TECHNOLOGIES AND LEGAL-ETHICAL OVERSIGHT: THE PACING PROBLEM* 19–32 (Gary Marchant et al. eds., 2011).

79. See *id.*

80. See *id.*

81. See discussion *infra* Section VII.C.

82. See Marchant *supra* note 78, at 19–20.

II. Fintech, Bigtech, and Newtech

Traditional financial markets have been transformed through the impact of the introduction of new technology in legacy institutions and systems. They will also have to contend with the entry of large technology companies in western and Asian markets into traditionally protected sectors. Traditional markets (LegacyTech) will have to deal with the impact of FinTech, MarketTech, BigTech, other new forms of NewTech, and FutureTech in the financial area.⁸³

A. BIG TECH

The largest technology companies in the west include Google, Amazon, Facebook, Apple and Microsoft.⁸⁴ The six largest BigTech companies have a market capitalisation in excess of the largest global systemically financial institutions (G-SIFIs).⁸⁵ The largest technology companies in China include Alibaba, Tencent, and Baidu as well as JD.com and Ping An insurance.⁸⁶ While some U.S. BigTech companies have provided financial services, such as Google Wallet, set up in May 2011,⁸⁷ and Apple Pay, introduced in October 2014,⁸⁸ these only operate on an intermediary basis using existing bank account transfers, while Alipay,⁸⁹ WeChat,⁹⁰ and Baidu⁹¹ have provided

83. See discussion *supra* Section I.D.

84. David McLaughlin, *Why Were Facebook and Google Allowed to Get so Big?: Quick Take*, BLOOMBERG (Mar. 14, 2019, 3:00 AM), <https://www.bloomberg.com/news/articles/2019-03-14/why-were-facebook-and-google-allowed-to-get-so-big-quicktake> [<https://perma.cc/FD87-ZRAX>]. See Jason Fernando, *FAANG Stocks*, INVESTOPEDIA (Jul. 18, 2020), <https://www.investopedia.com/terms/f/faang-stocks.asp> [<https://perma.cc/YB7A-6PUA>] (explaining the growth of FAANG, an acronym for Facebook, Amazon, Apple, Netflix, and Google).

85. See Frost et al., *supra* note 61, at 22; Vichett Oung et al., *BigTech in Finance: Market Developments and Potential Financial Stability Implications*, FIN. STABILITY BD. [FSB], 4, fig.1 (Dec. 9, 2019), <https://www.fsb.org/wp-content/uploads/P091219-1.pdf> [<https://perma.cc/NNW9-VKWS>].

86. Alibaba was set up by Jack Ma in 1999 and has a market capitalisation of around \$477 billion (£362.7 billion). Tencent is led by Ma Huateng (Pony Ma) and has a market capitalisation of \$385 billion. Baidu was set up in January 2000 by Robin Li and Eric Xu and has a market capitalisation of around \$99 billion. Baidu, Alibaba, and Tencent are collectively referred to as “BAT.” See Ferenzly, *supra* note 61.

87. Tara Siegel Bernard, *Google Unveils App for Paying with Phone*, N.Y. TIMES (May 26, 2011), <https://www.nytimes.com/2011/05/27/technology/27google.html> [<https://perma.cc/EMN8-M5S6>].

88. Jillian D’Onfro, *Apple Will Officially Launch Apple Pay on October 20*, BUS. INSIDER (Oct. 16, 2014, 12:09 PM), <https://www.businessinsider.com/apple-will-launch-apple-pay-on-october-20-2014-10> [<https://perma.cc/C6SZ-RBV2>].

89. Alipay was created in 2004 to act as a third party mobile and online payment platform. Alipay purchased the mobile platform PayPal in 2013, with PayPal having originally been set up by Elon Musk and others in 1998. Alipay was renamed Ant Financial Services Group in October 2014. See Gerry Shih, *Alibaba Affiliate Alipay Rebranded Ant in New Financial Services Push*, REUTERS (Oct. 16, 2014, 1:50 AM), <https://www.reuters.com/article/us-china-alibaba/alibaba-affiliate-alipay-rebranded-ant-in-new-financial-services-push-idUSKCN0I50KJ20141016> [<https://perma.cc/25V3-4AGM>]. Alipay is based in Hangzhou and

a comprehensive range of financial services since their inception. Apple Pay has 22 million users, with Google Wallet has 11.1 million, and Samsung Pay only has 9.8 million.⁹² Meanwhile, Alipay has 500 million active account users and WeChat has 900 million.⁹³ Alipay and WeChat Pay control 94 percent of the Chinese mobile payments market.⁹⁴ The Chinese online service providers are claimed to be substantially further ahead than other companies due to the wide range of services provided, the earlier lack of digital bank and credit card provision in China and earlier lack of regulation.⁹⁵ WeChat and AliPay operate as “Super-Apps” (Applications) as they provide a full suite of services through a single interface.

Other BigTech financial service providers operate in markets around the world. M-Pesa, the mobile payment service established by Vodafone and Safaricom in Kenya in 2007, currently has 42 million customers across Africa as well as in Afghanistan, India, and Eastern Europe.⁹⁶ In Latin America, financial services are provided through the Argentinian company, *Mercado Libre* (Free Market), which was set up in August 1999 in Buenos Aires,

listed on the New York Stock Exchange. The Alibaba Group was 43 percent owned by Yahoo following a \$1 billion investment in 2005, although Alipay was reported to have been transferred without Yahoo’s consent in 2011. See Michael Kan, *Alibaba Transferred Alipay Ownership Without Yahoo Approval*, COMPUTERWORLD (May 13, 2011, 5:50 AM), <https://www.computerworld.com/article/2508000/alibaba-transferred-alipay-ownership-without-yahoo-approval.html> [<https://perma.cc/E4BT-3Y8M>]. Alipay has over 870 million account users and a 54.26 percent share of the payment market in China. It is the second largest mobile payment service provide in the world. See Dylan Bushell-Embling, *Alipay Is World’s Second Largest Mobile Wallet*, COMPUTERWORLD H.K. (April 9, 2018, 8:10 AM), <https://web.archive.org/web/20181006194900/https://www.cw.com.hk/digital-transformation/alipay-world-s-second-largest-mobile-wallet>. Alipay established *Yu’e Bao* (Leftover Treasure) as a money market fund in 2013 which became the largest in the world within four years with \$210 billion in assets under management. See Ian Fraser, *Chinese Payment Giants Are Lightyears Ahead* RACONTEUR (Sept. 25, 2018), <https://www.raconteur.net/finance/future-payments-2018/alipay-wechat-china-payments> [<https://perma.cc/UHC2-DPM2>].

90. WeChat Pay provides payment and financial services through the messaging and social media platform WeChat which was set up in 2011 with over one billion active users. WeChat is based in Shenzhen and listed on the Hong Kong Stock Exchange. WeChat has over 600 million active mobile payment users with 37 percent of the Chinese mobile payment market. WeChat pay has been described as a “super app” or “app for everything.” See Eveline Chao, *How WeChat Became China’s App for Everything*, FAST CO. (Jan. 2, 2017), <https://www.fastcompany.com/3065255/china-wechat-tencent-red-envelopes-and-social-money> [<https://perma.cc/CZ2E-R4WR>].

91. See *Baidu Renames Its Online Payments Wallet to ‘Du Xiaman Pay’*, CHINA KNOWLEDGE (Nov. 3, 2018), <https://www.chinaknowledge.com/News/DetailNews/82154/Baidu-renames-its-online-payment-wallet-to-‘Du-Xiaoman-Pay’> [<https://perma.cc/7NAD-G3DZ>].

92. Frost, et al., *supra* note 61, at 6.

93. *Id.*

94. *Id.*

95. See, e.g., Ian Fraser, *Chinese Payment Giants Are Lightyears Ahead* RACONTEUR (Sept. 25, 2018), <https://www.raconteur.net/finance/future-payments-2018/alipay-wechat-china-payments> [<https://perma.cc/4ZSE-GMLM>].

96. See *What is M-Pesa?*, VODAFONE, <https://www.vodafone.com/what-we-do/services/m-pesa> [<https://perma.cc/6UDU-44ZU>] (last visited Sept. 23, 2020).

Argentina.⁹⁷ In South Korea, Kakao Bank,⁹⁸ Samsung Pay,⁹⁹ and K Bank¹⁰⁰ offer mobile payment and credit services. Financial services are provided through NTT Docomo¹⁰¹ in Japan with Line Corporation.¹⁰²

B. BIGTECH AND TECHFINS

Large technology firms operating in financial markets have been referred to as “TechFins.”¹⁰³ BigTech and TechFins generally begin with the provision of payment services, with settlement being carried out through existing payment and settlement systems.¹⁰⁴ This is then extended to include the provision of credit, insurance, and saving and investment products either directly or indirectly in cooperation with other partner institutions. Saving products may also be provided.¹⁰⁵ This creates a unique business model based on network effects arising through the use of related e-commerce, messaging, and search engine platforms, and technology including Big Data and AI.¹⁰⁶ This allows BigTech companies to reuse their large account

97. See *About MercadoLibre*, MERCADO LIBRE, <http://investor.mercadolibre.com/investor-relations> [<https://perma.cc/NAE5-WUTB>] (last visited Sept. 23, 2020).

98. Kakao Bank was established by the Korean internet company Kakao in January 2016. See Jene Park, *How a Messaging App Challenged Traditional Banks and Captured 45% of the Market*, COUNTERPOINT RES. (Oct. 12, 2017), <https://www.counterpointresearch.com/how-a-messaging-app-challenged-traditional-banks-and-captured-45-of-the-market/> [<https://perma.cc/9HA5-PNUW>].

99. Samsung Pay was established by Samsung Electronics in August 2015 using proprietary Samsung software and compatible systems with activity in over twenty-six countries. See generally *Samsung Pay*, SAMSUNG, <https://www.samsung.com/us/samsung-pay/> [<https://perma.cc/CT8G-AESH>] (last visited Sept. 23, 2020).

100. K bank was established by the KT Corporation (formerly Korea Telecom) in 2017 as South Korea’s first online bank. See *Fintech*, KT, <https://corp.kt.com/eng/html/global/solutions/fintech.html> [<https://perma.cc/NPX4-6HH9>] (last visited Sept. 23, 2020).

101. NTT DOCOMO was originally set up in 1992. See generally *Company Information Overview*, NTT DOCOMO (July 1, 2020), <https://www.nttdocomo.co.jp/english/corporate/about/outline/index.html> [<https://perma.cc/7TKP-5HM6>].

102. See Press Release, Line Pay Corp., NTT DOCOMO to Join Mobile Payment Alliance (MoPA) of Merchant Stores Established by LINE Pay and Merpay (June 27, 2019), <https://linecorp.com/en/pr/news/en/2019/2767> [<https://perma.cc/2X9T-Y9U4>]. Line is a subsidiary of the South Korean internet company Naver Corporation, originally set up in 1999. See *Affiliates*, NAVER <https://www.navercorp.com/en/naver/affiliates> [<https://perma.cc/PV4J-YA7S>] (last visited Sept. 23, 2020).

103. The term was introduced by Jack Ma to refer to new business models used to “rebuild the [financial] system with technology.” Zen Soo, *TechFin: Jack Ma Coins Term to Set Alipay’s Goal to Give Emerging Markets Access to Capital*, SOUTH CHINA MORNING POST (Dec. 2, 2016, 8:45 PM), <https://www.scmp.com/tech/article/2051249/techfin-jack-ma-coins-term-set-alipays-goal-give-emerging-markets-access> [<https://perma.cc/8S2X-XA8P>]. See also 2019 BIS Ann. Rep., 55, 57 tbl. III.1 (June 23, 2019), <https://www.bis.org/publ/arpdf/ar2019e.pdf> [<https://perma.cc/Y255-HKBT>].

104. See Frost et al., *supra* note 61, at 2.

105. See *id.*

106. *Id.* at 2.

networks and data pools at almost zero marginal cost.¹⁰⁷ Market demand side factors include unmet customer demand and consumer preferences, with supply side drivers including data access, technological advantage, funding availability, and a lack of regulation and competition.¹⁰⁸

C. BIGTECH ADVANTAGE

BigTech operates by providing value through online multi-sided platforms (MSPs) which combine social networks, e-commerce and search engines.¹⁰⁹ BigTech follows a traditional lifecycle of birth, growth, and maturity, although this also uses personal data and network effects with a high speed of development.¹¹⁰ BigTech business models generally use data analytics, network externalities, and interwoven activities (referred to as DNA) with financial services fuelling a feedback loop with related synergies being generated.¹¹¹ BigData access can improve screening and monitoring that reduces costs and improves lending efficiency and access.¹¹² High information costs are removed, which can increase access and reduce financial exclusion.¹¹³ More accurate credit scoring can also be produced which outperforms credit bureau ratings and traditional borrower analysis.¹¹⁴ Monitoring and collateral costs are reduced, including through the use of credit line account access and the threat of service downgrades or exclusions.¹¹⁵

D. BIGTECH DISADVANTAGE

Difficulties with BigTech can nevertheless arise, in particular, in ensuring adequate financial regulation, data privacy protection, and maintaining adequate competition.¹¹⁶ Dominant companies create captive ecosystems

107. *Id.* at 2–3.

108. *Id.* at 9–10.

109. BIS Ann. Rep., *supra* note 103, at 63.

110. The BigTech lifecycle consists of: birth (establish the MSP, set an adequate pricing structure and attract a critical mass of users on both sides); growth (economies of scale, add functionalities to enhance user experience with network externalities being triggered); maturity (economies of scope, build the ecosystem by raising switching costs, use of BigData analytics and expand into other financial services). A “tipping point” is arrived at during the growth period before network externalities are triggered. *Id.* at 63, 71 fig. III.8.

111. *Id.* at 62, 58 fig. III.2.

112. *Id.* at 64.

113. Information costs include soft information (communicated but difficult to quantify) and hard information (quantitative data that can be easily processed). *See id.* at 62, 64.

114. *Id.* at 66, fig. III.b (demonstrating that BigTech can use BigData and artificial intelligence to improve data processing and analysis).

115. *Id.* at 65.

116. *See FinTech and Market Structure in Financial Services: Market Developments and Potential Financial Stability Implications*, FIN. STABILITY BD. (FSB) 1, 9 (Feb. 14, 2019), <https://www.fsb.org/wp-content/uploads/P140219.pdf> [<https://perma.cc/LMH8-CSEE>] (noting that FinTech and BigTech could “materially alter the universe of financial service providers” which

that prohibit market entry or growth by rival platforms.¹¹⁷ Entry barriers can be used to consolidate power which can be exploited to increase user switching costs or exclude competition creating “bottlenecks.”¹¹⁸ Firms may prioritise their own products or engage in “product bundling” or cross-subsidisation.¹¹⁹ Dominant positions are generated through data control which creates digital monopolies with price discrimination and rent extraction.¹²⁰

E. BIGTECH RESPONSE

It is arguable that BigTech and TechFin companies entering financial sectors should be subject to equivalent regulatory control which can be understood as “same activity, same regulation.”¹²¹ Additional issues nevertheless arise in balancing financial regulation with data protection and competition issues which creates separate policy conflicts.¹²² This might be referred to as creating a separate regulatory policy trilemma.¹²³ Competition implications also have to be reconsidered as new market entry may only increase dominance and concentration and limit competition and contestability.¹²⁴ One solution would be to increase data availability and transfer, especially as large volumes of data is produced at zero marginal cost and it is a non-rivalrous good which can be re-consumed without a loss of value.¹²⁵ Data transfer is supported by open banking policies based on account and data portability, although this may conflict with personal data privacy and protection, which limits data sharing and exchange.¹²⁶

Policymakers and regulators have to ensure that all of these legitimate objectives and concerns are fully taken into account and appropriately balanced. The impact of any other developments in the areas of NewTech and FutureTech will also have to be reviewed.

III. Data Regulation and Data Technology

The nature of financial regulation has changed following the global financial crisis beginning in 2008.¹²⁷ As markets have become increasingly data-based and data-driven, regulation has become data-focused and data-

could affect “the degree of concentration and contestability in financial services, with both potential benefits and risks for financial stability”).

117. BIS Ann. Rep., *supra* note 103, at 67.

118. *Id.*

119. *Id.*

120. *Id.*

121. See *id.* at 71 fig. III.8 (depicting the BIS “regulatory compass” for BigTech firms).

122. Brummer & Yadav, *supra* note 58, at 242.

123. See *id.*

124. BIS Ann. Rep., *supra* note 103, at 73.

125. *Id.* at 74.

126. *Id.* at 75; see also discussion *infra* Sections III.C and III.D.

127. See Walker, *Financial Markets and Exchanges*, *supra* note 5, at 5–6.

directed. All of this has created a new world of BigData, consequent DataRisk, and a corresponding DataReg and DataTech response.

The global financial crisis arose as a result of significant failures, in particular, in terms of credit and debit expansion, product complexity, mispricing and mismanagement of risk, and regulatory limitations, especially with regard to regulation, supervision, resolution, market support, and macro-prudential oversight.¹²⁸ A number of important initiatives were subsequently adopted especially in terms of the Basel Committee on Banking Supervision's Basel III framework which increased regulatory capital and introduced two liquidity controls and, for the first time, a leverage ratio.¹²⁹ Other associated reforms were adopted by the Basel Committee in such areas as corporate governance, compensation, cross-border bank resolution, supervisory colleges, and macro-prudential oversight.¹³⁰

A series of further responses were adopted by the Financial Stability Board (FSB) which focused on wider markets and the financial system as a whole.¹³¹ Much of this has become data-based with banks requiring substantial additional amounts of data reporting in terms of regulatory compliance.

A parallel series of initiatives have been adopted within the European Union. Following the European financial crisis in 2008 and 2009, a number of reform proposals were announced. The European Commission issued an initial *Framework for Action and European Economic Recovery Plan (EERP)* in 2008¹³² with a report entitled *Economic Crisis in Europe: Causes, Consequences and Response* being released in 2009.¹³³ An influential response report was produced by former *Banque de France* Governor and President of the

128. *Id.* at 30–31.

129. Core Equity Tier 1 (CET1) was increased from 2 to 4.5 percent with a conservation buffer (2.5 percent), countercyclical buffer (0–2.5 percent) and systemic risk (0–3.5 percent). A one-month Liquidity Cover Ratio (LCR) and a twelve-month Net Stable Funding Ratio (NSFR) were established with a ratio of 3 percent of own capital leverage imposed. See BASEL COMM. ON BANKING SUPERVISION, *The Basel Framework*, BANK FOR INT'L SETTLEMENTS 152 (2019), http://www.bis.org/basel_framework/index.htm?m=3%7C14%7C697 [https://perma.cc/3AF3-WG46].

130. Fin. Stability Inst., *Overview of Basel III and Related Post-Crisis Reforms – Executive Summary*, BANK FOR INT'L SETTLEMENTS 1 (2018), https://www.bis.org/fsi/fsisummaries/b3_rpcr.pdf [https://perma.cc/JF8S-CGDH].

131. FSB measures were specifically adopted in the areas of: (1) financial regulation; (2) global systemically important institutions (GSIFs); (3) crisis management and resolution; (4) effective supervision and supervisory colleges; (5) financial derivatives; (6) shadow banking; (7) macro-prudential policy; (8) accounting; (9) disclosure; (10) benchmarks; (11) credit rating agencies and legal identifiers; and (12) standards implementation. See generally George A. Walker, *International Financial Instability and the Financial Stability Board*, 47 INT'L LAW. 1, 11–27 (2013).

132. See generally *Communication from the Commission to the European Council: A European Economic Recovery Plan*, COM (2008) 800 final (Oct. 11, 2008).

133. See generally European Commission Directorate-General of Economic and Financial Affairs, *Economic Crisis in Europe: Causes, Consequences and Responses*, EUR. ECON., at 8 (July 2009), http://ec.europa.eu/economy_finance/publications/pages/publication15887_en.pdf [https://perma.cc/R2EN-LK2W].

European Bank for Reconstruction and Development (EBRD), Jacques de Larosière, in February 2009.¹³⁴ Other measures have since been adopted to establish a European Single Banking Rulebook (SBR), Single Supervision Mechanism (SSM), Single Resolution Mechanism (SRM) with a Single Resolution Board (SRB), a European Stability Mechanism (ESM), and revised European Deposit Insurance Scheme (EDIS) proposals.¹³⁵ Institutional structures were also strengthened with the establishment of a European Banking Authority (EBA), European Securities and Markets Authority (ESMA), European Pension & Occupational Schemes Authority (EPOSA) within a new European System of Financial Supervisors (ESFS), and a monitoring European Systemic Risk Board (ESRB).¹³⁶ All of this was adopted with other connected initiatives to construct a European Banking Union (EBU)¹³⁷ and European Capital Markets Union (CMU).¹³⁸ These unions parallel the crisis defects identified in terms of the need to improve financial regulation, supervision, resolution, support, and oversight.¹³⁹

A number of particular directives have been adopted as part of the European financial market law programme.¹⁴⁰ Many of these reflect and develop wider international initiatives especially led by the Basel Committee and FSB.¹⁴¹ These include the Capital Requirements Directive (CRD IV) and Capital Requirements Regulation (CRR) of 2013, which established an enhanced regulatory and capital regime for banks and investment firms.¹⁴² Payment was strengthened with the Payment Services Directive 2 (PSD2) in 2015.¹⁴³ The earlier Markets in Financial Instruments Directive (MiFID)

134. See generally Jacques de Larosière et al., *The High-Level Group on Financial Supervision in the EU* (Feb. 25, 2009), https://ec.europa.eu/economy_finance/publications/pages/publication14527_en.pdf [<https://perma.cc/GGE9-TGL4>].

135. See *The SRB in the Banking Union*, SINGLE RES. BD., <https://srb.europa.eu/en/content/srb-banking-union> [<https://perma.cc/H7WK-GGQR>] (last visited Sept. 23, 2020).

136. George A. Walker, *U.K. Regulatory Revision – A New Blueprint for Reform*, 46 INT'L LAW. 787, 820 (Fall 2012).

137. See generally *What Is the Banking Union*, EUR. COMM'N, https://ec.europa.eu/info/business-economy-euro/banking-and-finance/banking-union/what-banking-union_en [<https://perma.cc/7RAR-K3JZ>] (last visited Sept. 23, 2020).

138. See generally *What Is the Capital Markets Union?*, EUR. COMM'N, https://ec.europa.eu/info/business-economy-euro/growth-and-investment/capital-markets-union/what-capital-markets-union_en [<https://perma.cc/T57X-NQFF>] (last visited Sept. 23, 2020).

139. See *The SRB in the Banking Union*, *supra* note 135.

140. See *Basel III – Implementation*, FIN. STABILITY BD., <https://www.fsb.org/work-of-the-fsb/implementation-monitoring/monitoring-of-priority-areas/basel-iii/> [<https://perma.cc/4EZQ-BDA2>] (last visited Sept. 23, 2020).

141. See *id.*

142. Directive 2013/36, of the European Parliament and of the Council of 26 June 2013 on Access to the Activity of Credit Institutions and the Prudential Supervision of Credit Institutions and Investment Firms, Amending Directive 2002/87/EC and Repealing Directives 2006/48/EC and 2006/49/EC, 2013 O.J. (L 176) 338; Commission Regulation 575/2013 of June 26, 2013, On Prudential Requirements for Credit Institutions and Investment Firms and Amending Regulation 648/2012, 2013 O.J. (L 176) 1, 2.

143. Directive 2015/2366, of the European Parliament and of the Council of 25 November 2015 on Payment Services in the Internal Market, Amending Directives 2002/65/EC and 2013/

2004 was replaced by a new MiFID¹⁴⁴ in 2014 to strengthen securities regulation with a separate Alternative Investment Fund Managers Directive (AIFMD) in 2011 to control hedge funds and alternative investment management.¹⁴⁵ A separate General Data Protection Regulation (GDPR)¹⁴⁶ was adopted in 2016, which replaced the earlier Data Protection Directive (DPR) of 1995.¹⁴⁷ A further Regulation was adopted on protecting personal data by EU institutions and bodies,¹⁴⁸ with an earlier ePrivacy Directive¹⁴⁹ to be replaced by a new ePrivacy Regulation (ePR).¹⁵⁰ An electronic Identification, Authentication, and Trust Services Regulation (eIDAS)¹⁵¹ was brought into effect in July 2014, replacing the Electronic Signatures Directive of 1999.¹⁵² A number of separate measures have been adopted in relation to cybersecurity, as part of the European Union's wider Digital Single Market (DSM).¹⁵³

The effect of all of these new sets of requirements has been to substantially increase the amount of data that banks and financial institutions have to collect, examine, and report, at the same time as additional protections that have been introduced in relation to such issues like data

36/EU and Regulation 1093/2010, and Repealing Directive 2007/64/EC, 2015 O.J. (L 337) 35, 36.

144. Directive 2014/65, of the European Parliament and of the Council of 15 May 2014 on Markets in Financial Instruments and Amending Directive 2001/92/EC and Directive 2011/61/EU, 2014 O.J. (L 173) 349, 350.

145. Directive 2011/61, of the European Parliament and of the Council of 8 June 2011 on Alternative Investment Fund Managers and Amending Directives 2003/41/EC and 2009/65/EC and Regulations 1060/2009/EC and 1095/2010/EU, 2011 O.J. (L 174) 1, 13.

146. Commission Regulation 2016/679 of Apr. 27, 2016, On the Protection of Natural Person with Regard to the Processing of Personal Data and on the Free Movement of Such Data, and Repealing Directive 95/46/EC, 2016 O.J. (L 119) 1.

147. *See id.*

148. Commission Regulation 45/2001 of Dec. 18, 2000, On the Protection of Individuals with Regard to the Processing of Personal Data by the Community Institutions and Bodies and on the Free Movement of Such Data, 2001 O.J. (L 8) 1, 4.

149. Directive 2002/58, of the European Parliament and of the Council of 12 July 2002 on the Processing of Personal Data and the Protection of Privacy in the Electronic Communications Sector, 2002 O.J. (L 201) 37, 42.

150. *Commission Proposal for a Regulation of the European Parliament and of the Council Concerning the Respect for Private Life and the Protection of Personal Data in Electronic Communications*, at 8, 12, COM (2017) 10 final (Oct. 1, 2017) (explaining that ePR would introduce new specific obligations in addition to the GDPR being a *lex specialis* to the GDPR *lex generalis* applying to electronic communications and includes specific rules on cookies, opt-outs, and unsolicited emails).

151. Commission Regulation 910/2014 of July 23, 2014, Electronic Identification and Trust Services for Electronic Transactions in the Internal Market and Repealing Directive 1999/93/EC, 2014 O.J. (L 257) 73, 83.

152. *Id.* at 73.

153. *See Cybersecurity*, EUR. COMM'N (Aug. 25, 2020), <https://ec.europa.eu/digital-single-market/en/cyber-security> [<https://perma.cc/P92F-N395>].

protection, privacy, and data security.¹⁵⁴ This creates a form of significant data event, data “revolution,” or data “bridge” within European Union and wider financial law.¹⁵⁵ The new EU legislative packages have to be adopted within all Member States with Basel, FSB, and other international initiatives being given effect across the world.¹⁵⁶ With all of this, financial regulation has become more technology-enabled and datacentric, and data collection, analysis, transfer, and management have become core components within the regulatory arena.¹⁵⁷ Associated RegTech, SuperTech, and CompTech have also become correspondingly data-determined.¹⁵⁸

There has accordingly been a substantial imposition of data use, or “datafication,” of markets and market regulation with a significant expansion in DataRisk, DataReg, and DataTech, as well as Big Data analysis.¹⁵⁹ The data-focused nature of these measures can specifically be understood in terms of increased capital, liquidity, leverage, trade reporting (CapTech, LiquidTech, LeverTech, and TradeTech),¹⁶⁰ digital identity (IdTech),¹⁶¹ personal data (PdTech), account management (AccountTech), and data and cybersecurity (CyberTech).¹⁶²

A. CRD IV AND MiFID

Core Regulation has become much more data intensive. Banks and investment firms have to accurately measure their capital, liquidity, and leverage ratios in accordance with Basel III, EU CRD IV, CRR, and relevant domestic implementation measures.¹⁶³ The Basel Committee introduced the basic 8 percent minimum capital to risk adjusted assets in 1988 under its Basel I framework,¹⁶⁴ with this being revised and extended in 2004 (Basel II),

154. Dirk A. Zetzsche et al., *The Future of Data-Driven Finance and RegTech – Lessons from EU Big Bang II* 15 (Univ. Luxembourg Fac. L., Econ. & Fin., Law Working Paper Series No. 2019-005, 2019), https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3359399 [<https://perma.cc/JS2X-F7Z5>].

155. See *id.* at 4, 12 (commenting on the MiFID II, GDPR, PSP2, and eIDAS, the author refers to this in terms of a new “Big Bang” or “Big Bang II”).

156. See European Commission Memo 13/690, *The Commission, Capital Requirements – CRS IV/CRR – Frequently Asked Questions* 7 (July 16, 2013).

157. See Zetzsche et al., *supra* note 154, at 16.

158. See Dan Murphy & Jackson Mueller, *RegTech: Opportunities for More Efficient and Effective Regulatory Supervision and Compliance*, MILKEN INST., at 4 (2018), <https://milkeninstitute.org/sites/default/files/reports-pdf/RegTech-Opportunities-White-Paper-FINAL-.pdf> [<https://perma.cc/W3WF-4UHK>].

159. See *generally id.*

160. See European Commission Memo 13/690, *supra* note 156, at 31.

161. Zetzsche et al., *supra* note 154, at 32.

162. See *id.* at 9.

163. Directive 2014/65, *supra* note 144, at ¶ 106 (Basel III and CRD IV require national implementation with the CRR being directly applicable and enforceable in all relevant Member States of the European Union and European Economic Area (EEA)).

164. Basel Comm. on Banking Supervision, *International Convergence of Capital Measurement and Capital Standards* ¶ 44 (July 1988).

2010 (Basel III), and 2017 (Basel IV).¹⁶⁵ The Basel Committee applies a separate building block approach to securities related capital.¹⁶⁶

The Basel Committee incorporated within its revised Basel II three-pillar approach in 2004, a Pillar-Two supervisory review mechanism, and Pillar-Three market disclosure framework, in addition to the core capital charges applied to credit risk and market risk.¹⁶⁷ Pillar-Two supervisory review requires reporting to authorities to allow them to confirm the adequacy of internal capital compliance systems.¹⁶⁸ Pillar-Three imposes mandatory minimum and supplemental disclosure requirements to enhance market transparency and discipline.¹⁶⁹ Supervisory review provisions are incorporated into the EU CRD IV¹⁷⁰ with disclosure provided for under the CRR.¹⁷¹ Additional reporting requirements are implicated under the Basel Committee's other post-crisis measures on corporate governance, compensation, cross-border resolution, supervisory colleges, and macro-prudential supervision as well as in the FSB documents.¹⁷²

The Basel requirements were further strengthened under a series of finalisation measures in 2017 (referred to by commentators as Basel IV),¹⁷³ which reduced variability in the risk-weighted asset (RWA) framework

165. *Basel IV: BCBS Finalizes Reforms on Weighted Risk Assessment (RWA)*, PRICEWATERHOUSECOOPERS, 4, 8 (July 2018), <https://www.pwc.com/gx/en/advisory-services/basel-iv/booklet-toolbox.pdf> [<https://perma.cc/AAY5-K7YB>].

166. See *Minimum Capital Requirements for Market Risk*, BANK FOR INT'L SETTLEMENTS 1, 5 (Feb. 25, 2019).

167. Basel Comm. on Banking Supervision, *Basel III: A Global Regulatory Framework for More Resilient Banks and Banking Systems*, BANK FOR INT'L SETTLEMENTS 3, 30 (June 1, 2011), <https://www.bis.org/publ/bcbs189.pdf> [<https://perma.cc/P7BV-BZDF>].

168. Basel Comm. on Banking Supervision, *International Convergence of Capital Measurement and Capital Standards: A Revised Framework: Comprehensive Version*, BANK FOR INT'L SETTLEMENTS 163 (June 30, 2006), <https://www.bis.org/publ/bcbs128.pdf> [<https://perma.cc/7M4C-7VBD>].

169. *Id.* at 184.

170. See Directive 2013/36, *supra* note 142, at 373.

171. Basel Comm. on Banking Supervision, *Standards: Revised Pillar Three Disclosure Requirements* BANK FOR INT'L SETTLEMENTS 53, 64 (Jan. 28, 2015), <https://www.bis.org/bcbs/publ/d309.pdf> [<https://perma.cc/H8DZ-7TKY>].

172. See Basel Comm. on Banking Supervision, *Consultative Document: Core Principles for Effective Banking Supervision* BANK FOR INT'L SETTLEMENTS 10–11, 39 (Dec. 20, 2011), <https://www.bis.org/publ/bcbs213.pdf> [<https://perma.cc/W3CE-B7NE>].

173. See, e.g., *Basel IV: Finalizing Post-Crisis Reforms*, ERNST & YOUNG (Dec. 2017), [https://www.ey.com/Publication/vwLUAssets/EY-basel-iv-finalizing-post-crises-reforms/\\$FILE/EY-basel-iv-finalizing-post-crises-reforms.pdf](https://www.ey.com/Publication/vwLUAssets/EY-basel-iv-finalizing-post-crises-reforms/$FILE/EY-basel-iv-finalizing-post-crises-reforms.pdf) [<https://perma.cc/ZS4W-W26C>]. The finalisation measures adopted in 2017 effectively created a form of Basel IV. The objective was to improve credibility within the framework and the effectiveness of internal models. The revisions improve the calculation of RWAs, the treatment of credit risk (by enhancing risk sensitivity and reducing reliance on external credit ratings), simplify the treatment of operational risk (with a single standardised approach in place of four earlier approaches), and add a leverage surcharge ratio for the largest banks (with an additional 50 percent of risk-based capital buffer) with a new risk sensitive output floor (internal models cannot fall below 72.5 percent of risk weighted assets). The measures are expected to come into effect by January 2022 with the output floor between 2022 and 2027). *Id.* at 1.

through enhancing risk sensitivity within the standardised approach, limiting internal modelling, and applying a finalised leverage ratio and revised capital flow.¹⁷⁴

Securities regulation within the European Union was enhanced under MiFID II and MiFIR in 2014.¹⁷⁵ The objectives were to strengthen investor protection, reduce the risks of a disorderly market, limit systemic risk, increase market efficiency, and reduce cost.¹⁷⁶ The measures apply to regulated markets (RMs), multilateral trading facilities (MTFs), organised trading facilities (OTFs), and systemic internalisers (SIs).¹⁷⁷ Additional requirements are imposed with regards to transparency, market data,¹⁷⁸ and algorithmic and high frequency trading (HFT).¹⁷⁹ The package includes other requirements on authorisation, regulation and passporting, client categorisation, client order handling, pre-trade transparency, post-trade transparency, inducements and investment research, and best execution.¹⁸⁰ Specific obligations are imposed with regards to trade and transaction reporting, with separate data requirements imposed on data reporting services providers (DRSPs).¹⁸¹ All of this imposes substantial data collection, management, and reporting obligations on firms.¹⁸²

B. eIDAS

Electronic identification (eID) and electronic Trust Services (eTS) are provided for under the EU eIDAS Regulation of 2014.¹⁸³ The objective is to create an EU-wide system for the use of electronic identification by natural persons and businesses, as well as to create a parallel regime for trust services, including electronic signatures, electronic seals, timestamping, electronic delivery services, and website authentication.¹⁸⁴ This operates on a “once only” principle basis without the need to constantly reapply or

174. See Basel Comm. on Banking Supervision, *Basel III: Finalising Post-Crisis Reforms*, BANK FOR INT'L SETTLEMENTS, 1, 140 (Dec. 7, 2017), <https://www.bis.org/bcbs/publ/d424.pdf> [<https://perma.cc/7JU6-A3EB>].

175. Directive 2014/65, *supra* note 144, at 365, 372.

176. See European Commission Memo 14/305, *Markets in Financial Instruments Directive (MiFID II): Frequently Asked Questions 1* (Apr. 15, 2014).

177. See *id.* at 2, 4.

178. See *id.* at 2, 14.

179. See *id.* at 6-7.

180. *An Overview of MiFID II*, KB ASSOCS. (2017), <https://kbassociates.ie/wp-content/uploads/2017/11/MiFID-II-Overview.pdf> [<https://perma.cc/7RGS-JXMB>].

181. *Market Data Regimes*, FIN. CONDUCT AUTH. (Jan. 23, 2018), <https://www.fca.org.uk/markets/mifid-ii/market-data-regimes> [<https://perma.cc/ER78-3588>]; *Transaction Reporting*, FIN. CONDUCT AUTH. (Sept. 16, 2020), <https://www.fca.org.uk/markets/transaction-reporting> [<https://perma.cc/822A-3KB6>].

182. See *Transaction Reporting*, *supra* note 181.

183. Commission Regulation 910/2014, *supra* note 151, at 81.

184. See eGovernment & Trust (Unit H.4), *Trust Services and Electronic identification (eID)*, EUR. COMMISSION (July 24, 2020), <https://ec.europa.eu/digital-single-market/en/trust-services-and-eid> [<https://perma.cc/3UCE-LEB9>].

supply documents.¹⁸⁵ This can assist opening bank accounts, student mobility, tax filing, as well as professional, transport, retail, and financial services provisions.¹⁸⁶ National identification systems have been recognised on a voluntary basis since 2015, with full recognition since September 2018.¹⁸⁷ This creates a mutual recognition device for different national identification systems without the need for full standards harmonisation.¹⁸⁸

The eIDAS Regulation applies to electronic identification schemes that have been notified by a Member State, and to trust-service providers established within the European Union.¹⁸⁹ Relevant definitions are provided.¹⁹⁰ Trust services are to benefit from the internal market principle, with no restriction being imposed in any Member State with electronic identification having a legally enforceable right of mutual recognition.¹⁹¹ Data protection was subject to the terms of the Data Protection Directive (DPD) 95/46/EC¹⁹² and now the GDPR.¹⁹³ International trust services may be recognised under the terms of an agreement reached between the European Union and the relevant third country.¹⁹⁴ EID may specifically be used to secure electronic “know your customer” (eKYC), such as for money-laundering purposes.¹⁹⁵ This will help ensure that individuals develop

185. *Electronic ID in Action: Once Only Principle* (Illustration), EUR. COMMISSION (2020), http://ec.europa.eu/newsroom/dae/document.cfm?doc_id=54414 [<https://perma.cc/RH6C-L679>].

186. See eGovernment & Trust (Unit H.4), *supra* note 184.

187. See eGovernment and Trust (Unit H.4), *e-Identification*, EUR. COMMISSION (June 26, 2018), <https://ec.europa.eu/digital-single-market/en/e-identification> [<https://perma.cc/BE8L-PFHQ>].

188. See *id.*

189. Commission Regulation 910/2014, *supra* note 151, at art. 2(1), at 83.

190. “Electronic identification” means the process of using personal identification data in electronic form uniquely representing a natural person, a legal person, or a natural person representing a legal person. Electronic identification means a material or immaterial unit containing person identification data used for authentication on an online basis. “Personal identification data” is data enabling the identity of a natural or legal person or natural person representing a legal person to be established. “Authentication” means an electronic process that enables the electronic identification of a natural or legal person or the origin and integrity of data in electronic form to be confirmed. A “trust service” means an electronic service provided for remuneration consisting of the creation, verification, and validation of electronic signatures, electronic seals, or electronic timestamps, electronic registered delivery services and certificates related to those services, website authentication, or the preservation of electronic signatures, seals, or certificates. *Id.* art. 3, at 83–84.

191. *Id.* at art. 4, 6, at 86.

192. See generally Directive 95/46/EC of the European Parliament and of the Council of 24 October 1995 on the Protection of Individuals with Regard to the Processing of Personal Data and on the Free Movement of Such Data, 1995 O.J. (L 281).

193. See Commission Regulation 910/2014, *supra* note 151, at art. 5, at 86.

194. *Id.* at art. 14, at 92.

195. See *Communication from the Commission to the European Parliament, the Council, the European Central Bank, the European Economic and Social Committee and the Committee of the Regions*, at 13, COM (2017) 139 final (Mar. 23, 2017).

appropriate new RegTech conditions and CompTech compliance mechanisms in all areas covered.¹⁹⁶

C. GDPR

Personal data within the European Union is now subject to enhanced protection under the GDPR, and contains, the provisions of which directly applicable as an EU regulation.¹⁹⁷ The GDPR replaced the earlier DPD 95/46/EC.¹⁹⁸ The GDPR came into effect in April 2016 and was implemented in the United Kingdom under the Data Protection Act (DPA) of 2018.¹⁹⁹ The protections provided are based on the European Convention on Human Rights (ECHR), which confers a right to respect private and family life, home, and correspondence,²⁰⁰ with additional protections being provided for personal data flows by the OECD²⁰¹ and Council of Europe²⁰² on automatic processing. The right to the protection of personal data is also expressly provided for under Article 16(1) of the Treaty on the Function of the European Union (TFEU).²⁰³

The GDPR applies to personal data, which is information relating to a living individual that can be identified directly from the information or through matching with other information that is, or will be likely to be, in the possession of the organisation or entity concerned.²⁰⁴ Obligations are imposed on data controllers²⁰⁵ and data processors.²⁰⁶ Public entities that

196. See discussion *infra* Section IV.C.

197. Commission Regulation 2016/679, *supra* note 146 at 1, art. 1.

198. See Ben Wolford, *What is GDPR, The EU's New Data Protection Law?*, GDPR.EU, <https://gdpr.eu/what-is-gdpr/> [<https://perma.cc/Y5S4-MRT6>] (last visited Sept. 21, 2020).

199. See *id.*

200. Convention for the Protection of Human Rights and Fundamental Freedoms, art. 8(1), Nov. 4, 1950, 213 U.N.T.S. 221.

201. Convention for the Protection of Individuals with Regard to Automatic Processing of Personal Data, *opened for signature* Jan. 28, 1981, ETS No. 108.

202. See *OECD Guidelines on the Protection of Privacy and Transborder Flows of Personal Data*, OECD (1980), <https://www.oecd.org/internet/ieconomy/oecdguidelinesontheProtectionofPrivacyandtransborderflowsofpersonaldata.htm> [<https://perma.cc/3BRW-BAQZ>] (including provisions covering notice, purpose, consent, security, disclosure, access, and accountability).

203. Consolidated Version of the Treaty on the Functioning of the European Union, art. 16(1), Oct. 26, 2012, 2012 O.J. (C 326) 55 [hereinafter TFEU].

204. Commission Regulation 2016/679, *supra* note 146, art. 4(1), at 33. This was given an extensive interpretation by the Court of Justice to include ISP addresses as these allow users to be identified. See, e.g., Case C-70/10, *Scarlet Extended SA v Société belge des auteurs, compositeurs et éditeurs SCRL (SABAM)*, ECLI:EU:C:2011:771, (Nov. 24, 2011). See also Laraine Laudati, *Summaries of EU Court Decision Relating to Data Protection*, EUR. COMMISSION (Jan. 28, 2016), 38–39, https://ec.europa.eu/anti-fraud/sites/antifraud/files/caselaw_2001_2015_en.pdf [<https://perma.cc/U64B-KT7M>].

205. A controller is the natural or legal person, public authority or agency, or other body which, alone or jointly, determines the purposes and means of the processing of personal data. Commission Regulation 2016/679, *supra* note 146, art. 4(7), at 33.

206. A data processor means a natural or legal person, public authority, agency, or other body which processes personal data on behalf of the controller. *Id.* art. 4(8).

regularly and systematically process personal data must employ a Data Protection Officer (DPO).²⁰⁷ The GDPR applies to the processing of personal data by a controller or processor irrespective of whether the processing takes place within the European Union.²⁰⁸ This includes where the personal data of EU subjects is processed outside the European Union or where a Member State law would apply, under public international law.²⁰⁹

Data is to be protected “by design and by default” in technical and organisational implementation.²¹⁰ Six revised data protection principles are applied under the GDPR, which are based on fair and lawful processing and legitimate purpose with data being adequate, relevant and non-excessive, accurate, up-to-date, not kept for longer than necessary, processed in accordance with individual rights, and kept securely and properly transferred.²¹¹ Six additional principles are applied in relation to ensuring that processing is lawful.²¹² Controllers must be able to demonstrate that a data subject has consented to the processing with this having been requested in a distinguishable, intelligible, and accessible form using clear and plain language, and that the data subject being able to withdraw consent at any time.²¹³ Additional protections apply regarding special categories of personal data “revealing racial or ethnic origin, political opinions, religious

207. *Id.* arts. 37-39, at 55–56.

208. *Id.* art. 3(1), at 32.

209. The GDPR applies to the processing of personal data of EU data subjects by a controller or processor not established within the European Union where this relates either to the offering of goods or services (irrespective of whether a payment by the data subject is required) or the monitoring of behaviour insofar as the behavior takes place within the European Union. *Id.* art. 3(2), at 33. The GDPR also applies to the processing of personal data by a controller not established within the European Union but in a place where Member State law would apply under public international law. *Id.*

210. Controllers, at the time of determining the means of processing and at the time of processing, must implement appropriate technical and organisational measures (including pseudonymisation) designed to implement data protection principles (including data minimisation) in an effective manner and to integrate the necessary standards into the processing to comply with the GDPR and protect the rights of data subjects taking into account the state of the art, implementation costs and nature, scope, context and purpose of the processing. *Id.* art. 25(1), at 48. Controllers must also implement appropriate technical and organisational measures to ensure that only personal data which is necessary for each specific processing purpose is processed by default. *Id.* art. 25(2). Approved certification mechanisms may be used to confirm compliance. *See id.*

211. Commission Regulation 2016/679, *supra* note 146, art. 5, at 35.

212. These are based on: (a) data subject consent; (b) necessary performance of a contract; (c) compliance with legal obligation; (d) necessary to protect vital interest of the data subject or another natural person; (e) necessary for the performance of a task carried out in the public interest or the exercise of official authority invested in the controller; or (f) necessary for the purposes of legitimate interests pursued by the controller or by a third party except where these are overridden by the interest or fundamental rights and freedoms of the data subject including where the data subject is a child. *Id.* art. 6(1), at 36.

213. *Id.* art. 7(1)–(3), at 37. The processing of information society services in relation to a child of sixteen years or older is lawful with consent having to be obtained from a person with parental responsibility for anyone younger. *Id.* art. 8(1), at 37.

or philosophical beliefs, or trade union membership, and the processing of genetic data, biometric data [to] . . . identify a natural person, data concerning health . . . or sex life or sexual orientation.”²¹⁴

A number of rights are conferred on data subjects under the GDPR. These can be summarised in terms of the right to be informed and access data,²¹⁵ right to access data correction,²¹⁶ right to data erasure (right to be forgotten),²¹⁷ right to restrict processing,²¹⁸ transfer rights (data portability),²¹⁹ right to object,²²⁰ and right to prohibit automated processing.²²¹ Firms in breach of GDPR may be fined up to 20 million Euros or 4 percent of annual global turnover.²²² Member States must establish an independent Supervisory Authority (SA) with activities being coordinated through a European Data Protection Board (EDPB).²²³ The Information Commissioner of the United Kingdom is responsible for the GDPR as well as the Freedom of Information Act, Privacy and Electronic Communications Regulations (PECR), Environmental Information Regulations, INSPIRE (Infrastructure for Spatial Information in the European Community) Regulations, and the re-use of Public Sector Information Regulations.²²⁴

Special provisions apply regarding the transfer of personal data to third countries or international organisations. Any transfers must be subject to the conditions set out in the GDPR.²²⁵ Transfers must ensure that an adequate level of data protection is provided²²⁶ taking into account matters such as the “rule of law, human rights and fundamental freedoms, and legislation” as well as the availability of an independent supervisory authority responsible for data protection and other international commitments entered into under legally binding conventions or instruments or multilateral or regional participations.²²⁷ The Commission determines whether an adequate level of protection is provided and reviews this every four years.²²⁸ Information may only otherwise be transferred by a controller or processor, provided that appropriate safeguards are maintained and that enforceable data subject rights and effective legal remedies are available,

214. *Id.* art. 9, at 38–39.

215. *Id.* art. 15, at 43.

216. *Id.* art. 16, at 43.

217. *Id.* art. 17, at 43–44.

218. *Id.* art. 18, at 44–45.

219. *Id.* art. 20, at 45.

220. *Id.* art. 21, at 45–46.

221. *Id.* art. 22, at 46.

222. *Id.* art. 83(5), at 82–83.

223. *Id.* art. 64–76, at 73–9.

224. *Legislation We Cover*, INFO. COMM’R OFFICE, <https://ico.org.uk/about-the-ico/what-we-do/legislation-we-cover/> [<https://perma.cc/UPF3-BLMB>] (last visited Sept. 22, 2020).

225. Commission Regulation 2016/679, *supra* note 146, at art. 44, at 60.

226. *Id.* art. 45(1), at 61.

227. *Id.* art. 45(2).

228. *Id.* art. 45(3).

including through binding corporate rules.²²⁹ Orders by non-EU courts or tribunals to transfer information may only be recognised or enforced if based on a relevant international agreement, including a mutual legal assistance treaty.²³⁰

D. PSP2 AND OPEN BANKING

The rights attached to bank accounts and the nature of bank accounts have been radically altered as part of this datafication of financial regulation. Data portability was already provided for under the GDPR, although this is taken forward with the additional access rights created under the PSD2 and associated Open Banking movement.²³¹ European payments are managed through the Single Euro Payments Area (SEPA) which was anticipated with the establishment of the Euro in 1999.²³² The Payments Services Directive's (PSD) legal basis was established in 2007 when the PSD introduced common provisions on payments across the EEA.²³³ Euro area countries were required to make transfers and direct debits in Euro under the same conditions under the SEPA Regulation in 2012 from August 2014.²³⁴ PSD2 was adopted in 2015 to make it easier and safer to use internet "payment services, protect consumers against fraud, abuse[,] and payment difficulties, promote innovate mobile and internet payment services, strengthen consumer rights, and strengthen the role of the European Banking Authority (EBA) to coordinate supervisory authorities and draft technical standards."²³⁵ PSD2 specifically provides for additional information to be made available to customers and allow them to transfer account and transaction data to other service providers.²³⁶

PSD2 has been implemented in the United Kingdom with the Open Banking initiative; The Competition and Markets Authority (CMA) conducted an investigation into retail banking with a final report published

229. *Id.* art. 46(1-2), 47, at 62–64.

230. *Id.* art. 48, at 62.

231. Directive 2015/2366, *supra* note 143, art. 67, at 50.

232. *Extension of the Geographical Scope of SEPA Schemes in March 2019*, EUR. PAYMENTS COUNCIL (Nov. 30, 2018), <https://www.europeanpaymentscouncil.eu/news-insights/news/extension-geographical-scope-sepa-schemes-march-2019> [<https://perma.cc/D3LG-Y9W8>] (SEPA consisted of thirty six members by 2018: twenty-eight Member States of the European Union, four members of the European Free Trade Association (Iceland, Liechtenstein, Norway, and Switzerland) with Andorra, Monaco, San Marino, and the Vatican City).

233. *See* Directive 2007/64/EC, of the European Parliament and of the Council of 13 Nov. 2007 on Payment Services in the Internal Market, 2007 O.J. (L 319); *Extension of the Geographical Scope of SEPA Schemes in March 2019*, *supra* note 232.

234. Regulation 260/2012, of the European Parliament and of the Council of 12 Mar. 2012 Establishing Technical and Business Requirements for Credit Transfers and Direct Debits in Euro, 2012 O.J. (L 94).

235. *Payment Services*, EUROPEAN COMM'N, https://ec.europa.eu/info/business-economy-euro/banking-and-finance/consumer-finance-and-payments/payment-services/payment-services_en [<https://perma.cc/6TX3-TYZW>] (last visited Sept. 22, 2020).

236. Directive 2015/2366, *supra* note 143, art. 43, at 36.

in August 2016.²³⁷ The CMA concluded that larger banks did not have to compete for customers' business with smaller and new entrant banks, finding it difficult to expand, which limited competition.²³⁸ Only 3 percent of personal accounts and 4 percent of business clients switched to another bank each with a number of causes identified.²³⁹ Four sets of responses were recommended with three foundation measures based on the adoption of a new Open Banking Standard, the provision of service quality information and customer prompts, with additional recommendations on current account switching and overdraft charging.²⁴⁰

The CMA has provided a summary of the principal remedies and a timeline for implementation by 2018.²⁴¹ Market standard Application Programme Interfaces (APIs) would be established to allow for the exchange of information in a timely and secure manner.²⁴² The development of the Open Banking Standard was provided for in the 2015 U.K. Government Budget²⁴³ with an Open Banking Working Group (OBWG) set up by the Treasury.²⁴⁴ The OBWG produced *The Open Banking Standard* in 2015.²⁴⁵ A non-profit company, Open Banking Ltd., was created to support adoption of the Open API standard.²⁴⁶ Open Banking represents the implementation of the PSD2 requirements in the United Kingdom.²⁴⁷

PSD applies to payment services provided within the European Union subject to specific exclusions.²⁴⁸ Payment services consist of any specified business activity.²⁴⁹ Payment institutions must be authorised by a relevant competent authority.²⁵⁰ A relevant competent authority must be designated with provisions on supervision and professional secrecy.²⁵¹ The Payment

237. *Making Banks Work Harder for You*, COMPETITION & MKTS AUTH. (Aug. 9, 2016), http://www.agefi.fr/sites/agefi.fr/files/fichiers/2016/08/cma_overview-of-the-banking-retail-market_9_aout.pdf.

238. *Id.*

239. *Id.* at 3.

240. *Id.*

241. *Id.* at 11.

242. *Id.* at 6–8.

243. HM TREASURY, BUDGET 2015, 2015, HC 1093, at 93 (U.K.).

244. *The Open Banking Standard 3* (Louise Bolotin ed., 2015), <http://theodi.org/wp-content/uploads/2020/03/298569302-The-Open-Banking-Standard-1.pdf>.

245. *Id.*

246. See *About Us*, OPEN BANKING, <https://www.openbanking.org.uk/about-us/> [https://perma.cc/W3T8-JQBC] (last visited Sept. 22, 2020).

247. See *id.*

248. Directive 2015/2366, *supra* note 143, at art. 3, 4–6.

249. *Id.* at art. 4(3). Payment services include: (1) Operating payment account; (2) providing cash withdrawals; (3) execution of payment instructions (including through direct debits, payment cards, or standing orders); (4) execution of credit line payments; (5) issuing payment instruments and/or acquiring payment transactions; (6) money remittance; (7) payment initiation services; and (8) account information services. *Id.* annex 1, 35, 116.

250. See *id.* art. 5–18, at 10–22; *Id.* art. 19–21, at 22–24 (defining additional requirements for agents, branches and outsourced entities, liability, and recordkeeping).

251. See *id.* art. 22–31, 32–34 (exemption), 35–37 (common provisions).

Systems Regulatory (PSR) was set up in 2015 to be the relevant authority within the United Kingdom.²⁵² “Transparency . . . conditions and information requirements” are imposed under Title III.²⁵³ Rights and obligations are dealt with under Title IV, which includes common provisions, authorisation of payment transactions, execution, data protection, operational and security risks, and dispute settlement.²⁵⁴ Specific rights are conferred for payment initiation services and account information service providers.²⁵⁵ Under the PSD2, payment initiation services or account information services providers generally have to be separately authorised where they hold funds.²⁵⁶ Member States are to “permit processing of personal data by payment systems and payment service providers when necessary to safeguard the prevention, investigation and detection of payment fraud” with personal data generally being subject to the terms of the GDPR.²⁵⁷ Payment service providers “shall only access, process and retain personal data . . . with the explicit consent of the payment service user.”²⁵⁸

The effect is of this is that it substantially alters the traditional relationship between banks and their customers. While banks have traditionally considered account data to be proprietary and within their exclusive control, GDPR, PSD2, and Open Banking transfer control to the client and permit data portability and transferability.²⁵⁹ Clients may effectively sell access to their data to third party services providers.²⁶⁰ It has to be stressed that these measures do not strictly create ownership rights in the information or data as it is arguable that they neither constitute property nor can they be owned as such.²⁶¹ People hold rather than own information and data; banks and other financial institutions may continue to use the customer data accumulated, subject to the protections provided under these measures.²⁶²

While a core objective is to increase competition by removing any data control advantages that banks and financial institutions may hold against other new service providers, it remains to be seen whether a level playing field has been created between larger BigTech companies and the financial industry, and whether this will protect or damage client interests longer

252. *Background to the PSR*, PAYMENT SYSTEMS REGULATOR, <https://www.psr.org.uk/about-psr/background-psr> [<https://perma.cc/H74Q-R6JX>] (last visited Sept. 22, 2020).

253. This includes provisions on general rules, single payment transactions, framework contracts and common provisions. *Id.* art. 1(2), at 3.

254. *Id.* art. 61–103.

255. *Id.* art. 66(7), at 49–50.

256. *Id.* art. 66(3)(a), at 49.

257. *Id.* art. 94(1).

258. *Id.* at 94(2).

259. See Margaret Doyle et al., *How to Flourish in an Uncertain Future: Open Banking and PSD2* DELOITTE 8 (2017), <https://www2.deloitte.com/content/dam/Deloitte/cz/Documents/financial-services/cz-open-banking-and-psd2.pdf> [<https://perma.cc/426V-GLFL>].

260. *Id.*

261. Walker, *Digital Information Law*, *supra* note 30.

262. See Doyle et al., *supra* note 259, at 1.

term.²⁶³ Competition and diversity may increase efficiency and resilience, but increased risk-taking and increased competition can undermine profitability with additional threats arising from “BigTech in finance and greater third party dependencies.”²⁶⁴

The relationship between incumbent financial institutions and FinTech firms has generally been complimentary and cooperative, subject to certain exceptions in credit provision and payment. A more significant competitive impact may nevertheless arise with the entry of BigTech into the financial services area. BigTech companies benefit from established customer networks, name recognition, trust with proprietary customer data, substantial financial resources, and access to low cost capital.²⁶⁵ This could allow them to scale quickly, especially where “network effects are present such as in payments and settlements, lending, and insurance.”²⁶⁶ Further, “[c]ross-subsidisation could allow BigTech firms to operate with lower margins and gain greater market share,” which may increase concentration and alter market composition to the detriment of incumbent firms.²⁶⁷ While increasing reliance on third party “service providers (e.g. data provision, cloud storage and analytics, and physical connectivity)” may reduce individual firm operational risk, this could pose new risks across the financial system, especially where risks are not managed at the firm level, and where there are increased “complexities and interconnectedness.”²⁶⁸

The FSB has established a Financial Innovation Network (FIN) to examine innovations in the FinTech arena from a financial stability perspective, including “credit, digital currencies, distributed ledger technology, artificial intelligence[,] and machine learning.”²⁶⁹ A FinTech Issues Group has been set up to examine the financial stability implications of emerging “FinTech innovations to support financial stability and to engender new systemic risks.”²⁷⁰ The FSB published a separate report on *BigTech in Finance* in December 2019,²⁷¹ which examined the benefits and risks to financial stability, including through increased linkage and through

263. It is arguable that information and data can be treated like a product for competition purposes, including in relation to the application of monopoly and collusion, despite the argument they are strictly not property. See MARK R. PATTERSON, *ANTITRUST LAW IN THE NEW ECONOMY: GOOGLE, YELP, LIBOR, AND THE CONTROL OF INFORMATION* 173–79 (2017). Growth driven dominant firms may engage in predatory pricing and extract monopoly rents. See *id.*

264. *FinTech and Market Structure in Financial Services: Market Developments and Potential Financial Stability Implications*, FIN. STABILITY BD. (FSB) 1 (Feb. 14, 2019), <https://www.fsb.org/wp-content/uploads/P140219.pdf> [<https://perma.cc/4HD5-BLZC>].

265. See *id.* at 1–2.

266. *Id.* at 2.

267. *Id.*

268. *Id.*

269. *Monitoring of FinTech*, FSB.ORG, <https://www.fsb.org/work-of-the-fsb/policy-development/additional-policy-areas/monitoring-of-fintech/> [<https://perma.cc/ZZ7M-8WRN>] (last visited Sept. 22, 2020).

270. *Id.*

271. Oung et al., *supra* note 85.

possible propagation channels with domestic authorities having to consider to what extent additional or new regulation may be required.²⁷²

E. CYBERSECURITY

It is essential to maintain data security and integrity against cyber threats, as digitally targeted attacks have substantially increased in recent years.²⁷³ The European Commission (the Commission) conducted a review of the EU Cybersecurity Strategy in 2013 with a follow-up assessment issued in 2017.²⁷⁴ Five policy objectives were adopted in June 2013 on cyber resilience, cybercrime, cyber defense, cybersecurity, and cyberspace policy.²⁷⁵ The EU Cybersecurity Strategy is to build an open, safe, and secure Cyberspace expanding on the five policy objectives stated.²⁷⁶

The Commission adopted a revised cybersecurity package in September 2017.²⁷⁷ The European Union Agency for Network and Information Security (ENISA) was strengthened with a permanent mandate specifically to assist on the implementation of the Directive on security of Network and Information Systems (NIS).²⁷⁸ The NIS Directive requires Member States

272. *Id.* at 22.

273. 4,000 ransomware attacks were reported each day in 2016. 80 percent of European companies had experienced at least one cybersecurity incident in 2017. Security events had risen by 38 percent with 50 percent of all crimes being cybercrimes in some Member States. The 'WannaCry' attack in May 2017 impacted 230,000 systems in 150 countries including hospitals and ambulance services. *Building Strong Cybersecurity in Europe*, EUROPEAN COMM'N (Sept. 12, 2018), https://ec.europa.eu/commission/sites/beta-political/files/sotou2018-factsheet-cybersecurity_en.pdf [https://perma.cc/4ZL2-G7JW].

274. *Commission Staff Working Document Assessment of the EU 2013 Cybersecurity Strategy*, at 2, SWD(2017) 295 final (Sept. 3, 2017).

275. *Id.*

276. *Id.* at 3. (1) Achieving cyber resilience (increasing Member States' and private sector capabilities, improving information sharing, and increasing cybersecurity awareness); (2) Drastically reducing cybercrime (ensuring swift transposition of existing laws, enhancing operational capability to combat cybercrime, and improving coordination at the EU level); (3) Developing cyber defense policy and capabilities (assessing operational EU cyber defense requirements and promoting the development of EU cyber defense capabilities and technologies, developing an EU cyber defense policy framework to protect networks within CSDP missions and operations, promoting dialogue and coordination between civilian and military actors in the European Union, and ensuring dialogue with international partners including NATO); (4) Developing industrial and technological resources for cybersecurity (promoting a Single Market for cybersecurity products and fostering R&D investments and innovation); and (5) Establishing a coherent international cyberspace policy for the European Union and promote EU core values (mainstreaming cyberspace issues in EU external relations and CFSP, supporting the development of behavior and confidence building measures in cybersecurity, supporting the promotion and protection of fundamental rights, including access to information and freedom of expression, and supporting global cybersecurity capacity building). *Id.* at 5.

277. *See Resilience, Deterrence and Defence: Building Strong Cybersecurity for the EU*, SEC (2017) 450 final (Sept. 13, 2017).

278. Directive (EU) 2016/1148 of the European Parliament and of the Council of 6 July 2016 Concerning Measures for a High Common Level of Security of Network and Information

to be prepared through the establishment of a competent national NIS authority and Computer Security Incident Response Team (CSIRT), the establishment of a separate cooperation group, and the promotion of cultural security across sectors.²⁷⁹ A separate communication was issued in September 2017 to support implementation with an “NIS toolkit.”²⁸⁰ The European Union would create a single cybersecurity market in relevant products, services, and processes with an EU certification framework managed through the ENISA.²⁸¹ A duty of care principle would be adopted to reduce product and software vulnerabilities, and promote “security by design” in relation to all internet connected devices.²⁸² Additionally, it was proposed that the ENISA be turned into a European Union Cybersecurity Agency.²⁸³ The Commission has produced a blueprint for stress testing or rehearsals to prepare for “a large scale cross-border [cybersecurity] incident.”²⁸⁴ A “Cyber Diplomacy Toolbox” was also adopted under the EU Common Foreign and Security Policy as a “joint [EU] diplomatic response to malicious cyber activity.”²⁸⁵

All these capital, trading, identification, data, payment, and cybersecurity requirements are data-intensive, essentially data-based, and data-directed. As a result, significant new areas of possible DataRisk with corresponding DataReg and DataTech responses are emerging. These new measures form an important part of the newly developing RegTech framework.

IV. Regulatory Technology

Regulatory technology (RegTech) is concerned with the use of technology for regulatory purposes.²⁸⁶ Deloitte referred to RegTech as the new FinTech and a sub-part of the wider FinTech.²⁸⁷ RegTech can be used by firms to

Systems Across the Union, 2016 O.J. (L. 194) 1, 1–2 (EU). See also *Cybersecurity*, EUR. COMMISSION (Feb. 7, 2013), <https://ec.europa.eu/digital-single-market/en/cyber-security> [<https://perma.cc/4NJ4-CFGL>].

279. *The Directive on Security of Network and Information Systems (NIS Directive)*, EUR. COMM’N (July 7, 2020), <https://ec.europa.eu/digital-single-market/en/network-and-information-security-nis-directive> [<https://perma.cc/GG8J-M5JS>].

280. See *Making the Most of NIS: Towards the Effective Implementation of Directive (EU) 2016/1148 Concerning Measures for a High Common Level of Security of Network and Information Systems Across the Union*, COM (2017) 476 final (Oct. 4, 2017).

281. See Directive 2016/1148, *supra* note 278.

282. *Resilience, Deterrence and Defence: Building Strong Cybersecurity for the EU*, *supra* note 277, at 5.

283. *Id.* at 2.

284. *Id.* See also Recommendation 2017/1584, of the European Union of 13 Sept. 2017 on the Coordinated Response to Large-Scale Cybersecurity Incidents and Crisis, 2017 O.J. (L 239) 60, 36–7.

285. *Resilience, Deterrence and Defence: Building Strong Cybersecurity for the EU*, *supra* note 277, at 16.

286. See *supra* note 2.

287. *RegTech Is the New Fintech: How Agile Regulatory Technology Is Helping Firms Better Understand and Manage Their Risk*, DELOITTE (2016), <https://www2.deloitte.com/content/dam/>

support their compliance with regulatory requirements as well as by authorities in carrying out their regulatory, supervision, and macro-prudential work.²⁸⁸ A distinction may then be drawn between private and official RegTech, and within official RegTech.

RegTech has developed since the global financial crisis, moving through an earlier RegTech 1.0 phase based on technological development alone to a new RegTech 2.0 period that attempts to work more seamlessly with financial institutions, markets, regulators, and central banks.²⁸⁹ This can be understood in terms of developing from early simple data collection to data reporting and compliance and then to more sophisticated and predictive data management.²⁹⁰ RegTech has now arrived at a new inflection point and become increasingly important within financial institutions due to the need to secure compliance with mission-critical, post-crisis regulatory obligations.²⁹¹ This is partly to avoid further fines, with over \$200 billion in penalties being imposed since the financial crisis,²⁹² and due to firms having to protect a \$4.7 trillion industry from new destructive start-up competition.²⁹³

Regulation has also become increasingly data-based and acquisitive, especially with the imposition of new bank capital, liquidity, and leverage requirements under Basel III.²⁹⁴ Additionally, regulations have become more data-based with reporting obligations under MiFID II for securities firms and compliance burdens under Solvency II for insurance companies.²⁹⁵ RegTech impacts client identity management, risk management, regulatory compliance, and financial crime, as well as supervisory oversight and analysis.²⁹⁶ Relevant technological tools include advanced robotic and automated data collection, machine reading and learning, natural language processing (NLP), big data analytics, and wider artificial intelligence, including predictive learning.²⁹⁷

Deloitte/ie/Documents/FinancialServices/IE_2016_FS_RegTech_is_the_new_FinTech.pdf [https://perma.cc/F6RV-P8HN].

288. *See id.* at 6.

289. Alvarez & Marsal, *RegTech 2.0*, BURNMARK (Jan. 2018), https://www.alvarezandmarsal.com/sites/default/files/regtech_2.0_report_final.pdf [https://perma.cc/J7QS-QCH9].

290. *Id.* at 4–5.

291. *Id.* at 4.

292. Todd Ehret, *INSIGHT: Personal Liability Holds Focus in U.S. Regulatory Enforcement; Tips for Self-Protection*, REUTERS (Dec. 29, 2018), <https://www.reuters.com/article/bc-finreg-personal-liability-self-protoc/insight-personal-liability-holds-focus-in-u-s-regulatory-enforcement-tips-for-self-protection-idUSKBN1O41NH>.

293. *The Fintech Revolution*, THE ECONOMIST (May 9, 2015), <https://www.economist.com/leaders/2015/05/09/the-fintech-revolution> [https://perma.cc/52P7-C3AK].

294. *See* Arner et al., *supra* note 4, at 393.

295. *Regulatory Evolution: The Helicopter View*, DELOITTE 57, 65, (2015), <https://www2.deloitte.com/lu/en/pages/strategy/articles/regulatory-evolution.html> [https://perma.cc/K6Y2-7YAJ].

296. Alvarez & Marsal, *supra* note 289, at 7.

297. *See generally id.*

All of this forms part of RegTech 3.0 which reflects a new, more sophisticated relationship between markets and technology, and incorporates a number of new, more advanced, and technology-based regulatory techniques.

A. REGTECH MEANING

RegTech uses technology to develop new regulatory solutions for firms and authorities: Bank of England Chief Economist Andy Haldane predicted almost real-time regulatory reporting and analysis in 2014.²⁹⁸ The U.K. government referred to the importance of machine learning and cognitive computing, digital currencies and blockchain, big data analytics, optimisation and fusion and distributed systems, mobile payments and peer-to-peer applications in its *FinTech Futures* report in 2015.²⁹⁹ Ten recommendations were made, and the tenth recommended that regulators engage with the FinTech community and automate regulation and compliance and create a state-of-the-art regulatory reporting and analytics infrastructure through RegTech.³⁰⁰ These efforts would promote the United Kingdom as a “premier location for starting, growing[,] and retaining innovative financial technology businesses.”³⁰¹ Regulatory technologies consist of any technological innovation that can be applied to or used in regulation specifically to improve efficiency and transparency.³⁰²

The Institute of International Finance refers to RegTech as the use of new technologies to solve regulatory and compliance requirements more effectively and efficiently.³⁰³ RegTech is used for the purposes of this paper

298. The global financial system could be strengthened through improved global financial surveillance, improved country debt structures, enhanced macro-prudential and capital flow management policies, and improved international liquidity assistance. Andrew G. Haldane, Maxwell Fry Annual Global Finance Lecture at Birmingham University (Oct. 29, 2014), in *Managing Global Finance as a System*, BANK OF ENG. (Oct. 29, 2014), <https://www.bankofengland.co.uk/-/media/boe/files/speech/2014/managing-global-finance-as-a-system.pdf?la=EN&hash=93BF6D650AAE5D055618D2D2DBC5870DC0580FA7> [https://perma.cc/NGT6-UERH].

299. Mark Walport et al., *Fintech Futures: The UK as a World Leader in Financial Technologies*, GOV'T OFFICE FOR SCI., 7 GS/15/3 (Mar. 2015), https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/413095/gs-15-3-fintech-futures.pdf [https://perma.cc/BZ3A-KEL5].

300. The government had to secure an appropriate balance between regulation, innovation, and stability with additional opportunities arising in using FinTech tools to improve regulatory process including regulation and compliance and reporting and make regulation and reporting more transparent, efficient, and effective. RegTech was referred to as a “possible grand challenge,” which could act as a “catalyst” although regulatory authorities had to work with FinTech and academic communities to realise the opportunities available and secure change and benefit for the UK. *Id.* at 12.

301. *Id.* at 17.

302. *Id.* at 47.

303. *RegTech in Financial Services: Technology Solutions for Compliance and Reporting*, INST. OF INT'L FIN., 2 (Mar. 2016), https://www.iif.com/Portals/0/Files/private/iif-regtech_

to refer to any use of technology for financial risk management, financial regulation, financial supervision, or financial compliance purposes.³⁰⁴

B. REGTECH ADVANTAGE AND CHALLENGE

RegTech can bring several operational advantages, including speed, efficiency, analytical capability, agility, and adaptability.³⁰⁵ RegTech often uses lower cost shared cloud facilities including software-as-a-service (SaaS) functions which benefit from low cost, flexibility, efficiency, scalability, and security.³⁰⁶ As regulation has become more complex, intrusive, and stringent, market innovation and regulatory control had to be balanced.³⁰⁷ Regulation would benefit from automated reporting and advanced analytics, although regulatory capacity would have to be improved to analyse and assess the unprecedented quantities of data provided.³⁰⁸ Regulatory authorities, financial services, and FinTech companies would need to work together to create an open dialogue to secure regulatory aims and compliance which could specifically be assisted through the use of real-time transaction analysis, online registration, standard data formats, standard (risk weighted) asset indices, automated reporting, open source compliance systems, and big data analytics.³⁰⁹ RegTech could benefit from applied big data analytics, data driven regulation, and compliance;³¹⁰ improved regulatory infrastructure;³¹¹ strengthened education and training; university engagement; improved commercial, public domain, and proprietary industry data collection; and increased collaboration between authorities, businesses, and academia.³¹² RegTech could substantially reduce ongoing compliant costs.³¹³

in_financial_services_-_solutions_for_compliance_and_reporting.pdf?ver=2019-01-04-142943-690 [https://perma.cc/5DCA-H8QD].

304. See Gallie, *supra* note 3, at 167–98.

305. *RegTech Is the New Fintech: How Agile Regulatory Technology Is Helping Firms Better Understand and Manage Their Risks*, *supra* note 287, at 5.

306. *Id.* at 6.

307. Walport et al., *FinTech Futures*, *supra* note 299, at 48.

308. *Id.*

309. *Id.* at 47.

310. Using (a) regulatory policy modelling; (b) adoption of common international reporting standard; (c) use of mathematical systemic risk tools; (d) increased harmonisation; (e) development of uniform compliance tools; (f) improved collaboration and selected data sharing; and (g) regulatory collaboration on FinTech and RegTech. *Id.* at 49.

311. A fully integrated analytics infrastructure could be constructed to manage new financial, economic, retail, spatial, text, and social data with RegTech companies using improved data base and streamed processing infrastructure, data mining analytics tools, visualisation (understanding and reporting) tools, and the development of new computational platforms to allow the analysis of multiple heterogeneous data sources without the need for new extensive programming expertise. *Id.* at 47.

312. *Id.*

313. JPMorgan Chase estimated in 2014 that it had employed an additional 13,000 new members of staff in 2012–2014 to support regulatory, compliance and control which cost \$2 billion, \$600 million being spent on regulatory and control technology. Deutsche Bank

C. REGTECH TOOLS AND SOLUTIONS

RegTech uses several new technological tools and can impact multiple aspects of a financial institution's standard and specialised business functions. This may impact many of the separate sub-functions that may be increasingly fragmented and disruptive in the new FinTech arena.³¹⁴ RegTech could be used to improve many aspects of banks and other financial institutions' compliance and more general systems and controls requirements as well as regulatory authority functions. RegTech may then improve identity management,³¹⁵ risk management,³¹⁶ regulatory compliance,³¹⁷ and financial crime control,³¹⁸ as well as regulatory, supervisory, and macro-prudential analysis.

RegTech rules include machine learning, robotics and AI, cryptography, biometrics, blockchain and other distributed ledgers, application program interfaces (APIs), and shared utility functions and cloud applications.³¹⁹ These may improve risk data aggregation,³²⁰ modelling, scenario analysis, and forecasting;³²¹ payment transaction monitoring;³²² client and legal

invested 1.3 billion in regulatory compliance in 2014. UBS's regulatory costs were \$946 million in 2014. Deloitte estimated that \$5.7 to 6.6 billion were spent in regulatory compliance during 2012 by European insurance companies with 58 percent of this on Solvency 2 implementation. *RegTech in Financial Services: Technology Solutions for Compliance and Reporting*, *supra* note 303, at 23.

314. See discussion *supra* Section I.

315. (a) Know Your Customer (KYC) procedures; (b) Anti-money laundering oversight, including suspicious transaction reporting; and (c) Continuing Anti-Money Laundering (AML) and Anti-Terrorist Financing (ATF), monitoring and reporting. See Alvarez & Marsal, *supra* note 289, at 7.

316. (a) Financial risk (credit risk, market risk, interest rate risk, foreign exchange, and financial derivatives risk management); (b) Operational risk management; (c) Firm and employee conduct risk; (d) Legal risk management; and (e) Wider environmental risks including cyber risk. See *id.*

317. (a) Regulatory data collection; (b) Regulatory data analysis and intelligence; (c) Regulatory reporting; (d) Other regulatory compliance; and (e) Internal governance. See *id.*

318. (a) Internal fraud; (b) External fraud; (c) AML and ATF; (d) Insider trading; and (e) Market abuse. See *id.*

319. *RegTech in Financial Services: Technology Solutions for Compliance and Reporting*, *supra* note 303, at 3–4.

320. High quality structured risk data aggregation is required for capital and liquidity reporting, recovery and resolution planning (RRP), stress testing, and trade repository data collection with difficulties arising with incompatible IT systems and the lack of a common definitional framework. Financial compliance is increasingly data driven. Technology can be used to aggregate, share, and store risk data and for filing and submission purposes. *Id.* at 6–8.

321. Risk management and stress testing modelling, scenario analysis, and forecasting are complicated by the number of risks, scenarios, variables, and methodological diversity that has to be incorporated. This is relevant in relation to capital and liquidity compliance, stress testing, risk management and product development, expected credit loss (ECL) counting, and consumer protection. *Id.* at 8–9.

322. Payment systems provide low quality and inconsistent transaction metadata which prevents automated interpretation and processing. Automated identification solutions could be used to improve KYC and ATF identification including through the use of biometric fingerprint and iris scanning or other blockchain identity technology. *Id.* at 9–10.

person identification;³²³ internal culture and behaviour monitoring;³²⁴ financial market trading;³²⁵ and new regulatory identification.³²⁶ A number of specific tools can be identified to carry out and improve each of these RegTech functions and objectives.³²⁷

Associated barriers and obstacles must also be removed. Specific issues arise with regard to regulation and legislation,³²⁸ data harmonisation and definition,³²⁹ inefficient report portals and systems,³³⁰ and the lack of effective cross-institutional AML and ATF monitoring.³³¹ Further issues arise in continuing regulatory uncertainty, unfamiliar and unclear technology solutions, lack of effective networks and platforms, and knowledge-sharing barriers between authorities and the financial industry.³³²

323. Artificial intelligence and automated interpretation can be used to monitor qualitative behavioural information contained in emails and aural messaging (including Know Your Customer (KYC) and Customer Due Diligence (CDD)). *Id.* at 10.

324. Trade regulatory tasks can be improved through automation, especially in connection with margins calculation, trading venue selection, counterparty identification, and transaction impact assessments. Automated regulatory interpretation technologies could be used to secure compliance with changing regulatory obligations still. *Id.* at 10-11.

325. *Id.* at 11.

326. *Id.*

327. These include: (a) Data aggregation and management technologies (new cryptographic and secure technologies, standardised shared utility functions, data mining algorithms using machine learning, and blockchain tools); (b) Advanced data analysis and interpretation (machine learning, robotics, unstructured data analysis, natural language understanding, visual analytics, and biometrics technology); (c) Real-time compliance and risk management (powerful calculation engines and cloud analytics); (d) Blockchain, DLT, and APIs. *Id.* at 11–15.

328. (a) Data privacy and data protection rules; (b) Data security requirements; (c) Data localisation requirements; (d) The need for centralised and automated risk data aggregation within banking groups (specifically to ensure compliance with the Basel Committee's principles on information technology infrastructures); (e) RRP conditions on critical information technology and risk infrastructure; and (f) KYC and ATF obligations. *Id.* at 18.

329. Data standardisation initiatives include: (a) the Legal Entity Identifier (LEI); (b) Unique Product Identifier (UPI); (c) instrument identifiers (including through the use of the International Securities Identification Number (ISIN) system); (d) transaction standards including the proposed global Unique Transactions Identifier (UTI); (e) ISO 20022 and the universal financial industry messaging scheme; and (f) financial and business reporting standards including XBRL. *Id.* at 20. Data definition harmonisation initiatives include (a) the UK FCA and PRA Memorandum of Understanding on data; (b) ECB Directorate General Statistics data harmonisation initiative; (c) banks' Integrated Reporting Dictionary (BIRD); (d) Single Data Dictionary (SDD); and (e) European Reporting Framework (ERF). *Id.* at 20–21.

330. *Id.* at 22–23.

331. *Id.* at 23.

332. *Id.* at 23–24.

A new core RegTech taxonomy³³³ can be constructed based on eight core functions: personal identification,³³⁴ data and privacy management,³³⁵ risk analysis,³³⁶ market integrity,³³⁷ client interface and relations, cyber security,³³⁸ compliance, and ongoing regulatory monitoring.³³⁹ Eight tools can then be identified with advanced, new forms of cloud, fog, and edge computing as well as biometrics and cryptographic access control, distributed ledgers and blockchain ledger storage, algorithms and automation, data mining and big data analytics, API and linkage, machinery and machine learning, robotics, and AI. A further summary systems taxonomy can be constructed from these tools and can outline the types of new techniques available to the authorities in terms of automated (algorithmic), assistive (robotics), cognitive (machine reading), predictive or presage (data analytics), and formative or originative (machine learning and AI) facilities or a combination of such types.

RegTech may also be used to create closer operational relationships between regulated institutions, financial markets, and authorities through the embedding of agencies within the markets such as blockchain.³⁴⁰ That concept could produce new forms of embedded regulation and supervision, resulting in substantial gains and efficiencies with more timely and accurate data supply and examination at significantly lower costs.

Effective relationships must also be established between law and technology, and regulation and code. The U.K. Government Chief Scientific Advisor Sir Mark Walport, referred to the governance and regulation advantages of legal code over technical code in January 2016.³⁴¹

333. A taxonomy refers to a structure or ordering although a wider ontology can also be constructed incorporating attributes and relations. See R.J. Voster BEng, *RegTech: Closing the Circle*, COMPACT, Feb. 2017, at 48, 53, <https://www.compact.nl/pdf/C-2017-2-Voster.pdf> [https://perma.cc/QWDS-75TN].

334. Arner et al., *supra* note 4, at 390–91 (individual identification, profiling and due diligence, including know your customer (KYC) with customer due diligence (CDD) and enhanced due diligence (EDD) for money laundering control purposes). This is also referred to this in terms of “know your data” (KYD). *Id.*

335. See *RegTech in Financial Services: Technology Solutions for Compliance and Reporting*, *supra* note 303 (data collection, aggregation, curation, and harmonisation, analysis, and storage including emergency and continuity planning).

336. *Id.* (risk modelling, forecasting, and analysis).

337. *Id.* (market, venue and counterparty analysis, market trading, clearing and settlement, reporting and margin, and risk position management).

338. *Id.* (client website interface, APIs, roboadvice, support, and complaints handling).

339. See *generally id.* (systems management and reporting for GDPR and privacy purposes as well as for financial crime, suitability, systems, and resource (capital, liquidity, and leverage) management).

340. See Raphael Auer, *Embedded Supervision: How to Build Regulation into Blockchain Finance* (BIS: Monetary & Econ. Department, BIS Working Paper No. 811, Sept. 2019), <https://www.bis.org/publ/work811.pdf> [https://perma.cc/FU58-TMZF].

341. Technology could be used to enhance regulation in the form of RegTech. Walport referred to the importance of technical code (including computer software and protocols) and legal code with technical code being intrinsic and legal code extrinsic. The modern financial

An appropriate balance must be achieved to secure the maximum realisation of potential benefits and to constrain associated disadvantages and costs. This balance must operate within a clear, sound, and stable legal and regulatory regime that respects and protects the rule of law.³⁴²

D. REGTECH ADOPTION

A number of initiatives were adopted by various authorities across the world to support RegTech development. The U.K. Government, in its 2015 budget, announced that the FCA would work with the Prudential Regulation Authority (PRA) to identify means of supporting “the adoption of new technologies to facilitate the delivery of regulatory requirements.”³⁴³ Project Innovate was established by the FCA in the United Kingdom in October 2014 to encourage innovation in the financial services markets.³⁴⁴ *RegTech Call for Input (CFI)* was published in November 2015³⁴⁵ and was followed by the *Feedback Statement* in July 2016.³⁴⁶ The FCA previously held bilateral meetings with over forty industry representatives, including technology companies, trade bodies, consultancies, and academia, during the 2015 RegTech roundtables in March 2016.³⁴⁷ Technological innovation was identified as a key priority in the FCA’s *Business Plan 2016*.³⁴⁸

Six key emerging themes were identified in the initial *Call for Input*: the importance of technology accelerators, real-time and system embedded compliance and risk evaluation tools, big data techniques, visualisation and

system was already substantially digital and reliant on technical code, which determined the creation and amendment of digital records of legal obligations between institutions with financial governance and regulation focusing on legal rather than technical requirements. Distributed ledger systems lacked central control with governments having to ensure an appropriate balance between external legal and internal technical code governance. Press Release, U.K. Gov’t Off. for Sci., Matt Hancock, Sec’y State for Health & Social Care, *Distributed Ledger Technology: Beyond Block Chain* (Jan. 19, 2016), <https://www.gov.uk/government/news/distributed-ledger-technology-beyond-block-chain>; Mark Walport, *Distributed Ledger Technology: Beyond Block Chain*, GOV’T OFFICE FOR SCI. 41–45 (Mark Peplow ed., 2016), https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/492972/gs-16-1-distributed-ledger-technology.pdf [<https://perma.cc/WZ83-MXGX>].

342. See, e.g., G.A. Walker, *Initial Coin Offerings – Technology and Rule of Law*, 2019:2:7 RULE L. & ANTI-CORRUPTION CTR. J. 2, 10 (2019) (Qatar).

343. HM TREASURY, BUDGET 2015, *supra* note 243, at 57; see also *Fintech: The UK’s Unique Environment for Growth*, U.K. TRADE & INV., URN UKTI/14/1028 at 24 (Aug. 2014).

344. *Call for Input: Supporting the Development and Adoption of RegTech*, FIN. CONDUCT AUTH., ¶1.1, Pub. Ref. 005176 (Nov. 2015), <https://www.fca.org.uk/publication/call-for-input/regtech-call-for-input.pdf> [<https://perma.cc/DM92-AKFW>].

345. *Id.* at 1.

346. See *Call for Input on Supporting the Development and Adopters of RegTech*, FIN. CONDUCT AUTH., FS16/4 (July 1, 2016), <https://www.fca.org.uk/publication/feedback/fs-16-04.pdf> [<https://perma.cc/L8UB-L378>].

347. *Id.*

348. *Business Plan 2016/17*, FIN. CONDUCT AUTH., 32–34 (Apr. 2016), <https://www.fca.org.uk/publication/corporate/business-plan-2016-17.pdf> [<https://perma.cc/4WYZ-VAP2>].

robo-tools, software integration tools, and cloud technologies.³⁴⁹ FCA involvement would be developed in four areas through the provision of regulatory expertise, supporting the FinTech and RegTech environment, producing relevant standards and guidance, and responding to barriers to entry, innovation, and adoption.³⁵⁰ Responses were sought in relation to possible RegTech content,³⁵¹ FCA role,³⁵² continuing obstacles,³⁵³ relevant rules and policy design,³⁵⁴ and possible use applications.³⁵⁵ The FCA was specifically concerned with the improvement of the regulatory interface, effectiveness and efficiencies, and the standing of the regulatory position.³⁵⁶ The FCA would fully engage in the development of RegTech with the FinTech community in response to the perceived need for regulatory direction.³⁵⁷ It would subsequently encourage and support the development and use of new innovative technology and act as a catalyst for innovation subject to any relevant mandate restrictions.³⁵⁸

The FCA conducted a TechSprint (hackathon) in April 2016 with five TechSprints being held by 2018.³⁵⁹ The fourth November 2017 TechSprint focused on using technology to make digital regulatory reporting more

349. *Call for Input: Supporting the Development and Adoption of RegTech*, *supra* note 344, at ¶ 1.7.

350. *Id.* at ¶ 1.8.

351. Responses focus on: (a) efficiency and collaboration (alternative reporting methods, cloud and cloud computing, shared utilities, and online platforms); (b) integration, standardisation, and understanding (semantic tech and data point models, APIs, shared data ontology—with a formal naming and definition of types, properties, and entity interrelationships—and producing a revised interactive FCA Robo Handbook); (c) predict, learn, and simplify (big data analytics, modelling and visualisation technology, risk and compliance monitoring, and machine learning and cognitive technology); and (d) new directions (blockchain and DLT, biometrics, inbuilt compliance automation, and smart regulation) and system monitoring and visualisation. *Call for Input on Supporting the Development and Adopters of RegTech*, *supra* note 346, at 7–9.

352. (a) Clarification of FCA expectations to assist drive industry standard and guidance production; (b) Improve collaboration and engagement; and (c) FCA certification of RegTech to increase credibility and acceptance and consequent investment. *Id.* at 10.

353. Slow adoption arose as a result of: (a) regulatory uncertainty and lack of technological credibility; (b) need for regulatory assistance and approval including through the use of a “virtual sandbox;” (c) need to encourage early adopters (to avoid firms “staying in the pack”); and (d) continued investment by certain firms in maintaining legacy systems without new technology adoption. *Id.* at 11. General obstacles included: (a) legislative restrictions on accessing, processing, and storing data; (b) need for alternative regulatory engagement; and (c) early stage technology development. *Id.*

354. (a) Adopting machine readable regulation to allow automatic adoption in a speedy, efficient, and effective manner; (b) Adopting a common global regulatory taxonomy; and (c) Continuing industry consultation to ensure international systems consistency and compatibility. *Id.* ¶ 4.7.

355. MiFID II, Basel 3, and BCBS 239, capital assessment and stress testing (CCAR and AQR), EU BRRD, and U.S. Dodd-Frank implementation. *Id.* ¶ 4.8.

356. *Call for Input: Supporting the Development and Adoption of RegTech*, *supra* note 344, at ¶ 2.2.

357. *Id.* at ¶¶ 5.5–5.6.

358. *Id.*

359. *Id.* at ¶ 5.7; *TechSprints*, FIN. CONDUCT AUTH. (Mar. 3, 2020), <https://www.fca.org.uk/firms/innovation/regtech/techsprints> [<https://perma.cc/C8HL-R2WU>].

accurate, efficient, and consistent with a proof of concept being produced and a subsequent *Call for Input* published in February 2018.³⁶⁰ The objective was to allow firms to map their regulatory requirements directly to the data held to allow for automated, straight through processing of regulatory returns with lower compliance costs, improved data accuracy, and flexibility in responding to future regulatory change.³⁶¹ Further proofs of concept were developed with the FCA's RegTech programme continuing to focus on efficiency and collaboration,³⁶² integration, standards and understanding,³⁶³ prediction, learning and simplification,³⁶⁴ and other new directions.³⁶⁵ All of

360. *Previous DRR Phases*, FIN. CONDUCT AUTH. (June 17, 2020), <https://www.fca.org.uk/firms/our-work-programme/pilot-updates> [<https://perma.cc/AE79-VNDC>].

361. Regulatory reporting rules had to be interpreted manually and manually input to firm's systems, and the proof of concept would remove the need for human interpretation and manual execution. FCA rules would be produced in a machine executable format with automated interpretation and implementation, automated reports production review, and submission which would then be subject to FCA receipt and validation. The FCA created a linked directory of relevant regulatory requirements and information on a specific rule (SUP 16.12 FSA 001) with all relevant parts of the FCA and PRA Handbooks being routed through XML files into the directory. The reporting rules were converted into the Semantics of Business Vocabulary and Business Rules (SBVR) format using Financial Industry Regulatory Ontology (FIRO) incorporating the OWL (Web Ontology Language) and Resource Description Framework (RDF) standards. An RDF file was created to set out the relationship between verbs and nouns (retail, customer, account, and liability) with FCA meaning being mapped to firm data bases using the FCA Ontology. The machine executable version of the rule was automatically implemented with changes leading to automatic adjustments in the data reported. *Call for Input: Using Technology to Achieve Smarter Regulatory Reporting*, FIN. CONDUCT AUTH. 8–11 (Feb. 2018), <https://www.fca.org.uk/publication/call-for-input/call-for-input-smarter-regulatory-reporting.pdf> [<https://perma.cc/T7WQ-XK8F>]. See also Andrew Burt et al., *2017 Model Driven and Machine Executable Regulations Tech Sprint: Success Criteria & Recommendations*, IMMUTA: INFO. SOC'Y PROJECT YALE L. SCH. (2017), <https://go.immuta.com/e/646383/1-646383-2018-12-18-87m1s/87m2z/541081961?h=hqpO9NX3wUFwovUsOwe5hR-pGAs904w2fN3WjuTWvnQ> [<https://perma.cc/PBK8-2DRD>].

362. (a) Modernising the FCA Handbook (using SBVR and NLP to create a machine readable Handbook); (b) Model driven regulation (using semantics and triples—statements in subject/predicate/object form—to map and translate multiple internal and external data ontologies into a universal format); (c) Model driven and machine readable regulation (linking regulation, compliance procedures, databases, and data standards into a universal machine readable format); and (d) Improving employee security (merging behavioural modelling software with psychology and behaviour change theory to measure and improve personal security within financial firms in cooperation with CybSafe). *Our Work Programme*, FIN. CONDUCT AUTH. (Dec. 10, 2019), <https://www.fca.org.uk/firms/innovation/regtech/our-work-programme> [<https://perma.cc/K457-VRPA>].

363. (a) MITOC/ISDA (producing a standardised model to express data and processes as collections of economic features and trade events); (b) RegHome (instructing a platform for intra-bank knowledge exchange on regulation using a Wiki style approach to allow the sharing of best practices and knowledge on a crowd sourced basis); and (c) ITRAC (developing a global information technology risk and controls framework to resolve challenges in leveraging new technology). *Id.*

364. (a) Intelligent Regulatory Assistant (IRA) (creating a form of digital regulatory lawyer to interact with clients including populating Authorisation forms for regulatory approval); (b) Intelligent Regulatory Advisor (IRA) (a handbook supported “Robo advisor” to provide

this will assist in creating a digitally automated new form of integrated financial regulation as financial firms will be able to machine read and comply with regulatory requirements and adjustments on a smart continuing basis. This should improve cost, improve data accuracy, and remove systems errors.

E. REGTECH MARKET

RegTech may impact all aspects of financial services as well as other technologically connected service areas.³⁶⁶ This may include changes within financial services, enterprise risk management and portfolio risk management, tax management, trade reporting and regulatory reporting, quantitative analytics, and AML/KYC and ATF, as well as blockchain and Bitcoin directly.³⁶⁷ Other areas may include identification and background checks; information security and cybersecurity; government and legislation; employment health, safety, and quality; healthcare; vendor risk management; and general compliance management.³⁶⁸ The effect of this is to automate many aspects of risk management and due diligence as well as other operational functions within institutions.³⁶⁹ Responsive and predictive elements can also be incorporated by machine reading, machine learning, big data, and predictive analytics and AI.³⁷⁰ This may either be carried out within financial institutions or separate start-up platforms, although the platforms must ultimately work with existing institutions and within the financial market and other professional service sections.³⁷¹

Many new RegTech businesses have been set up in recent years.³⁷² Many of these are in the United Kingdom or United States with others in Ireland,

automated advice to support authorisation processes); (c) Ascent Experiment (using NLP (Natural Language Processing) and Artificial Intelligence (AI) technologies to interpret and comply with the MiFID II regulations (MiFIR) with Commonwealth Bank of Australia, ING, and Pinsent Masons). *Id.*

365. (a) BARAC (using blockchain technology to automate regulation and compliance); (b) SmartReg (using smart contracts and DLT to allow FCA compliance verification with UCL and Santander); (c) Project Maison (using distributed technology for regulatory reporting with R3, RBS, and another partner bank). *Id.*

366. *What Is Regtech? And Why Is it Becoming the Next Big Thing?*, COMPLY ADVANTAGE, <https://complyadvantage.com/blog/what-is-regtech/> [<https://perma.cc/8M2Y-DBP3>] (last visited Sept. 6, 2020).

367. *Id.*

368. *Id.*

369. *Is RegTech the Future of Compliance?*, GRANT THORNTON (May 6, 2019), <https://www.grantthornton.com/library/articles/financial-services/2018/BK/RegTech-future-compliance.aspx> [<https://perma.cc/6QLY-3TSM>].

370. *Id.*

371. *Id.*

372. *The 100 Most Innovative RegTech Companies and Start-Ups*, CONSULTANCY.UK (Nov. 21, 2017), <https://www.consultancy.uk/news/14706/the-100-most-innovative-regtech-companies-and-start-ups> [<https://perma.cc/EAZ2-GQHT>].

Switzerland, and Australia.³⁷³ Other important areas include Brazil, Bermuda, South Africa, Cyprus, India, and the United Arab Emirates.³⁷⁴ The London FinTech publication, *FinTech Global*, examined 416 RegTech operations in 2016 and constructed a list of the leading 100 operations.³⁷⁵ This was based on an assessment of their use of innovative technology to generate efficiencies and performance enhancements within financial institutions and reduce costs, improve efficiency, and enhance revenue for clients.³⁷⁶ Specific innovations included related to predictive edge analytics, behavioral and emotional analytics, voice processing, compliance and surveillance technology, and other automated functions.³⁷⁷

V. Regulatory Innovation

The FAC in the United Kingdom wants an innovative new approach to financial innovation with the establishment of its Project Innovate in October 2014.³⁷⁸ The objective is to promote competition and growth in financial services by supporting small and large businesses developing products and services that could improve consumers' experience and outcomes.³⁷⁹ This new regulatory model has been implemented in a number of other countries.³⁸⁰ These include a number of elements with the core U.K. model, including an original Innovation Hub, a subsequent *Regulatory Sandbox* set up in May 2016, direct regulatory support and Advice Unit, and with additional work being carried out in the more specific area of RegTech.³⁸¹ This is supported by a domestic and international engagement program.³⁸²

373. *Id.*; see also *RegTech 100 Companies 2018*, FINTECH GLOB., <https://fintech.global/regtech100/regtech-100-2018/> [<https://perma.cc/BRN4-K5X6>] (last visited Sep. 6, 2020).

374. *Id.*

375. *Id.*

376. *Id.*

377. *Id.*

378. Christopher Woolard, FCA Director of Strategy and Competition, Speech at FCA's Event on UK FinTech (Feb. 22, 2016) in *UK FinTech: Regulating for Innovation*, FIN. CONDUCT AUTH. (Feb. 23, 2016), <https://www.fca.org.uk/news/speeches/uk-fintech-regulating-innovation> [<https://perma.cc/498K-LWT8>] [hereinafter "Woolard 2016 Speech"].

379. *Regulatory Sandbox*, FIN. CONDUCT AUTH. at 1 (Nov. 2015), <https://www.fca.org.uk/publication/research/regulatory-sandbox.pdf> [<https://perma.cc/KS8Z-SHDV>].

380. These include Hong Kong, Malaysia, Mauritius, Thailand, Abu Dhabi, Singapore, Australia, Canada, Brunei, Bahrain, and Switzerland. UNSGA FinTech Working Group & CCAF, *Early Lessons on Regulatory Innovations to Enable Inclusive FinTech: Innovation Offices, Regulatory Sandboxes, and RegTech*, UNITED NATIONS SECRETARY-GENERAL'S SPECIAL ADVOCATE, 19 fig. 5 (2019), https://www.unsgsa.org/files/2915/5016/4448/Early_Lessons_on_Regulatory_Innovations_to_Enable_Inclusive_FinTech.pdf [<https://perma.cc/5WVU-W4SH>].

381. *Innovate: 5 Sub-Units* (illustration), in Kieran Garvey et al., *Guide to Promoting Financial & Regulatory Innovation: Insights from the UK*, CAMBRIDGE CTR. FOR ALT. FIN. 11 (Mar. 2018), <https://www.jbs.cam.ac.uk/wp-content/uploads/2020/08/2018-06-ccaf-whitepaper-guide-to-promoting-financial-regulation-innovation.pdf> [<https://perma.cc/588D-YCFL>].

382. UNSGA FinTech Working Group & CCAF, *supra* note 380, at 56.

While several obvious advantages can be identified in terms of such an initiative, other concerns also arise. This could potentially provide important support to technological development and innovation in the financial area, although it has received little attention by international regulatory committees or official agencies to date. Further work could be undertaken in this area, including the development of relevant international standards or core principles on the model of existing core standards in the banking, securities, insurance, payment, and financial crime areas.

A. PROJECT COMPONENTS

The U.K. Project Innovate consists of a number of key elements. These can be summarised in terms of the underlying or original Innovation Hub, the Regulatory Sandbox, Direct Support and the Advice Unit, RegTech, and Engagement.³⁸³

1. *Innovation Hub*

Project Innovate is based on the FCA Innovation Hub, the purpose of which is to encourage innovation in financial services by supporting innovator businesses and a range of services for consumers.³⁸⁴ Support is provided for innovator businesses looking to introduce ground-breaking or significantly different new financial products and services.³⁸⁵ This assists firms to understand the regulatory framework and regulatory obligations with the FCA. Moreover, firms will be able to incorporate additional flexibility within its framework, remove barriers to entry, and encourage and support innovation (where this would not otherwise erode consumer protection or the integrity of the financial system).³⁸⁶ The FCA states that it is committed to looking to the future, anticipating trends, and reacting accordingly.³⁸⁷ For this purpose, it has to understand the needs of innovator businesses, their products and services, and possible benefits and risk to consumers.³⁸⁸

The FCA has developed four core criteria for support.³⁸⁹ These are based on genuine innovation, consumer benefit, background research, and the need for support.³⁹⁰ The business must involve a ground-breaking or significantly different idea with no or few other comparable examples, independent expert support, and an element of step-change in scale.³⁹¹ The

383. Garvey et al., *supra* note 381, at 11.

384. *Objectives of Innovation Hub*, FIN. CONDUCT AUTH. (Aug. 3, 2020), <https://www.fca.org.uk/firms/innovation/innovation-hub-objectives> [<https://perma.cc/7C5L-QUPP>].

385. *Id.*

386. *Id.*

387. *Id.*

388. *Id.*

389. *Criteria for Support*, FIN. CONDUCT AUTH., <https://www.fca.org.uk/publication/forms/project-innovate-criteria.pdf> [<https://perma.cc/9NPR-TPJQ>] (last visited Sept. 21, 2020).

390. *Id.*

391. *Id.*

innovation must provide a reasonable prospect of an identifiable benefit to consumers directly or through increased competition, possibly including lower price for higher quality.³⁹² The business has to have conducted background research, including on appropriate resources in understanding the regulatory obligations involved.³⁹³ The business also must have genuine need for support with no alternative means of engaging with the FCA or with the product or service not fitting easily into the existing regulatory framework.³⁹⁴

2. *Regulatory Sandbox*

The FCA consulted on the establishment of the Regulatory Sandbox in November 2015.³⁹⁵ The paper was published as a report to Her Majesty's Treasury on the feasibility and practicalities of developing a regulatory sandbox to operate as a "safe space" to allow businesses to test innovative products, services, business models, and delivery mechanisms without immediately incurring all of the generally applicable regulatory consequences of engaging in the specific activity.³⁹⁶ The FCA sought to expand its Project Innovate to include a regulatory sandbox with a separate event being hosted in December 2015 to discuss its proposals with the industry.³⁹⁷ The FCA separately stated in its November 2015 regulatory sandbox document that the firm should be in scope with the planned solution design for or supporting the financial services industry.³⁹⁸ The sandbox was established on May 1, 2016.³⁹⁹

The FCA is subject to a statutory obligation to promote effective competition with disrupted innovation being a key part of effective competition.⁴⁰⁰ Project Innovate attempts to support innovation and challenge existing business models with the FCA engaging constructively with innovative businesses and seeking to remove unnecessary regulatory barriers to innovation.⁴⁰¹ The FCA was asked by the Treasury to consider the feasibility of developing a regulatory sandbox following a recommendation by the Government Office for a science report on *FinTech Futures*.⁴⁰² The sandbox can reduce the time and potential costs of bringing innovative ideas to market, enable greater access to finance, and enable

392. *Id.*

393. *Id.*

394. *Id.*

395. *Regulatory Sandbox Lessons Learned Report*, FIN. CONDUCT AUTH. ¶1.1, (Oct. 20, 2017), <https://www.fca.org.uk/publication/research-and-data/regulatory-sandbox-lessons-learned-report.pdf> [<https://perma.cc/RZG7-9WZZ>].

396. *Id.* at 1.

397. *Id.*

398. *Id.* at ¶ 3.4.

399. *Id.*

400. *Regulatory Sandbox Lessons Learned Report*, *supra* note 395, at ¶ 1.1.

401. *Id.*

402. Walport et al., *FinTech Futures*, *supra* note 299 at 4, 47.

additional products and services to be tested at the same time as allowing the FCA to ensure that appropriate consumer protection standards are built into any new products and services.⁴⁰³ In designing its sandbox, the FCA considered the existing regulatory barriers have for firms, the need for consumer safeguards, and the legal constraints under EU or U.K. law. The FCA intended to create a new sandbox which would operate in a flexible manner with a range of options for firms subject to the specific eligibility criteria.⁴⁰⁴ The FCA would work with the industry to develop a virtual sandbox within which firms could test ideas without entering a real market, with a separate not-for-profit sandbox umbrella company also being set up with the assistance of the FCA.⁴⁰⁵

The FCA considered the various options available for applicant firms. Unauthorised firms could be made subject to a tailored authorisation process equivalent to the simplified banking procedure adopted by the FCA in January 2014.⁴⁰⁶ The FCA would provide restricted authorisation, although this would not replace the mobilisation process for banking applicants.⁴⁰⁷ Authorised firms and technology firms providing outsourced services could either operate through the use of a No Enforcement Action Letter (NAL), Individual Guidance (IG), or a Waiver.⁴⁰⁸ Four separate safeguard approaches were also identified by the FCA in its original consultation, with the FCA preferring an approach based on a case-by-case consent model subject to specific disclosure, protection, and compensation conditions imposed.⁴⁰⁹ The umbrella option may also be available with new platforms acting as appointed representatives of an industry established umbrella company.⁴¹⁰ Less onerous regimes operate outside the FSMA under the

403. *Regulatory Sandbox Lessons Learned Report*, *supra* note 395, at ¶ 1.1.

404. *Id.* at ¶ 1.1, 2.4.

405. *Regulatory Sandbox Lessons Learned Report*, *supra* note 395, at ¶ 1.3.

406. A revised application procedure was created for banks in January 2014. This operates on a dual-regulated basis with the PRA and FCA. Two options are made available with a revised form of the earlier procedure consisting of a pre-application stage, led by firm preparation, and a six month's application review conducted by the PRA and FCA. A separate simplified procedure is made available for smaller or other firms consisting of pre-application, assessment, and authorisation and then mobilisation. A shorter application is provided focusing on key elements, including business care, capital, liquidity, and senior appointments, with a separate mobilisation plan that allows the firm to be authorised with restriction and then to receive full authorisation once it has completed the third mobilisation phase. See *Banking Authorisation Process*, FIN. CONDUCT AUTH. 4 (Jan. 2015), <https://www.fca.org.uk/publication/corporate/banking-authorisation-process.pdf> [<https://perma.cc/NE8S-WBUD>].

407. *Regulatory Sandbox Lessons Learned Report*, *supra* note 395, at ¶ 3.12.

408. *Id.* at ¶ 3.13.

409. Approach (1) customer testing subject to informed consent; (2) FCA agreement on disclosure, protection, and compensation on case-by-case basis; (3) customers have same rights as those with fully authorised firms; and (4) sandbox firms must compensate customers for losses suffered. See *id.* at ¶¶ 3.15, 4.7–4.10.

410. The umbrella company would monitor start-ups operating as appointed representatives although this would not be available for all types of regulated business such as insurance underwriting and investment management. See *id.* at ¶¶ 3.15, 4.7–4.10.

Payment Services Regulations and Electronic Money Regulations.⁴¹¹ The FCA also considered recommending that the Government amend the Regulated Activities Order (RAO) to create a new regulated activity of “sandboxing” for testing or amending the waiver test to provide the FCA with more flexibility.⁴¹² The FCA rejected amending the Exemptions Order or “By Way of Business Order” specifically due to the more onerous nature of EU regulatory requirements that could not otherwise be disqualified to sandbox firms.⁴¹³

The Regulatory Sandbox operates using a number of specific sandbox tools including restricted authorisation, individual guidance, waivers, or modifications, and no enforcement action letters.⁴¹⁴ Firms apply under a simplified authorisation process with restricted authorisation or registration being provided to allow them to test their product ideas.⁴¹⁵ Individual guidance is provided on interpreting the regulatory obligations that apply in any specific case.⁴¹⁶ Waivers or modifications may also be permitted of unduly burdensome requirements, although the FCA cannot waive national or international law.⁴¹⁷ A No Enforcement Action Letter (NAL) may be issued in particular cases where this is considered necessary in regard to the circumstances and characteristics of the specific sandbox test.⁴¹⁸ No disciplinary action should follow, provided that the firm is open, remains within the testing parameters, and treats customers fairly. This would only apply with regard to FCA disciplinary action and only for the duration of test.

3. *Direct Support and Advice Unit*

The FCA operates a Direct Support Team that aids businesses considering applying for authorisation or permission variation, or that would otherwise benefit from support. The same criteria are applied based on genuine innovation, consumer benefit, background research, and need for support. A dedicated request form is provided.⁴¹⁹ The team can respond to inquiries, assist in preparation for authorisation, and apply for authorisation or provide ongoing support.⁴²⁰ The purpose of each of these is to promote innovation while the FCA uses the lessons learned to identify trends and potential issues at an early stage, including the need for possible policy and process changes.

411. *Id.* at ¶ 3.11.

412. *Id.* at ¶ 5.2.

413. *Id.* at ¶ 5.4.

414. *Regulatory Sandbox*, FIN. CONDUCT AUTH. (July 23, 2020), <https://www.fca.org.uk/firms/regulatory-sandbox> [<https://perma.cc/X5GD-W2FJ>].

415. *Id.*

416. *Id.*

417. See *Regulatory Sandbox Lessons Learned Report*, *supra* note 395, at ¶ 3.13.

418. *Id.*

419. *Request Innovation Hub Support*, FIN. CONDUCT AUTH. (May 13, 2020), <https://www.fca.org.uk/firms/innovation/direct-support> [<https://perma.cc/EQ2Y-TVWB>].

420. *Id.*

The FCA maintains a separate Advice Unit that provides regulatory feedback on developing automated models to deliver low cost advice and guidance to consumers.⁴²¹ This follows from the HM Treasury FCA review of the advice market, with a final report being published in March 2016.⁴²² The Financial Advice Market Review (FAMR) was launched in August 2015 to examine concerns in the market for financial advice within the United Kingdom.⁴²³ Specifically, the launch sought to examine possibilities that the Government, industry, and regulatory authorities could take on an individual or collective basis to promote the development of an advisory market that delivers affordable and accessible financial advice and guidance to everyone at all stages of their lives.⁴²⁴ There was an increasing need for individuals to assume responsibility for their financial decisions as those decisions became increasingly complex due to social and demographic adjustments with an aging population, changes in housing market, and employment market conditions.⁴²⁵ Additional pension flexibility had also been introduced in April 2015.⁴²⁶ The review examined the supply and demand for financial advice, barriers, and possible remedies. The Advice Unit focuses on FAMR areas including investments, pensions (accumulation and decumulation and protection), as well as automated (robo) models in the mortgage, general insurance, and debt sectors.⁴²⁷

Slightly revised eligibility criteria apply with the need to deliver low cost advice or lower cost guidance to unserved or underserved consumers, genuine consumer benefit, automated proposition, proposal clarity, specific sector relevance, and need for regulatory input.⁴²⁸ An initial meeting was held with the Advice Unit or other FCA areas if required to discuss the proposal. A dedicated point of contact is created for firms requiring ongoing engagement. Feedback is provided on the regulatory implications of the proposed model and assistance in making an appropriate application.⁴²⁹

4. *Regulatory Technology (RegTech)*

The FCA is separately committed to promoting innovation and technology in the compliance area. The FCA refers to RegTech as a subset of FinTech focusing on technologies that may facilitate the delivery of regulatory requirements more efficiently and effectively than existing

421. *Id.*

422. *Financial Advice Market Review: Final Report*, HM TREASURY & FIN. CONDUCT AUTH., 40 (Mar. 2016), <https://www.fca.org.uk/publication/corporate/famr-final-report.pdf> [<https://perma.cc/WT7M-6L7Y>].

423. *Id.* at 3.

424. *Id.*

425. *Id.*

426. *Id.*

427. *Id.* at 6.

428. *How to Prepare an Advice Unit Application*, FIN. CONDUCT AUTH. (Jan. 17, 2020), <https://www.fca.org.uk/firms/advice-unit/prepare-application> [<https://perma.cc/XE4Q-3NHH>].

429. *Id.*

capabilities.⁴³⁰ The FCA published a call for input on supporting the development and adoption of RegTech in November 2015.⁴³¹ The FCA accepts that firms have a substantially greater reporting obligation and have to comply with higher regulatory standards, especially following the global financial crisis with technology being able to help manage and reduce compliance costs.⁴³² The Government specifically announced in the 2015 Budget that the FCA would be asked to identify ways to support the adoption of RegTech with the PRA.⁴³³ The FCA met with over forty technology companies, trade bodies, consultancies, and academia to develop its understanding of FinTech, RegTech, and possible solutions. Key areas of interest included the use of technology accelerators for regulatory compliance and reporting, real-time and system embedded compliance/risk evaluation tools, big data techniques, visualisation and robo tools, software integration tools, and cloud technologies.⁴³⁴

The FCA identified four specific areas in which it considered that it could assist by providing regulatory expertise, supporting the emerging FinTech and RegTech environments, providing standards and guidance to deal with barriers to entry, and supporting innovation and adoption.⁴³⁵ The consultation asked for comment on five specific issues.⁴³⁶ The FCA held a number of bilateral meetings and four roundtables focusing on regulatory interface, improving effectiveness and efficiencies, and understanding the regulatory position.⁴³⁷ The FCA held a separate TechSprint and hackathon in April 2016.⁴³⁸ The TechSprint specifically focused on access to financial services with a separate event being held in November 2016 on unlocking

430. *Call for Input on Supporting the Development and Adopters of RegTech*, *supra* note 346, at ¶1.7.
 431. Work on Project Innovate forms part of the Government's wider plan to promote the United Kingdom and capitalise on the development and commercialisation of new financial business models and disruptive innovation to create a leading global FinTech hub. The United Kingdom is considered uniquely positioned due to the presence of a large and technologically sophisticated consumer base, its position as a world leading centre for financial services, excellent infrastructure, and position as a global trading hub. This is to be achieved by supporting innovation in financial technology and encouraging collaboration between Government, business, and academia. *Id.* at ¶¶ 1.2–1.3.

432. *Id.*

433. HM TREASURY, BUDGET 2015, *supra* note 243, at 53.

434. *Call for Input on Supporting the Development and Adopters of RegTech*, *supra* note 346, ¶ 1.7.

435. *Id.* ¶ 1.8.

436. (a) Which RegTech technologies could make it easier for firms to interact with regulatory authorities at a lower cost and administrative burden; (b) How the FCA could support the development and adoption of RegTech in financial services with the most suitable methods; (c) Whether any specific regulatory rules or policies be removed that act as barriers to innovation or RegTech adoption; (d) Whether any specific rules or policies be introduced to support innovation or RegTech adoption; and (e) Which regulatory compliance or reporting requirements could most benefit from RegTech. *Id.* at ¶ 2.1.

437. *Call for Input on Supporting the Development and Adopters of RegTech*, *supra* note 346, at ¶ 1.4.

438. Sharon Collard, et al., *Access to Financial Services in the UK*, (Fin. Conduct. Auth. Occasional Paper 17, May 2016) ¶ 4.5.8, <https://www.fca.org.uk/publication/occasional-papers/occasional-paper-17.pdf> [<https://perma.cc/4SZK-7GKQ>].

regulatory reporting, and a separate event in March 2017 on mental health.⁴³⁹

The response to the FCA's call for input confirmed agreement that it should adopt an active role in the RegTech area and that improved collaboration and engagement within the FinTech ecosystem would encourage the development of RegTech solutions and relations between regulatory authorities and firms.⁴⁴⁰ The FCA confirmed its desire to be fully engaged with the FinTech community and support the development and use of innovative technology, including through acting as a catalyst for further change while accepting its legal and regulatory limits and responsibilities.⁴⁴¹ The FCA continues to encourage innovation and development to identify opportunities for the adoption of new technologies supporting regulatory compliance and interface, engage internationally with FinTech firms to obtain access to other markets, and promote an industry in which consumers have an appropriate degree of protection and access to RegTech and FinTech advantages and benefits.⁴⁴²

5. *Engagement*

The FCA is committed to continuing to engage with U.K. firms within the City of London and on a regional basis.⁴⁴³ It also collaborates closely with other international authorities.⁴⁴⁴ A series of Cooperation Agreements and Frameworks have been entered into with other overseas agencies which include a referral mechanism to allow firms to enter each other's markets.⁴⁴⁵ This is subject to complying with the relevant eligibility criteria within the home country.⁴⁴⁶ Agreements have been specifically signed with Australia,⁴⁴⁷ Singapore,⁴⁴⁸ Hong Kong,⁴⁴⁹ Canada,⁴⁵⁰ and Japan⁴⁵¹ with other

439. See generally, *Consumer Access TechSprint*, FIN. CONDUCT AUTH., <https://www.fca.org.uk/events/techsprints/consumer-access-techsprint> [<https://perma.cc/AFN7-X9PT>]; *Unlocking Regulatory TechSprint*, FIN. CONDUCT AUTH., <https://www.fca.org.uk/events/techsprints/unlocking-regulatory-reporting-techsprint> [<https://perma.cc/S4TT-AQ9V>]; *Financial Services and Mental Health TechSprint*, FIN. CONDUCT AUTH., <https://www.fca.org.uk/events/techsprints/financial-services-and-mental-health-techsprint> [<https://perma.cc/PRY7-N793>].

440. *Call for Input on Supporting the Development and Adopters of RegTech*, *supra* note 346, at ¶ 5.5.

441. *Id.* at ¶ 5.6.

442. *Id.* ¶ 5.15.

443. See generally, *Innovate: Engagement*, FIN. CONDUCT AUTH. (Aug. 3, 2020), <https://www.fca.org.uk/firms/innovation/engagement> [<https://perma.cc/7VK8-NXT2>].

444. *Id.*

445. *Id.*

446. *Id.*

447. Innovation Hubs Co-operation Agreement Between Financial Conduct Authority (FCA) and Australian Securities and Investments Commission (ASIC), Aus.-U.K., Mar. 23, 2016, <https://www.fca.org.uk/publication/mou/fca-asic-cooperation-agreement.pdf> [<https://perma.cc/EUU7-3Q8P>].

448. Co-operation Agreement Between Financial Conduct Authority (FCA) and Monetary Authority of Singapore (MAS), Sing.-U.K., May 11, 2016, <https://www.fca.org.uk/publication/mou/fca-monetary-authority-of-singapore-co-operation-agreement.pdf> [<https://perma.cc/WKT9-ARNE>].

information sharing agreements being signed with Korea⁴⁵² and China.⁴⁵³ The Cooperation Agreements generally set out their purpose,⁴⁵⁴ principles,⁴⁵⁵ and scope of assistance⁴⁵⁶ as well as confidentiality and permissible uses⁴⁵⁷ and duration or term.⁴⁵⁸

449. Co-operation Agreement Between Financial Conduct Authority (FCA) and Hong Kong Monetary Authority (HKMA), Hong Kong Special Administrative Region, H.K.-U.K., Dec. 7, 2016, <https://www.fca.org.uk/publication/mou/fca-hkma-co-operation-agreement.pdf> [<https://perma.cc/5QPV-KPYK>].

450. Co-operation Agreement Between Financial Conduct Authority (FCA) and Ontario Securities Commission (OSC), Can.-U.K., Feb. 22, 2017, <https://www.fca.org.uk/publication/mou/fca-osc-co-operation-agreement.pdf> [<https://perma.cc/29R7-NSNA>].

451. Letter from Shunsuke Shirakawa, Vice Comm'r for Int'l Affairs Fin. Servs. Agency Japan, to Christopher Woolard, Dir. Strategy & Competition & Member Bd. Fin. Conduct Auth. *in Exchange of Letters on Co-operation Framework Between the Financial Services Agency of Japan and the Financial Conduct Authority*, FIN. CONDUCT AUTH., <https://www.fca.org.uk/publication/mou/exchange-letter-jfsa-fca.pdf> [<https://perma.cc/P9PD-MMKC>].

452. Co-operation Agreement Between Financial Conduct Authority (FCA) and the Financial Services Commission (FSC), S. Kor.-U.K. (June 27, 2018), <https://www.fca.org.uk/publication/mou/fca-korean-fsc-co-operation-agreement.pdf> [<https://perma.cc/9JPY-5XCC>].

453. Co-operation Agreement Between Financial Conduct Authority (FCA) and the People's Bank of China (PBOC), China-U.K. (Nov. 11, 2016), <https://www.fca.org.uk/publication/mou/fca-pboc-co-operation-agreement.pdf> [<https://perma.cc/JK8T-NYP5>].

454. The purpose is generally to provide a framework for cooperation and referrals between the Innovation Hubs of each authority with a central referral mechanism and terms for the sharing and use of financial innovation information in their markets. Innovation Hubs Co-operation Agreement Between Financial Conduct Authority (FCA) and Australian Securities and Investments Commission (ASIC), *supra* note 447, at ¶ 3.1.

455. The authorities generally intend to provide the fullest mutual assistance to each other with the agreements operating subject to domestic laws and regulations. To this extent, they contain a statement of intent and do not create enforceable rights which are legally binding and do not amend any separate Memorandum of Understanding entered between the relevant authorities. *Id.* ¶ 4.1.

456. The Cooperation Agreements generally provide for a referral mechanism and information sharing. The authorities undertake to refer to each other through their Innovation Hubs innovator businesses that would like to enter both markets with referrals being made in writing including necessary information to allow the authority to determine that it satisfies the referring authority's Criteria for Support. It is accepted that applicants are not automatically authorised and that they still have to comply with the full authorisation processes in each jurisdiction. The authorities undertake to share information on emerging market trends and developments, regulatory issues relating to financial services innovation, and any further information on the specific innovator businesses subject to referral. *Id.* ¶¶ 5.1–5.6.

457. Any information exchange will be treated as confidential by the other authority with information on a specific business only being included subject to consent. Information is only to be used for the purpose of providing assistance to the business through the Innovation Hub and ensuring compliance with relevant laws. Information is only to be used for the purpose for which it was referred unless separate consent is provided. If any disclosure is required under law, the authority will notify the other authority. *Id.* at ¶¶ 6.1–6.5.

458. *Id.* at ¶ 7.1.

B. PROJECT ADVANTAGES

A number of advantages can be identified in support of Innovation Hubs and Regulatory Sandboxes specifically. These generally relate to the eight sets of interests identified previously consisting of technology, applicant businesses, users and stakeholders, markets, governance and control, infrastructure, central banking and government policy, and overall financial stability. Regulatory support innovations in the FinTech area can assist in promoting technological testing and advancement and new business model testing and advancement, reducing the time and cost to market entry,⁴⁵⁹ providing new business funding,⁴⁶⁰ increasing consumer choice and service quality,⁴⁶¹ increasing consumer safety and security, increasing consumer privacy and data protection, increasing domestic and cross-border competition,⁴⁶² innovation,⁴⁶³ governance, and oversight,⁴⁶⁴ strengthening infrastructure, possibly supporting central bank and government policies (including in the areas of monetary, economic, fiscal, taxation, and welfare provision), and increasing overall financial stability. Innovation Hubs and Regulatory Sandboxes can reduce application and compliance costs⁴⁶⁵ and legal risks⁴⁶⁶ through additional support and assistance being provided to

459. *Regulatory Sandbox Lessons Learned Report*, *supra* note 321, at ¶ 1.1.

460. *Id.* at ¶¶ 1.1, 2.11.

461. This could bring better outcomes for consumers through increased product and service range, reduced costs, and improved access. *Id.* at ¶ 4.2. This will also ensure the adoption of appropriate consumer protection safeguards. *Id.* at ¶ 1.1. The risk of consumer detriment should be limited. *Id.* at ¶ 2.6.

462. Many cities are using financial technology to promote their status as an international financial centre. *See, e.g.*, Harriet Baldwin, Economic Secretary, Address at Conduct Authority Robo-Advice Conference (Sept. 30, 2015), in ‘Our Ambition Is Now to Be the Leading FinTech Centre in the World’ Says Harriet Baldwin, GOV.UK (Sept. 30, 2015), <https://www.gov.uk/government/speeches/our-ambition-is-now-to-be-the-leading-fintech-centre-in-the-world-says-harriett-baldwin> [<https://perma.cc/HGV5-59FS>].

463. *See, e.g.*, Alasdair Smith et al., *Retail Banking Market Investigation: Final Report*, COMPETITION & MKTS. AUTH., at xii (Aug. 9, 2016), <https://assets.publishing.service.gov.uk/media/57ac9667e5274a0f6c00007a/retail-banking-market-investigation-full-final-report.pdf> [<https://perma.cc/KB3D-E76D>].

464. *Regulatory Sandbox Lessons Learned Report*, *supra* note 395, at ¶ 4.2.

465. Having to obtain a full license can act as a significant disincentive and barrier to entry. *See, e.g.*, Response from Jason Albert, Assistant General Counsel, Regul. Affairs, Microsoft Corp., to Thomas Curry, Comptroller Currency, Off. Comptroller Currency, Re: Comments on Supporting Responsible Innovation in The Federal Banking System: An OCC Perspective (May 31, 2016), <https://occ.gov/topics/supervision-and-examination/responsible-innovation/comments/microsoft-response-occ-innovation.pdf> [<https://perma.cc/HR7N-LHV8>]. Only a handful of new banking licenses were issued in the United States between 2008 and 2017. Subas Roy, *Analysis: RegTech in the US – The State We Are in*, FINTECH FUTURES (July 24, 2017), <http://www.bankingtech.com/895941/analysis-regtech-in-the-us-the-state-we-are-in> [<https://perma.cc/HNT7-PKAU>].

466. *See, e.g.*, Jon Marino, *Banks and Start-ups Debate Regulation*, CNBC (June 6, 2016), <http://www.cnbc.com/2016/06/06/banks-and-start-ups-debate-regulation.html> [<https://perma.cc/Y53Y-Q86W>]. Legal risk can also act as a barrier in requiring parties to understand and avoid

start-up firms. Such support is important to existing firms updating legacy systems as well as new start-ups.⁴⁶⁷ Innovative regulatory support can also promote economic development⁴⁶⁸ because financial institutions can more easily discuss ideas with technology firms.⁴⁶⁹ Such innovations can also assist the authorities in understanding market change in development, technological challenges, risk exposure, possible regulatory solutions, and gaps in legal and regulatory coverage.⁴⁷⁰

C. PROJECT DISADVANTAGES

Several corresponding disadvantages also arise that have to be considered. These include possible limited technological development at this stage, high test conditions and eligibility criteria, business preference for an unlevel playing field, unfair competition, possible shadow banking increase,⁴⁷¹ possibly limited control and oversight, potential infrastructure damage and policy conflict, limited support and regulatory outcomes, regulatory fragmentation,⁴⁷² increased moral hazard⁴⁷³ and risk taking, and weakened overall financial stability. Concerns may also arise with regard to potential

confusion in agreeing to relevant contract terms and conditions. AMAR BHIDÍ, *A CALL FOR JUDGEMENT: SENSIBLE FINANCE FOR A DYNAMIC ECONOMY* 61 (2010).

467. Transfer costs can act as a significant hurdle for bank digitalisation. *See generally, Accelerating the Pace and Impact of Digital Transformation: Full Report*, HAR. BUS. REV., (2016), <https://hbr.org/resources/pdfs/comm/genpact/AcceleratingPaceAndImpactofDigitalTransformation.pdf> [<https://perma.cc/6WHW-9C6Y>].

468. The creation of a regulatory sandbox was approved by the World Bank in Jordan. World Bank, *Promoting Financial Inclusion Policies and Regulations in Jordan: Integrated Safeguards Data Sheet Identification / Concept Stage (ISDS)*, at 4, Report No: ISDSC21700 (Apr. 4, 2017), <http://documents1.worldbank.org/curated/en/882131491409011040/pdf/IL-AISISDS-CP-P163719-04-05-2017-1491408996196.pdf> [<https://perma.cc/W6YW-UQBX>]. On financial inclusion, *see* Global Partnership for Fin. Inclusion [GPII], *G20 High-Level Principles for Digital Financial Inclusion* (2016), <https://www.gpfi.org/sites/gpfi/files/documents/G20%20High%20Level%20Principles%20for%20Digital%20Financial%20Inclusion%20-%20Full%20version-.pdf> [<https://perma.cc/HA5U-X2UR>].

469. *See generally*, Khairani Afifi Noordin, *FinTech: Regulatory Sandbox Allows Players to Innovate and Compete*, EDGE MALAYSIA (July 18, 2017, 11:30 AM), <https://www.theedgemarkets.com/article/fintech-regulatory-sandbox-allows-players-innovate-and-compete> [<https://perma.cc/UYL9-7UL2>].

470. Commentators have noted, for example, that regulatory misunderstanding in the United States led to an overregulation of person-to-person lending in 2011. *See, e.g.*, Andrew Verstein, *The Misregulation of Person-to-Person Lending*, 45 U.C. DAVIS L. REV. 445, 445 (2011).

471. Shadow banking was used by Paul McCulley, Pimco, to refer to high risk off-balance sheet vehicles attached to banks in 2007. *See, e.g.*, Roy Girasa, *Shadow Banking: Nature, Regulation, and Developments*, 35 NO. 12 BANKING & FIN. SERVICES POL'Y REP. 1, 1 (2016); *see also*, Greg Buchak et al., *Fintech, Regulatory Arbitrage, and the Rise of Shadow Banks* 1 (NBER Working Paper Series No. 23288, Sept. 2018), <https://www.nber.org/papers/w23288.pdf> [<https://perma.cc/33H3-5MM7>]; Ryan M. Nash & Eric Beardsley, *The Future of Finance: The Rise of the New Shadow Bank*, GOLDMAN SACHS, 3 (Mar. 3, 2015), https://www.betandbetter.com/photos_forum/1425585417.pdf [<https://perma.cc/NBY2-X59S>].

472. *See, e.g.*, Kathryn Judge, *Fragmentation Nodes: A Study in Financial Innovation, Complexity, and Systemic Risk*, 64 STAN. L. REV. 657, 660–61 (2012).

indecision⁴⁷⁴ and bias.⁴⁷⁵ These may not necessarily arise and represent concerns or challenges that have to be dealt with through appropriate responses both generally and in specific cases.

The United States, China, and Germany have resisted establishing regulatory sandboxes to date.⁴⁷⁶ U.S. regulators have expressed concerns with regard to regulatory fairness.⁴⁷⁷ Germany has a substantial FinTech market and attracts significant investment in this area.⁴⁷⁸ The German Federal Financial Supervisory Authority (BaFin) expressed concerns that regulatory sandboxes may specifically be contrary to their policy on treating the same businesses equally and that preferential treatment may not benefit consumers.⁴⁷⁹ China, nevertheless, has a significant FinTech presence⁴⁸⁰ and has entered into a Cooperation Agreement with the U.K. FCA on referral support.⁴⁸¹ Difficulties may arise with regard to heuristics in monitoring⁴⁸²

473. Moral hazard creates incentives for investors to act without proper care. See, e.g., George A. Akerlof, *The Market for "Lemons": Quality Uncertainty and the Market Mechanism*, 84 Q. J. OF ECON. 488, 488 (1970). This may also induce investors to take additional risk. PETER L. BERNSTEIN, *AGAINST THE GODS: THE REMARKABLE STORY OF RISK* 335–36 (1996).

474. BHIDE, *supra* note 466, at 30–31.

475. See, e.g., Ben Lee & Germaine Lau, *Regulatory Sandbox: Harmonizing New Tech and Old Rules?*, EJINSIGHT (Aug. 2, 2016, 5:56 PM), <https://www.ejinsight.com/eji/article/id/1357584/20160802-regulatory-sandbox-harmonizing-new-tech-and-old-rules> [<https://perma.cc/M6GR-DJ5Z>].

476. Lalita Clozel, *OCC's Curry Rules Out 'Safe Space' for Fintech Companies*, AM. BANKER, 1 (Nov. 3, 2016, 3:44 PM), <https://www.americanbanker.com/news/occs-curry-rules-out-safe-space-for-fintech-companies> [<https://perma.cc/6QYQ-CM7J>].

477. Lee & Lau, *supra* note 475; Carsten Kociok, *Financial Services: No "Sandbox" in Germany*, VII NAT'L L. R. 117 (Apr. 27, 2017), <https://www.natlawreview.com/article/financial-services-no-sandbox-germany> [<https://perma.cc/KW7A-YHR7>]; Chen Jia, *Regulators Act to Avoid Risks from Digitalized Products*, CHINA DAILY (Jan. 8, 2020, 6:52 AM), <https://www.chinadaily.com.cn/a/202001/08/WS5e150bc7a310cf3e35583112.html> [<https://perma.cc/QHZ9-FYMB>].

478. Oscar Williams-Grut, *German Fintech Startups Raised 80% More Than British Ones in the Second Quarter*, BUS. INSIDER (Aug. 17, 2016, 11:00 AM), <http://uk.businessinsider.com/kpmg-cb-insights-fintech-funding-q2-germany-overtakes-uk-2016-8?international=true&r=UK&irt> [<https://perma.cc/JHS4-CV9N>]; see also Lee & Lau, *supra* note 475; Chang-Hsien Tsai & Kuan-Jung Peng, *The FinTech Revolution and Financial Regulation: The Case of Online Supply-Chain Financing*, 4 ASIAN J. L. & SCI. 109, 116 (2017).

479. *Federal Financial Supervisory Authority: Annual Report*, BAFIN 40–41 (2015), https://www.bafin.de/SharedDocs/Downloads/EN/Jahresbericht/dl_jb_2015_en.html [<https://perma.cc/Q5RZ-8LE4>].

480. China is reported to have the largest number of unicorns in the world. Nina Xiang, *It's the Age of Unicorns. And Here's How China Is Ranking*, WORLD ECON. F. (July 7, 2017), <https://www.weforum.org/agenda/2017/07/its-the-age-of-unicorns-and-heres-how-china-is-ranking> [<https://perma.cc/P97A-APFL>].

481. *The UK and China Have Reached a New Fintech Agreement*, BUS. INSIDER (Nov. 14, 2016, 5:43 PM), <https://www.businessinsider.com/the-uk-and-china-have-reached-a-new-fintech-agreement-2016-11> [<https://perma.cc/B6ZD-FK54>].

482. Alp Simsek, *Speculation and Risk Sharing with New Financial Assets*, 128 Q.J. ECON. 3 at 1365 (2013); Markus K. Brunnermeier et al., *A Welfare Criterion for Models with Distorted Beliefs*, 6 (Nat'l Bureau of Econ. Rsch., Working Paper No. 20691, 2014), <https://www.nber.org/papers/w20691.pdf> [<https://perma.cc/G9RG-2DYX>].

and with regard to regulatory conflicts.⁴⁸³ It may be considered more appropriate to provide assistance through formal legal rather than experimental regulatory means.⁴⁸⁴ New start-ups and incumbents can also cooperate—although difficulties may remain in terms of compliance culture and competitive strategies.⁴⁸⁵ Short-term test results may not assist design effective, long-term solutions,⁴⁸⁶ and the authorities may also not be able to transfer the results to an effective new legal and regulatory regime.⁴⁸⁷ Domestic responses may also not resolve more substantial cross-border issues including identifying the most appropriate regulatory authority and applicable law and regulation.⁴⁸⁸ Further, the availability of hubs and sandboxes may encourage arbitrage and forum shopping.⁴⁸⁹

Application costs and uncertainties can cause substantial difficulties and act as barriers to entry.⁴⁹⁰ This may result in substantial opportunity costs for firms.⁴⁹¹ Uncertain procedures in timelines may cause planning difficulties.⁴⁹²

More general difficulties also arise with other issues applicable to FinTech. These include technological and operational risks and a potential lack of

483. *Blurred Lines: How Fintech Is Shaping Financial Services*, PwC 27–28 (Mar. 2016), https://www.pwc.com/il/en/home/assets/pwc_fintech_global_report.pdf [<https://perma.cc/48UP-3Y93>]; Richard Aspinwall, *Conflicting Objectives of Financial Regulation*, 36 CHALLENGE 6, 53 (1993); cf. Evan Davis & Stephanie Flanders, *Conflicting Regulator Objectives: The Supply of Gas to UK Industry*, REGUL. CHALLENGE 1, 43 (Matthew Bishop et al., 1995) (demonstrating how different government objectives may also conflict).

484. Andrew Meola, *China Just Hinted It Could Increase Fintech Regulation*, BUS. INSIDER (June 29, 2016, 5:59 PM), <https://www.businessinsider.com/china-just-hinted-it-could-increase-fintech-regulation-2016-6?r=UK> [<https://perma.cc/K4KC-HZ9U>]; see also *Federal Financial Supervisory Authority: Annual Report*, supra note 479, at 40–41.

485. Inna Romanova & Marina Kudinska, *Banking and Fintech: A Challenge or Opportunity*, 98 CONTEMP. STUD. ECON. & FIN. ANALYSIS 29 (2017).

486. EMILIOS AVGOULEAS, REGULATING FINANCIAL INNOVATION 685 (Niamh Moloney et al. eds., 2015).

487. Connell O’Neill et al., *Innovate or Stagnate: The Race to Regulate Fintech in Asia Pacific*, ALLEN & OVERY (Nov. 30, 2016), <https://www.allenoverly.com/en-gb/global/news-and-insights/publications/innovate-or-stagnate-the-race-to-regulate-fintech-in-asia-pacific> [<https://perma.cc/S85Q-YJ6G>].

488. Michelle Dy, *The Challenges to Cross-Border Financial Regulation in the Post-Financial Crisis Era: Conference Report*, NAT’L U. SING., at 2, Report. No. CBFL-Rep_MD1 (Aug. 2016), https://law.nus.edu.sg/cbfl/pdfs/reports/CBFL-Rep_MD1.pdf [<https://perma.cc/CZ8F-E6TK>].

489. See, e.g., Thomas O. McGarity, *Multi-Party Forum Shopping for Appellate Review of Administrative Action*, 129 U. PA. L. REV. 302, 304 (1980); Markus Petsche, *What’s Wrong with Forum Shopping? An Attempt to Identify and Assess the Real Issues of a Controversial Practice*, 45 INT’L LAW. 1005, 1006 (2011).

490. Markus Gnirck, *Asian Fintech Sandboxes—Can They Work And Do We Need Them?*, FORBES (Sept. 27, 2016, 10:00 PM), <https://www.forbes.com/sites/gnirckmarkus/2016/09/27/asian-fintech-sandboxes-can-they-work-and-do-we-need-them/#3b92ab0e1845> [<https://perma.cc/VZG9-47M9>].

491. *Id.*

492. Applications are considered on an individual basis in Hong Kong which can cause significant uncertainty. *Id.*

effective governance.⁴⁹³ Difficulties may also arise with regard to criminal activity, fraud, and money laundering.⁴⁹⁴ Issues may arise with regard to taxing relevant issues and limiting tax avoidance.⁴⁹⁵ Separate issues arise with regard to data privacy and protection.⁴⁹⁶ Concerns also arise with regard to data security and the ability of companies to withstand hacking attacks.⁴⁹⁷ Difficulties, as noted, may also arise with regard to fragmented markets⁴⁹⁸ and distorted competition.⁴⁹⁹

A regulatory sandbox specifically must prepare firms for the regulated market or it will fail.⁵⁰⁰ Regulatory authorities must cooperate in promoting financial innovation such as with the U.K. Regulatory Innovation Plan involving the Bank of England, Payment Systems Regulator, and the FCA and PRA.⁵⁰¹ Authorities must specifically balance promoting competition

493. Angela Walch, *The Bitcoin Blockchain as Financial Market Infrastructure: A Consideration of Operational Risk*, 18 N.Y.U. J. LEGIS. & PUB. POL'Y 837, 893 (2015); Misha Tsukerman, *Block Is Hot: A Survey of the State of Bitcoin Regulation and Suggestions for the Future*, 30 BERKLEY TECH. L.J. 1127, 1128 (2015).

494. *FATF Report: Virtual Currencies: Key Definitions and Potential AML/CFT Risks*, FIN. ACTION TASK FORCE 3, 9 (June 2014), <https://www.fatf-gafi.org/media/fatf/documents/reports/Virtual-currency-key-definitions-and-potential-aml-cft-risks.pdf> [https://perma.cc/BVCG-UMPD].

495. See, e.g., Aleksandra Bal, *How to Tax Bitcoin?*, in *HANDBOOK OF DIGITAL CURRENCY: BITCOIN, INNOVATION, FINANCIAL INSTRUMENTS, AND BIG DATA* 267, 271–72 (David Lee Kuo Chuen ed. 2015).

496. See generally, YAMAN AKDENIZ, *THE INTERNET, LAW AND SOCIETY* 3 (2000). The FTC in the United States has secured convictions against lenders selling consumers' sensitive financial data. See Complaint at 2, *FTC v. Sitesearch Corp.*, (2014) (No. 2:14-cv-02750-NVM), <https://www.ftc.gov/system/files/documents/cases/141223leaplabcmt.pdf> [https://perma.cc/ZL27-Y6C9]; see also Complaint at 3, *FTC v. Sequoia One LLC*, (2015) (No. 2:15-cv-01512), <https://www.ftc.gov/system/files/documents/cases/150812sequoiaonecmt.pdf> [https://perma.cc/D7VZ-TGBU].

497. See Ben Stobart, *It's Time to Think Differently About Cyber Security*, *WORLD ECON. F.* (June 22, 2017), <https://www.weforum.org/agenda/2017/06/how-to-win-the-cyber-war/> [https://perma.cc/DSV5-R3YU].

498. Markus Baldauf & Joshua Mollner, *Trading in Fragmented Markets*, *J. FIN. & QUANTITATIVE ANALYSIS* 1 (Stanford Institute for Econ. Policy Rsch. Working Paper No. 19-034, 2019), <https://siepr.stanford.edu/sites/default/files/publications/19-034.pdf> [https://perma.cc/5XNE-XGFC].

499. See Iris H-Y Chiu, *Fintech and Disruptive Business Models in Financial Products, Intermediation and Markets-Policy Implications for Financial Regulators*, 21 *J. TECH. L. & POL'Y* 55, 99.

500. Christopher Woolard, Exec. Dir. Strategy & Competition Fin. Conduct Auth., Address Before the Innovative Financial Global Summit (Apr. 10, 2017), in *Innovating for the Future: The Next Phase of Project Innovate*, FIN. CONDUCT AUTH., (Apr. 10, 2017), <https://www.fca.org.uk/news/speeches/innovating-future-next-phase-project-innovate> [https://perma.cc/YS9C-CT7F] (stating that a "... sandbox that fails to prepare firms to join the regulated market will not foster firms that succeed long-term") [hereinafter "Woolard 2017 Speech"].

501. *Regulatory Innovation Plan*, HM TREASURY 3 (Apr. 2017), https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/606953/HM_Treasury_Regulatory_Innovation_Plan.pdf [https://perma.cc/2BVJ-G23H]. The FCA set up a New Bank Start-Up Unit (NBSU) in January 2016. This does not involve any "experimental box." See *News Release – New Bank Start-up Unit Launched by the Financial Regulators*, BANK ENG. (Dec. 31,

and protecting market stability.⁵⁰² If international authorities, such as the Financial Stability Board (FSB), wish to promote financial innovation and the adoption of new technology in a safe and stable manner, they could consider developing appropriate international standards in the FinTech and RegTech areas. Once there was sufficient agreement on this, these could also be elevated to a form of new core principles for either FinTech or RegTech or both. The content of these would generally focus on many of the existing points of advantage discussed in this paper. This would include promoting technological efficiency, start-up or incumbent support, user and stakeholder interest, market competition and innovation, transparency and good governance, infrastructure integration, central bank and government policy consistency, and overall financial stability.⁵⁰³ These could be expanded with further sub-rules or guidance for specific application in the FinTech and RegTech areas.

The objective of this work would not be to advance any particular country's or financial centre's position. It would rather be to promote the safe adoption and continued development of technology in support of efficient and cost effective and high quality financial services delivery within a secure infrastructure and stable wider environment.⁵⁰⁴ Global failure or scandals could result in a further collapse in trust and reputation.⁵⁰⁵ The FCA specifically has been attempting to construct a common understanding of relevant principles of good innovation that can benefit stronger international cooperation and secure a successful longer term industry future with the FCA working with other national authorities and at the G10 and IOSCO levels.⁵⁰⁶ The overall objective must be to support innovation and competition in a responsible and contained rather than aggressive and uncoordinated manner with the risk to financial stability that could generate.⁵⁰⁷

D. INTERNATIONAL STANDARDS AND CORE PRINCIPLES

International authorities have examined specific aspects of new technological change in development. This has included the Basel

2018), <https://www.fca.org.uk/news/press-releases/new-bank-start-unit-launched-financial-regulators> [<https://perma.cc/EJ2L-U2FC>].

502. George A. Walker, *Financial Technology Law – A New Beginning and a New Future*, 50 INT'L L. 137, 186 (2017); Victor Fleischer, *Regulatory Arbitrage*, 89 TEX. L. REV. 227, 227 (2010); Frank Partnov, *Financial Derivatives and the Costs of Regulatory Arbitrage*, 22 J. CORP. L. 211, 255 (1997).

503. See discussion *infra* Section V.3.B.

504. Christopher Woolard warned against the international development of a “Wild West” condition in promoting innovation across different jurisdictions with separate sandboxes. Woolard also noted that firms must be prepared to join the regulated market longer term. See Woolard 2017 Speech, *supra* note 500.

505. *Id.*

506. *Id.*

507. *Id.*

Committee on Banking Supervision's work on electronic banking and FinTech⁵⁰⁸ and IOSCO's examination of various important new securities related activities including algorithmic trading, high frequency trading, and electronic markets and exchanges.⁵⁰⁹ Little attention focused at an early stage on FinTech more generally. The Financial Stability Board (FSB) was reported to produce an unofficial report on this in early 2016, although this was delayed.⁵¹⁰ Speeches have been issued by important officials,⁵¹¹ although without creating any clear and consistent international policy framework.⁵¹²

Any regulatory response has to benefit market function with market control.⁵¹³ Various approaches could be adopted to FinTech, including through the adoption of more generous and supportive or strict and conditional regimes.⁵¹⁴ This may also be law and regulation or more general practice-based standards.⁵¹⁵ A more generous approach would support financial innovation without substantial obligation.⁵¹⁶ Care, nevertheless, has to be exercised to avoid private-market hesitation and risk aversion,⁵¹⁷ as well as official regulatory inertia.⁵¹⁸

508. Basel Comm. on Banking Supervision, *Sound Practices: Implications of Fintech Developments for Banks and Bank Supervisors*, BANK FOR INT'L SETTLEMENTS (Feb. 2018), <https://www.bis.org/bcbs/publ/d431.pdf>.

509. See INT'L ORG. OF SEC. COMM'N, IOSCO RESEARCH REPORT ON FINANCIAL TECHNOLOGIES (FINTECH), 28 (Feb. 2017), <https://www.iosco.org/library/pubdocs/pdf/IOSCOPD554.pdf> [<https://perma.cc/3D45-ZBFJ>].

510. Press Release, Joe Perry, Fin. Stability Bd., FSB Publishes Second Progress Report on Measures to Reduce Misconduct Risk, (Sept. 1, 2016), <https://www.fsb.org/2016/09/fsb-publishes-second-progress-report-on-measures-to-reduce-misconduct-risk/> [<https://perma.cc/6CQX-YBM3>].

511. See, e.g., Carney, *supra* note 21.

512. See generally *id.*

513. *Contra* CHARLES GOODHART ET AL., FINANCIAL REGULATION: WHY, HOW, AND WHERE NOW? 14 (Routledge 1998); *contra* EMILIOS AVGOULIEAS, REGULATING FINANCIAL INNOVATION, IN OXFORD HANDBOOK OF FINANCIAL REGULATION 683, 688 (Niamh Moloney et al. eds. 2015).

514. Different models can be distinguished. For example, these could include: A Rule-based or Principle-based system; Agile and Iterative rule making; Pilot and Trial; Engagement and Enforcement; Industrial Standards and Consumer/Investor Advocate; Sunset Provision; or Regulatory Harmonisation. Chris Brummer & Daniel Gorfine, *FinTech: Building a 21st Century Regulator's Toolkit*, MILKEN INSTITUTE CTR. FOR FIN. MKTS. (Oct. 2014), <https://assets1b.milkeninstitute.org/assets/Publication/Viewpoint/PDF/3.14-FinTech-Reg-Toolkit-NEW.pdf> [<https://perma.cc/C6MD-ZT95>].

515. See Nathan Cortez, *Regulating Disruptive Innovation*, 29 BERKELEY TECH. L.J. 175, 202 (2014).

516. Douglas W. Arner et al., *The Evolution of FinTech: A New Post-Crisis Paradigm*, 47 GEO. J. INT'L L. 1271, 1309 (2016).

517. Iris H-Y Chiu, *FinTech and Disruptive Business Models in Financial Products, Intermediation and Markets-Policy Implications for Financial Regulators*, 21 J. OF TECH. L. & POLICY 55, 63 (2016).

518. Cortez, *supra* note 515, at 202.

E. GLOBAL SANDBOX

A number of other regulatory authorities have established regulatory sandboxes in other countries. Around twenty sandboxes have been created, including within the United Kingdom, with five other sandboxes proposed.⁵¹⁹ The EU Commission has conducted some discussion regarding relevant issues, including possibly creating an EU level regulatory sandbox.⁵²⁰ The FCA proposed establishing a “global sandbox” in February 2018.⁵²¹ It was later announced that eleven regulatory authorities and organisations would establish a Global Financial Innovation Network (GFIN) on August 7, 2018 with the GFIN to be formally launched in January 2019.⁵²² A draft Mission Statement was provided.⁵²³ The GFIN would create a network of regulatory authorities and carry out joint policy work and regulatory trials with cross-border trials.⁵²⁴ The GFIN would be self-sustaining and independent of any specific organisation with members contributing necessary staff resources working in collaboration with authorities, innovative companies and other stakeholders, and academia.⁵²⁵ It had been agreed in August 2018 to rename the global sandbox “the GFIN.”⁵²⁶ The GFIN established a Coordination Group, which meets twice

519. Sandboxes are operational in Canada, The Netherlands, Denmark, Russia, Hong Kong, Singapore, Brunei, Indonesia, Australia, Malaysia, Thailand, Mauritius, Bahrain, United Arab Emirates (UAE), UAE/Dubai, Saudi Arabia, Jordan, Sierra Leone, Switzerland, and the United Kingdom. It is proposed that sandboxes are established in South Korea, Japan, Taiwan, India, and the State of Arizona in the United States. Eggers et al., *supra* note 11, at 13.

520. *Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions, Europe's Next Leaders: The Start-Up and Scale-Up Initiative*, at 9, COM (2016) 733 final (Nov. 2016).

521. Fifty responses were received with the feedback focusing on regulatory cooperation, regulatory engagement, speed, governance and emerging technologies and business models. *Global Financial Innovation Network (GFIN) Consultation Document*, FIN. CONDUCT AUTH., 4 (Aug. 2018), <https://www.fca.org.uk/publication/consultation/gfin-consultation-document.pdf> [<https://perma.cc/5Q7V-RCAN>].

522. Press Release, Fin. Conduct Auth., FCA Collaborates on New Consultation to Explore the Opportunities of a Global Financial Innovation Network (Aug. 7, 2018), <https://www.fca.org.uk/news/press-releases/fca-collaborates-new-consultation-explore-opportunities-global-financial-innovation-network> [<https://perma.cc/7MDJ-NQL9>]; *Global Financial Innovation Network (GFIN)*, FIN. CONDUCT AUTH. (Aug. 21, 2020), <https://www.fca.org.uk/firms/innovation/global-financial-innovation-network> [<https://perma.cc/SC4W-Z8RB>].

523. The GFIN would be established as a collaborative policy and knowledge-sharing initiative to advance financial integrity, consumer wellbeing and protection, financial inclusion, competition, and financial stability through innovation and financial services by sharing experiences, working jointly on emerging policy issues, and facilitating responsible cross-border experimentation of new ideas. Press Release, Fin. Conduct Auth., *supra* note 522.

524. *Id.*

525. *Id.* at 7.

526. Thirty-five authorities had joined by June 2019 with seven observers. *Global Financial Innovation Network, GFIN – One Year On*, GLOB. FIN. INNOVATION NETWORK 3 (2019), <https://static1.squarespace.com/static/5db7cdf53d173c0e010e8f68/t/5dbfaaca6b4e151deddc42ae/1572842207667/GFIN-One-year-on-FINAL-20190612+%28CLEAN+VERSION%29.pdf> [<https://perma.cc/Y7NM-PB5S>].

a year, to determine strategic direction with other member led workstreams focusing on cross-border testing, collaboration, and regulatory trials and lessons.⁵²⁷ A number of lessons were learned from the first year of operation,⁵²⁸ with the GFIn summarising its reflections by using the letters in its name to focus on growth, be flexible, adaptable, innovative, and inclusive, and strengthen its network of authorities.⁵²⁹ Forty-four firms applied to participate in the first cross-border testing with eight selected.⁵³⁰

VI. New Regulatory Model

A number of important initiatives have already been adopted with the development of RegTech to date.⁵³¹ This has emerged as an important regulatory tool within a larger supportive environment of Innovation Hubs and Regulatory Sandboxes.⁵³² These have encouraged the development of new business models and solutions to assist and refine specific products and services within a safe and compliant regulatory framework.⁵³³ This has benefited entrepreneurs, as well as consumers, to assist authorities in understanding market changes and technological opportunity and adjusting current regulatory requirements accordingly.

This, nevertheless, represents a relatively small and specialist area of financial-market activity. The longer-term, potential value is to extract many of the most exciting lessons and potential new tools and techniques and apply these more generally across traditional financial sectors and markets. It may then be possible to construct a new RegTech 3.0 model within a wider revision in overall regulatory and supervisory policy.⁵³⁴ This new model and approach could then be built into a larger new more effective and sustainable control framework going forward.

In connection with this, it is possible to use the new core RegTech tools taxonomy with supporting function and systems taxonomy generated.⁵³⁵ Tools include advanced computing with biometrics and cryptography, DLT and blockchain, algorithms and automation, APIs and interlinkage, machine

527. The last workstream became the RegTech and lessons learned workstream. *Id.* at 8.

528. There was a level of demand for cross-border testing, need for a standard assessment process, clarity on expectations with an awareness of increased regulatory cooperation. *Id.* at 9.

529. *Id.* at 10.

530. Regulatory News, *FCA on Next Steps for Cross-Border Testing Pilot with Fintech Firms*, MOODY'S ANALYTICS (April 30, 2019), <https://www.moodyanalytics.com/regulatory-news/apr-30-19-fca-on-next-steps-for-cross-border-testing-pilot-with-fintech-firms> [<https://perma.cc/9W6M-J4PZ>].

531. *RegTech in Financial Services: Technology Solutions for Compliance and Reporting*, *supra* note 303, at 2–5.

532. *Id.* at 7.

533. *Id.*

534. *Id.* at 1.

535. A parallel technology has also been developed. See discussion *supra* Section III.C; *RegTech in Financial Services: Technology Solutions for Compliance and Reporting*, *supra* note 303, at 3.

reading and machine learning, robotics, and AI.⁵³⁶ Functions consist of identification, data, risk, market, client interface, cyber security, compliance management and ongoing regulatory monitoring.⁵³⁷ A number of new types of systems can be identified within firms and regulatory authorities which consist of automated (algorithmic), assistive (robotics), cognitive (machine reading), predictive or presage (data analytics), and formative or originative (machine learning and AI) systems, or a combination of these.⁵³⁸ This may collectively be referred to as creating a new form of Technology Supported or Enhanced or Assisted Regulation and Supervision.

Reference can also be made to Embedded Regulation and Embedded Supervision, which are used for the purposes of this text to refer to models under which regulatory agencies are included or incorporated into the market itself, such as through the use of blockchain.⁵³⁹ Enhanced and Embedded options may then be referred to together as creating a new form of Co-prudential regulation or Co-supervision for the purposes of this text. This can be applied in other areas to create new forms of Co-prudential resolution, Co-prudential support, and Co-prudential macro oversight. All of this can then collectively be known as Co-control.

It is further possible to develop a number of other more inclusive and dynamic policy approaches which might be referred to as PolicyTech.⁵⁴⁰ These are essentially intended to make the regulatory system more adaptive, collaborative, iterative, responsive, and emergent. A parallel set of systems for firms, as part of FirmTech and CompTech, rather than authorities can also be developed which are more reflexive, responsive, modular, sustainable, and participative. These are considered further below.

A. ADAPTIVE AND REFLEXIVE

Regulation has to be adaptive by design. Financial regulation traditionally operates in a reactive and static manner. General frameworks, including specification of outline objectives and allocation of powers, are set out in legislation which can take years to adopt. Detailed regulations are then either incorporated into the legislation or issued under delegated powers following consultation and comment procedures. Subsequent changes may be adopted after further delay in response to specific crises or concerns. The system essentially operates on a static or fixed and reactive basis with substantial delay or latency in responding to new demands. Authorities often also set minimum standards at higher levels than necessary to absorb

536. *RegTech in Financial Services: Technology Solutions for Compliance and Reporting*, *supra* note 303, at 3.

537. *Id.* at 11.

538. *Id.*

539. Auer, *supra* note 340, at 5.

540. PolicyTech can then either be used narrowly to consist of specific aspects regulatory policy within ControlTech or to include these new dynamic and adaptive approaches to regulation and supervision by officials and firms. See *supra* note 3 and accompanying text.

unforeseen or unpredictable events or losses. This incorporates substantial inefficiency within the system.

An attempt should be made to make regulation more flexible and able to respond to market and regulatory changes in advance. It should be more risk sensitive and be able to identify and contain risk more accurately without substantial excess and consequential inefficiency. Regulation should be targeted and proportionate with an appropriate regulatory balance being secured that protects rather than undermines market function and the essential benefits of markets and the market system.⁵⁴¹ Excessive regulation only obstructs or undermines core market function or diverts activities to less regulated areas which separately increases overall risk.⁵⁴² Authorities should attempt to work more closely with regulated institutions to measure and manage financial risk without transferring underlying responsibility and liability or increasing moral hazard. All of this is again a question of regulatory balance.

Firm compliance and CompTech should also be more reflexive. Firm responses should be timely and effective with again low latency or delay. The most desirable outcomes would be for firms to respond almost immediately to regulatory changes with consequential adjustments being implemented in terms of their risk management reactions and responses subject to avoiding unforeseen or unnecessary costs in doing so.

One of the most effective ways of securing this would be through the adoption of increased machine learning and semantic technology with automated algorithmic adjustments. Changes in regulatory conditions could automatically be read and processed by firms' systems with appropriate changes being implemented as necessary. This could be limited to more mechanical or quantitative conditions initially although extended later through forms of machine learning and AI.⁵⁴³

Regulation must also be structured and inclusive to include all activities that may impact a financial product or service chain. As services become increasingly fragmented, regulated and un-regulated services are increasingly outsourced or transferred to external platforms. Platforms carrying on un-regulated services will not be subject to direct oversight or control although failure may still impact on the product or cycle chain. This can partly be dealt with through extended outsourcing requirements, although authorities must still monitor the full product or service cycle in a structured and inclusive manner. This could, for example, include preparing product or cycle maps which detail full cycle chains and explain how possible

541. George A. Walker, *Market and Regulatory Balance*, 13 J. BANKING REG. EDITORIAL 1–3 (2012) (on the need to balance regulatory intervention in response to financial crisis and underlying market function and efficiency following the global financial crisis).

542. *Id.*

543. European Banking Auth. (EBA), *Final Report on EBA Guidelines on Outsourcing Arrangements*, at 6 EBA/GL/2019/02 (Feb. 25, 2019), [https://eba.europa.eu/documents/10180/2551996/EBA@evised+Guidelines+on+outsourcing+arrangements](https://eba.europa.eu/documents/10180/2551996/EBA%20revised+Guidelines+on+outsourcing+arrangements) [<https://perma.cc/FYL8-KY6L>].

failures are covered in practice. A more general policy of regulatory review and adjustment has to be pursued to ensure that all existing regulatory requirements set out in any specific national rulebook reflect possible technological impacts.

AI is already being used to improve risk analysis and risk management with more efficient decision taking and governance.⁵⁴⁴ This can be supplemented through the use of Big Data analysis to examine larger data sets where relevant and appropriate. Robotics and bots can specifically be used to maintain client interfaces and provide unregulated guidance rather than regulated advice more efficiently. The FCA has already issued guidelines in this area.⁵⁴⁵

A number of common or utility activities are increasingly being carried out through separate platforms which can provide common services to firms on a multiservice basis. This can specifically, for example, be used for electronic identity verification and money laundering related Know Your Client (KYC) authentication. An increasingly large number of services may be outsourced to share platforms on a common basis.

Financial firms and, in particular, smaller and medium sized firms may increasingly make use of cloud facilities to improve their computer capacity, increase efficiency and security and lower costs. Many functions can be carried out on an Infrastructure, Platform, or Software as a Service (IaaS, PaaS, or SaaS) basis.⁵⁴⁶ Separate firm systems can then be connected, such as through the use of APIs, which allow systems interoperability.⁵⁴⁷ The use of APIs is specifically provided for under the EU PSD2 and Open Banking initiative.⁵⁴⁸

Data management may be decentralised through the use of more localised fog computing or edge computing facilities with operations increasingly being run closer to or directly connected with the data source.⁵⁴⁹ Different levels of centralised and decentralised data management are increasingly

544. Jeanne Boillet, *Why AI is Both a Risk and a Way to Manage Risk*, ERNST & YOUNG (Apr. 1, 2018), https://www.ey.com/en_gl/assurance/why-ai-is-both-a-risk-and-a-way-to-manage-risk [<https://perma.cc/8JG3-SAQD>].

545. See discussion *supra* Section V.A.

546. See, e.g., PETER MELL & TIMOTHY GRACE, U.S. DEPT. OF COMMERCE, THE NIST DEFINITION OF CLOUD COMPUTING, RECOMMENDATION OF THE NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY 2–3 (2011).

547. APIs consist of a series of communication protocols and tools to allow software components to operate together either within a single system or between systems using remote API or web API interfaces. Kin Lane, *API Industry Guide on API Design*, 3SCALE 2 (July 2015), <https://www.redhat.com/cms/managed-files/mi-3scale-api-provider-guide-api-design-ebook-f7865-201706-en.pdf> [<https://perma.cc/RPA2-NM7R>].

548. Daniel Gozman et al., *Open Banking: Emergent Roles, Risks & Opportunities*, ASS'N FOR INFO. SYS. AIS ELEC. LIB. 2, 5 (2018), https://aisel.aisnet.org/ecis2018_rp/183/ [<https://perma.cc/D2RL-94D9>].

549. Chris Lee, *Centralized vs. Decentralized Logistics: Which is Better?*, WAREHOUSE ANYWHERE (Nov. 15, 2018), <https://www.warehouseanywhere.com/resources/centralized-vs-decentralized-logistics/> [<https://perma.cc/49LY-2D9P>].

being used. While DLT and blockchain maintain multiple copy systems, they are highly centralised using only one underlying code ledger.

As markets have increasingly become digital and data driven and regulation data based, the new regulatory approach must be data sensitive and capable of managing all relevant data sets. This includes trade and transaction data, identity data, client personal data, account data and other systems of firm data subject to cyberattack or manipulation.⁵⁵⁰ Specific regulatory policies, such as in relation to capital adequacy, liquidity and leverage limits, must also be adjusted to reflect potential technology and other operational risks including information or data losses. DataTech will become a key part of any new solutions both in relation to official RegTech and PolicyTech as well as FirmTech and CompTech.

The overall effect of this move to more adaptive regulation and specifically PolicyTech and CompTech may be to create a form of “Co-regulation” with regulatory authorities and firms working on a closer and more collaborative basis and with a more immediate or closer relation to the underlying markets concerned.

B. COLLABORATIVE AND RESPONSIVE

Financial supervision must also be more inclusive and immersive with authorities being able to monitor the activities of firms in a more direct and immediate manner. This may approach real-time supervision over time.⁵⁵¹ A substantial amount of legacy supervision is conducted through the submission of returns possibly after some substantial delay.⁵⁵² Returns may be annual, quarterly, or daily depending upon the nature of the market concerned and the data involved. A substantial supervisory review gap or omission necessarily arises in each case.

It is necessary to create a more integrated and interventionist form of supervision which may specifically include embedded market practices. Embedding would involve the authorities participating more directly in market data collection and examination. This could be achieved using existing market infrastructure systems or new forms of blockchain or DLT. The BIS has already examined the possibility of embedded supervision using blockchain.⁵⁵³ All of this would create a new form of more efficient SuperTech. This may require substantial investment by authorities in systems and training, although a substantial amount of this may be automated and become machine dependent over time with lower costs and increased accuracy and efficiency.

The corresponding behaviour of firms would be more responsive with the almost real-time provision of regulatory data to the authorities in accordance with pre-set timescales or adjusted as necessary. Much of this could again be

550. See discussion *supra* Sections III, IV.C.

551. Haldane, *supra* note 298, at 7.

552. *Id.*

553. Auer, *supra* note 340, at 21.

achieved through machine reading and automated processing subject to necessary investment. The FCA has conducted research on digital reporting.⁵⁵⁴

One effect of this over time would be again to create a form of Co-supervision with firms collecting all necessary data in a more efficient and structured manner and with the automatic communication of this to the authorities on a machine to machine basis. This would not remove all human interaction. The systems would be designed to be as automated as possible with anomalies being highlighted requiring additional verification or human determination. The reporting systems would also operate as closely as possible with the internal risk management procedures with reporting anomalies either triggering firm or supervisory adjustments and intervention.

C. ITERATIVE AND MODULAR

One of the key initiatives adopted following the global financial crisis has been the establishment of Resolution and Recovery Programmes (RRPs) within all major banks and certain other firms.⁵⁵⁵ These allow for a series of actions to be taken on a pre-crisis internal basis to avoid closure or collapse as a first phase. Authorities can then intervene and either attempt to rescue the firm or managing its winding-up if the internal phase fails including through Special Recovery Regimes (SRRs) such as through set up under the Banking Act 2009 in the United Kingdom.⁵⁵⁶ Many of the largest financial institutions have prepared RRP with a number of these being published such as in the United States.⁵⁵⁷

As technology, related information, and data risk become more important forms of operational risk within modern markets, these RRP will have to be adjusted to include all necessary technical points of failure. Separate or combined Technology Recovery Programmes (TRPs) may be prepared which would specifically require firms to plan and respond to possible technical failures. This may specifically include preparing “technology continuity plans” or maps and “closeout” or “run-off” programmes to manage residual technology systems or materials. This may specifically include transferring or disposing of residual data including personal client data.

554. See discussion *supra* Section V.A.4.

555. George A. Walker, *Financial Crisis and Financial Resolution*, 29 BANKING & FIN. L. REV. 55, 82 (2013).

556. *Id.* at 56. This provides for three Special Resolution Option (SROs) of private bank transfer, temporary bridge bank transfer or public transfer (nationalisation) in addition to a Special Administration Procedure (BAP), and Special Insolvency Procedure (BIP). *Id.* at 72.

557. See, e.g., 2019 165(d) Plan, Public Section, WELLS FARGO 52–61 (June 27, 2019), <https://www.federalreserve.gov/supervisionreg/resolution-plans/wells-fargo-2g-20190701.pdf> [<https://perma.cc/QK8X-TRUW>].

TRPs can be supported by crisis management groups (CMGs)⁵⁵⁸ or sub-groups focusing on technology (TMGs).⁵⁵⁹ Firm specific crisis management agreements are also entered into (COAGs)⁵⁶⁰ which can be supported by technology specific agreements or sub-agreements (TOAGs).⁵⁶¹ SRRs could be supplemented through the design of new Special Technology Regimes (STRs).⁵⁶² Senior managers have separately to prepare new “responsibility maps” and organograms under the Senior Managers Regime (SMR) in the United Kingdom.⁵⁶³ Firms could be required to prepare additional technology maps or technology organograms for their firms outlining all key technology points and the members of staff responsible. This could be included within the RRP or TRP documentation.

Firms may be specifically required to adopt a modular approach to technology resolution. This may include incorporating a number of technology specific features within standard RRP (or TRP) and SRR (or STR) to deal with all possible significant technology failures. This may specifically deal with outsourcing failures, computer systems failures, data collection, and management failures or other data exposures. Firms would be required to design and maintain an appropriate set of technological continuity measures and maps to explain to the authorities how they would manage any technological crises.

The authorities would also have to consider to what extent they have to manage this process in the event of the firm’s initial internal control systems failings either through its own staff or a separate administrator or receiver. Authorities and firms must consider the implications of post-crisis technology management including the sensitive equipment and data disposal. This again creates a form of Co-control.

D. RESILIENT AND SUSTAINABLE

The global financial crisis confirmed the need for appropriate market support facilities to be in place in the event of a major threat to the stability of a particular market or system more generally. Traditional Lender of Last Resort (LLR) policies have generally been restricted to banks in light of the inherent instability that arises within banking markets with firms funding themselves on a medium to long term basis through demand or sight deposits.⁵⁶⁴ This creates a form of maturity transformation and mismatch with banks being exposed where their reserves are exhausted through a bank run. While LLR staff facilities were made available to many banks following

558. Walker, *Financial Crisis and Financial Resolution*, *supra* note 555, at 57–58.

559. *Id.*

560. *Id.* at 59.

561. *Id.* at 59–60.

562. *Id.*

563. Etay Katz, Allen & Overy LLP, *Wholesale Investment Firms in FINANCIAL SERVICES LAW 737, 750* (George A. Walker & Robert Purves, eds., 3d ed. 2013).

564. Walker, *Conglomerate Law and International Financial Market Supervision*, *supra* note 15, at 327–28.

the crisis, a number of other more specific forms of support facility had to be developed on an ad hoc basis to manage instability in other markets.⁵⁶⁵ This, for example, included broker dealer and commercial paper facilities in the United States.⁵⁶⁶ This can be considered to have created a form of extended LLR (exLLR).⁵⁶⁷

Monetary authorities generally provide daily liquidity support to banks through the primary money markets to ensure that there is sufficient funding in the system.⁵⁶⁸ This may be understood in terms of a more general market Lender of Last Resort function. LLR may also be considered in terms of providing emergency assistance to a specific institution. A number of support arrangements had to be adopted during the global financial crisis to support specific markets.⁵⁶⁹ These can generally be considered to have consisted of either the provision of specific institution Funding of Last Resort (FLR), more general Market liquidity of Last Resort (MLR), capital of last resort (CLR), guarantees of last resort (GLR), and asset purchase or asset insurance of last resort (ALR or ILR).⁵⁷⁰ Particular forms of liquidity support and capital injection may be provided for in firm specific RRs.⁵⁷¹

Authorities will generally have to monitor the extent to which new forms of technology related risk may create additional instability and require market support. This would have to be carried out on a market-specific basis having regard to particular local conditions and market structures. This would specifically take into consideration the relevant capital, liquidity and leverage, and other financial requirements imposed on local institutions.⁵⁷² The objective would not be to prevent all market failure or any form of instability but to ensure that institutions and markets were sufficiently resilient to absorb acceptable levels of loss and manage related instability. The focus would then be on maintaining resilience rather than avoiding specific crisis or failure. Firms would specifically have to consider to what extent their own conditions and relevant capital, liquidity, and leverage levels allow them to maintain their resilience and sustainability. Authorities would monitor wider levels of sector or market resilience. This would again create a form of “co-support” with monetary and regulatory authorities as well firms working together to ensure safe levels of liquidity and capital stability including in response to technology generated losses or failures.

565. *Id.*

566. *See, e.g.*, Press Release, Federal Reserve Board, Federal Reserve Announces Extensive New Measures to Support the Economy (Mar. 23, 2020, 8:00 AM), <https://www.federalreserve.gov/newsevents/pressreleases/monetary20200323b.htm> [<https://perma.cc/S79Q-N9L4>].

567. *Id.*

568. *Id.*

569. Marc Dobler et al., *The Lender of Last Resort Function after the Global Financial Crisis*, 4 (Int'l Monetary Fund, Working Paper No. 16/10, 2016), <https://www.imf.org/external/pubs/ft/wp/2016/wp1610.pdf> [<https://perma.cc/H7DM-NY86>].

570. *See* Walker, *UK Financial Services Reform*, *supra* note 4, at 31.

571. *See* discussion *supra* Section VI.C.

572. *See* discussion *supra* Section VI.A.

In the event of instability in new FinTech markets, the authorities may have to consider providing ex-LLR to technology firms in outsourced or more fragmented markets where this may threaten the stability of the market. They may also have to consider providing some form of Technology of Last Resort (TLR) in extreme cases where internal RRP or TRPs fail. This may, for example, include managing the transfer of transaction and account data, including personal data, from one institution to another directly or indirectly and on a temporary or permanent basis, such as with a bridge bank or transferee bank following the closure of a major institution. The combination of these official general market and emergency measures and firm activities creates a form of “co-support.”

E. EMERGENT AND PARTICIPATIVE

The new approach should also be emergent to the extent that it considers the possible impact of all triggers and causal conditions on all parts of the system and relations between these parts.⁵⁷³ Markets can be considered to be emergent. Emergence connotes complexity with dynamic causation leading to unpredictable pathways and uncertain causal chains or loss transmission channels.⁵⁷⁴ Authorities have to attempt to predict more likely outcomes as well as be sufficiently adaptive to respond to new changes⁵⁷⁵ with firms and systems being sufficiently prepared and resilient to manage consequent losses.⁵⁷⁶

The further significant response adopted following the global financial crisis was the development of new macro-prudential policies and establishment of a number of dedicated macro-prudential agents across the world. This included the Financial Policy Committee (FPC) within the Bank of England, the European Systemic Risk Board (ESRB) in the European Union, and the Financial Stability Oversight Council (FSOC) in the United States.⁵⁷⁷ The objective of this policy is to attempt to monitor financial systems as a whole and detect any possible source of risk or instability and react appropriately. A number of policies have been developed by the specific institutions referred to and publications issued.⁵⁷⁸

573. Emergence is generally used in science and systems theory to refer to properties demonstrated by an entity not dependent upon the parts alone. Emergent properties arise from more fundamental entities and are novel or irreducible with reference to the constituent entities. See, e.g., Timothy O'Connor, *Emergent Properties*, 31 AM. PHIL. Q. 91, 93 (1994).

574. *Id.*

575. See discussion *supra* Section VI.A.

576. See discussion *supra* Section VI.D.

577. See generally, WALKER ET AL., *supra* note 5.

578. See *Financial Policy Committee*, BANK OF ENG. (last visited Sep. 15, 2020), <https://www.bankofengland.co.uk/about/people/financial-policy-committee> [<https://perma.cc/4R4K-3EWR>]; See *ESRB Home*, EUR. SYSTEMIC RISK BD. (last visited Sep. 15, 2020), <https://www.esrb.europa.eu/home/html/index.en.html> [<https://perma.cc/JRF5-FFAC>]; See *Financial Stability Oversight Council*, U.S. DEP'T TREASURY (last visited Sep. 15, 2020), <https://home.treasury.gov/policy-issues/financial-markets-financial-institutions-and-fiscal-service/fsoc> [<https://perma.cc/X674-M999>].

These new macro-prudential functions must specifically be extended to include dedicated technology risk oversight to ensure that all possible technology related exposures are detected and incorporated into larger decision taking and policy adjustments. These can be considered to create a form of “MacroTech.” This policy must also then be extended again to allow for emergence and dynamic effects and causation specifically arising as a result of technological interconnection and dependence and high possible speed of loss transmission and loss transfer. Dedicated facilities and policies should be created within each macro-prudential agent to respond to technology related exposures. FirmTech and CompTech may also be extended to require firms to consider the larger potential impact of their failure on wider markets and systems. Emergence should also be considered at the micro-sector prudential level through enhanced SuperTech⁵⁷⁹ although this becomes of even more importance at the macro system level.

VII. Regtech Comment and Conclusions

The purpose of this paper has been to consider the nature of RegTech and its evolution from RegTech 1.0. to 2.0 and 3.0. Its associated potential value and challenge has been noted. Recent changes in markets and MarketTech have been considered in further detail with the potential impact of BigTech growth. Emerging market trends have been explored including with NewTech and FutureTech. The nature of the new exposures and RiskTech are referred to and the emerging impact of DataTech and new regulation and DataReg outlined. The nature of RegTech has been examined in further detail with new functions, tools, and systems and the emerging market landscape. A series of provisional comments and conclusions can now be drawn on the structure and nature of the still evolving new technological and regulatory landscape under construction.

A. MARKET AND SOCIAL CHANGE

Financial markets have been impacted by a number of significant trends in recent decades. Societies has moved from an earlier post-War Consumer to a new Digital, Information, and Knowledge Society and then to a Risk, Sharing, and Caring and most recent Popular or Protest Society.⁵⁸⁰ We have entered a new post-modern social system and landscape. Post-modernism and post-modernity have generally been accompanied with the rejection of earlier values and universals, institutions, and structures and with a new focus on the individual and individual choice.⁵⁸¹

All of this has been driven by significant changes in Social Technologies which have had a consequent impact on social structures and expectations.

579. See discussion *supra* Section VI.B.

580. See discussion *supra* Section I.A; see also *supra* notes 23–29 and accompanying text.

581. See discussion *supra* Section I.A; see also *supra* note 32 and accompanying text.

We have entered a form of Post-Tech⁵⁸² or Post-Technology era. Much of this has, in turn, emerged from substantial innovation in underlying social technologies and networking which has effectively allowed substantial parts of the global population to come together in almost real time contact and communication. Increased social access and control has resulted in new demands for democratic inclusion and accountability with parallel rises in populism and protest movements across the world. While this has been partly political, it has also included a new sensitivity to climate impact and need for sustainable development. Policy makers have also had to consider other underlying demographic changes with significant increases in elderly populations in parts of the world and the economic and social pressures and consequences this creates.⁵⁸³

Markets and societies have separately been impacted by increased levels of digitalisation, disintermediation, dematerialisation, monetisation, and decentralisation as well as mobilisation, personalisation, socialisation, localisation, and democratisation.⁵⁸⁴ Innovations in FinTech will further continue to disrupt markets while wider changes in NewTech and FutureTech will result in wider change and challenge across societies more generally.

B. REGULATORY CHALLENGE

It is necessary to respond to all of the new pressures created in markets and financial markets. This includes the advance of BigTech⁵⁸⁵ as well as other technological innovations in the areas of NewTech and FutureTech, including InfraTech and AppliedTech.⁵⁸⁶

A number of significant regulatory reforms have been adopted over the last decade following the global financial crisis. Much of this has been data-based or data-centred such as with new capital, liquidity, and leverage as well as trading conditions implemented under CRD4 and MiFID 2, digital identification standards under eIDAS, personal data protections with GDPR, new payment and Open Banking services under PSP2, and enhanced cybersecurity protections.⁵⁸⁷ A new data and technology driven world has been created with DataTech which requires corresponding new data and technology based solutions. Financial markets and sectors have also had to contain the massively increased amounts of new regulation and compliance costs imposed after the global financial crisis.

582. Post-Tech, or Post-Digital, is used to refer to systems and approaches that focus on the human and individual well-being and move from technological dependence. See, e.g., Sarah Genner, *On/Off: Risks and Rewards of the Anytime-Anywhere Internet* (2017) at 182 (Ph.D. thesis, University of Zurich), <http://doi.org/10.3218/3800-2> [<https://perma.cc/SPL6-T2WT>].

583. See discussion *supra* Section I; see also *supra* note 24 and accompanying text.

584. See discussion *supra* Section I.B.

585. See discussion *supra* Section II.

586. NewTech refers to technology currently under development and FutureTech to further innovations over time.

587. See discussion *supra* Section III.

The regulatory control of FinTech raises a number of specific new challenges. An earlier technology and risk gap or omission has been identified that must be corrected.⁵⁸⁸ Existing legal and regulatory requirements must be reviewed to ensure the effective containment of loss transfer or transmission with all new exposures being properly identified and managed. The underlying technology and control conflict that arises must be managed, in particular, through the development of technology adjusted regulatory, supervisory, resolution, support, and oversight mechanisms. All of these arrangements must be revised and extended, in particular, to ensure that they can deal with the significant new threats generated by increasingly fast technological risk generation and transmissions.

C. FINANCIAL TECHNOLOGY RISK AND RISKTECH

Developments in Fintech necessarily create a series of new challenges in terms of financial risk and exposure (FinRisk) with the need for new control techniques (RiskTech).⁵⁸⁹ FinRisk specifically includes new forms of technological, information, data, and cyber security threats. Technology risk can be considered to include operations, use, compliance, execution, and impact risk with operational risk specifically consisting of model (design), software (program), hardware (component), network (connection), and systems (aggregate) risk.⁵⁹⁰

Further challenges arise with regards to information risk. These can specifically include definition risk which is concerned with the nature and meaning of such key terms as information, data, knowledge, ideas, and records or archives.⁵⁹¹ Information related exposures can be summarised in terms of substance (form), law (protection), quantum (substance), processing (operations), and record (archive) risk. A series of additional challenges then arise with regard to data specifically. These can be summarised in terms of data collection, translation, security, access, and transfer risks. These may also be restated in terms of privacy, integrity, use (with six data protection principles), management (with eight data protection rights), and remedy and breach. DataTech will also include all of the new compliance obligations imposed in relation to trade, identity, personal data, account, and cyber security protection imposed under the new post-global financial crisis regulatory response.

A series of further exposures arise with regards to cyber security and systems integrity more generally. These can be summarised in terms of access, identity, operations, degradation, and destruction.⁵⁹² A complete

588. See discussion *supra* Section I.

589. These may be referred to as producing new forms of techRisk (or “tRisk” for technology), “eRisk” (for electronic), “dRisk” (for digital) and “iRisk” (for internet related exposures).

590. See Walker, *Digital Information Law*, *supra* note 30.

591. *Id.* at 181.

592. See discussion *supra* Section III.E.

form of RegTech will have to be able to contain all of this new FinRisk and include appropriately inclusive RiskTech.

The most significant difficulties arise with regard to contagion and systems or systemic risk and collapse. Modern markets are more intimately connected than before, which creates significant new forms of dependence and potential contagion. Network and infrastructure systems can operate as dangerous loss transmission and risk transfer channels with loss spreading in fractions of a second rather than in months, weeks, or days as previously. This can also result in multiple, parallel, or polymorphic contagious channels.⁵⁹³ These can then create complex forms of dynamic or emergent causal chains that are impossible to predict. This combination of polymorphic and emergent effects can produce massive new levels of uncertainty in modern technology driven or technology dependent markets.⁵⁹⁴ This may be further compounded by the uncertain nature of underlying modern digital information, data, and technology related risks and exposures.

All of this can be understood in practice with authorities having to respond to product, service, and market complexity; specialisation; dependence (reliance); no substitution (with no alternative mechanism or option available); and complex causation (emergent) exposures. Massive new data dependent markets and societies are being created with only limited attention having been applied to understanding and managing all of the corresponding significant exposures that necessarily arise in terms of DataRisk and FinRisk.

D. REGTECH TOOLS AND TECHNIQUES

A wide range of new regulatory tools and devices are being constructed to contain all of the relevant threats and exposures. These can be classified in different ways and will include identity and profile management, data collection, aggregation and curation, risk modelling, forecasting and analysis, financial crime containment, supervisory and compliance delivery, and continuing regulatory monitoring and response.⁵⁹⁵ Immediate solutions are expected in the areas of advanced processing with cloud, fog, and edge computing; biometrics and cryptography; blockchain and other DLT; algorithms and automation; data mining and big data analysis; application program interfaces (APIs) and new linkages (including with atomic swaps and hyperlinks);⁵⁹⁶ machine reading and machine learning; robotics; and AI.

593. This is referred to as creating new forms of multiform, multitudinal, multiphase or multifarious, variegated, or polymorphic transmission channels. These may then be integrated or connected and discrete, disparate, disassociated, divergent, and disunited.

594. See FRANK H. KNIGHT, *RISK, UNCERTAINTY, AND PROFIT* 15 (Frank H. Knight ed. 1921) (distinguishing between quantifiable and measurable risk and unquantifiable uncertainty).

595. See discussion *supra* Section IV.C.

596. Atomic swaps and hyperlinks create temporary escrow debit and credit balance accounts across separate blockchains with values being transferred if the relevant conditions are satisfied or the balances atomised and cancelled otherwise. Jake Frankenfield, *Atomic Swaps Defined*,

These will impact across a wide range of functions including specifically with regard to identification, data, risk, market, client, cybersecurity, compliance, and ongoing or future regulatory response management.⁵⁹⁷

A series of new systems have also been identified to improve financial regulation, compliance, and control.⁵⁹⁸ These essentially consist of one or more autonomous or automatized (algorithm), assisted (robotic), cognitive (machine reading), predictive or presage (data analysis), and formative or originative AI models. All of this facilitates the development of new Enhanced or Assisted technology supported firm management and compliance and official supervisory or oversight techniques.⁵⁹⁹ This may be complemented by other Embedded regulatory or supervisory techniques through which authorities participate more directly and immediately in markets and market operations. These Enhanced and Embedded forms of risk management and regulation will then come together within larger new Co-regulation or Co-control frameworks.

It has to be expected that a host of new regulatory solutions will emerge as technology continues to grow and evolve. Some obstacles and delays may arise, which can be considered to be inevitable. It may nevertheless be possible to close the regulatory and technology gap that has arisen over time.

E. NEW REGTECH RESPONSE AND POLICY

It is against this background that new forms of RegTech have emerged and where the longer-term potential of RegTech arises. While substantial continuing technological advance creates new threats and exposures, this also necessarily produces new opportunity and potential. Regulatory and supervisory processes can be revised and restructured as technology continues to change and evolve. A substantially more informed, inclusive, and progressive new control policy can be constructed over time. The objective must be to create a new sustainable, dynamic, and accommodative or supportive new policy model.

RegTech is generally understood under this text to include new forms of control or direction (ControlTech) and supervision (SuperTech) in terms of official or public response with corresponding advances in private risk management (FirmTech) and compliance technology (CompTech).⁶⁰⁰ ControlTech then includes more specific regulatory policy (PolicyTech), supervision (SuperTech), resolution (ResTech), market support (SupTech),

INVESTOPEDIA (June 28, 2020), <https://www.investopedia.com/terms/a/atomic-swaps.asp> [<https://perma.cc/XM2X-335X>].

597. See discussion *supra* Section IV.C.

598. See discussion *supra* Section IV.

599. Marco Antonio Cavallo, *How RegTech Closes the Gap Between Technology and Financial Services*, BLOOMBERG (April 26, 2017), <https://www.bloomberg.com/professional/blog/regtech-closes-gap-technology-financial-services/> [<https://perma.cc/LH62-H8LY>].

600. Marco Antonio Cavallo, *How RegTech Closes the Gap Between Technology and Financial Services*, BLOOMBERG (Apr. 26, 2017), <https://www.bloomberg.com/professional/blog/regtech-closes-gap-technology-financial-services/> [<https://perma.cc/JT83-CBEP>].

and macro-prudential or macro-technology oversight (MacroTech).⁶⁰¹ FinTech nevertheless still creates a wider new control landscape which requires a full regulatory response and FinReg.⁶⁰² FinReg will then consist of existing regulatory tools and techniques and new forms of RegTech with RegTech possibly only ever forming part of wider FinReg.

Markets and regulators have to work more closely together within the new Co-regulation and Co-control model. This can then be supported through the range of new more adaptive, collaborative, iterative, resilient, and emergent as well as reflexive, responsive, modular, sustainable and participative approaches referred to as part of a new still emerging or evolving PolicyTech framework.

Technology may further allow for official financial regulation to become more adaptive and inclusive with firm compliance being reflective and efficient with low latency and waste. Supervision could become increasingly collaborative and immersive as well as responsive and reactive. Financial resolution can be more iterative and modular. Market support systems can be designed to be increasingly resilient, self-contained, and autonomous.⁶⁰³ Wider oversight and macro-prudential supervision can be extended to include substantial technological elements or components and be more emergent and MacroTech based.⁶⁰⁴ Supervision and regulation will increasingly become machine and code based over time with regulators and regulatees working together more closely to secure a clearly defined shared set of objectives including consumer protection, market integration, and overall financial stability.⁶⁰⁵

Financial authorities should also cooperate within and between countries. Public authorities should separately coordinate their activities across a wider range of public policy fields. New forms of integrated global and virtual regulation will have to be developed with revised forms of FinTech and FinReg standards and supporting domestic and cross-border measures.⁶⁰⁶ These additional types of proto-global financial regulation may be referred to as creating a form of GlobalTech model for national and international market control and management. GlobalTech and RegTech together can create a new type of TotalTech response to ongoing market challenge and advance. Each of these is considered further below within the emerging new RegTech 3.0 response agenda referred to.

601. See Gallie, *supra* note 3.

602. Carmen Álvarez, *From Fintech to Big Tech: In Search of the New Digital Regulation*, BBVA (June 15, 2020), <https://www.bbva.com/en/from-fintech-to-big-tech-in-search-of-the-new-digital-regulation/> [<https://perma.cc/6S2H-8WE3>].

603. Global Affairs Canada, *SupTech: Leveraging Technology for Better Supervision*, TORONTO CTR. (July 2018), <https://res.torontocentre.org/guidedocs/SupTech%20-%20Leveraging%20Technology%20for%20Better%20Supervision%20FINAL.pdf> [<https://perma.cc/3XCE-BBDB>].

604. *Id.* at 6.

605. *Id.* at 4.

606. Walker, *BigTech, CoinTech and Facebook LibraTech*, *supra* note 7.

F. TECHNOLOGY REGULATION AND REGULATORY REVIEW

Financial regulatory systems must be complete and comprehensive in scope and coverage and coherent and consistent in content. External regulatory perimeters must be adjusted, and internal regulatory definitions, divisions, and allocations recalibrated. Financial regulation has to become more flexible or adaptive and involved or inclusive.⁶⁰⁷ Technology can be used to allow authorities to work more closely with firms without undermining their separate functions and responsibilities or transferring legal or regulatory liability. Massive opportunities would arise in creating new forms of interactive and increasingly integrated dynamic risk management and control systems or embedded structures. This would allow control parameters to be adjusted as market conditions change and for firm supervision and compliance to be more immediate and efficient with new enhanced and embedded regulatory models. This creates a range of new prudential options including Embedded solutions.

G. TECHNOLOGICAL SUPERVISORY REFORM

Financial supervision can become increasingly collaborative and constructive as external official and internal firm monitoring systems became more connected.⁶⁰⁸ Firms may become able to report risk management data in real time, or close to real time, with authorities being able to run parallel oversight programmes to create an almost single integrated form of risk and compliance management, reporting, and supervisory oversight.⁶⁰⁹ Financial supervision can be made more technologically relevant including, for example, through the development of appropriate new Technology Enhancement Programmes (TEPs) within authorities to ensure the effective oversight of financial institutions' technology systems and application of appropriate penalties in the event of significant infractions.⁶¹⁰ This could also assist create specific sets of "Technology Colleges" (TGs or sub-TGs) within the existing Supervisory College system set following the global financial crisis.⁶¹¹ Official capacity and technical literacy will have to be improved and necessary personnel and financial resources made available.

H. TECHNOLOGY RECOVERY PROGRAMMES

New types of technology-based resolution (tech-resolution), or wider techno-prudential resolution, can be constructed. Financial resolution can become more iterative and modular over time.⁶¹² Restructuring and

607. See discussion *supra* Section VI.A.

608. See discussion *supra* Section VI.B.

609. Arner et al., *supra* note 4, at 382.

610. See generally Arner et al., *supra* note 4 (discussing the potential of RegTech automating the process).

611. Global Affairs Canada, *supra* note 603, at 2.

612. See discussion *supra* Section VI.C.

recovery procedures can be adjusted within firms through the creation of appropriate new Technology Resolution Programmes (TRPs) with effective external official Technology Resolution Regimes (TSRs). Technological exposures and solutions can be built into existing RRP packages to create new forms of TRP models for firms. Technological exposures could be incorporated into impact and risk management analyses. Corresponding protective measures or alternative sources of technology provision could also be built into response programmes with other Technology Management Groups (TMGs) and Technology Cooperation Agreements (TOAGs). Technology may allow other stages or parts of RRP arrangements to operate more quickly or more effectively. Technology could have a significant impact increasing the overall efficiency and effectiveness of internal and external crisis management responses.

I. TECHNOLOGY SUPPORT PROGRAMMES

Technology can also be used to improve the timing and efficiency of existing market funding support arrangements or provide specific forms of new technology support as necessary depending upon the nature of any particular crisis or instability event.⁶¹³ Appropriate market support arrangements must be in place, including specifically with possible direct Technology of Last Resort (TLR) operations and with authorities being able to transfer or assume critical technological functions as necessary. Wider-extended Lender of Last Resort (ex-LLR) funding facilities must be in place to ensure necessary support where the stability of major financial markets is threatened through technological failure or contagion. These exposures could be technology generated or aggravated. New forms of coordinated support arrangement or packages can be designed as part of this which may be referred to as super-prudential or supra-prudential.⁶¹⁴ This would create new forms of CrisisTech with the resolution options.

The overall objective in all cases would be to allow markets to operate as independently, autonomously, and remotely as possible with any form of market or technology support being limited and discretionary. This would reflect existing principles to limit overreliance and minimise moral hazard, while providing necessary residual contingent support where the stability of a wider market or the financial system as a whole was materially threatened. Economies would then be designed to be as self-sufficient and sustainable as possible with the focus on continuing resilience and self-correction or maintenance with official support being limited to extreme circumstances.

613. See discussion *supra* Section VI.D.

614. This may possibly also be referred to as supra-prudential or post-prudential although super-prudential will be used for the purposes this paper.

J. MACRO-TECHNOLOGY OVERSIGHT

Macro-prudential regulation should be extended to include new related or derived technology threats and solutions.⁶¹⁵ Technology could substantially assist authorities understanding of underlying market changes and trends and identifying potential vulnerabilities with the most efficient and least invasive and most cost effective solutions being adopted.⁶¹⁶ Authorities may specifically be assisted through the use of market or sector focused BigData analytics and visualisation techniques and AI facilities. Macro-prudential oversight of a financial system or economy as a whole would become increasingly ineffective and irrelevant without a substantial technological component while technology may significantly assist identify emerging and new vulnerabilities and threats. Extended technologically sensitive macroprudential (MacroTech) systems must be designed with relevant agents having all necessary experience, resources, and powers as noted. While support would be remote and contingent, it should still be possible to develop more intimate and integrated forms of regulation and supervision.

K. SUPERVISORY AND POLICY COORDINATION AND FINTECH AND REGULATORY ETHICS

New systems of digital regulation and control have to be constructed. Regulated firms, markets, and authorities should work more closely. This can be created through co-working, and specifically co-regulation, co-supervision, co-resolution, co-support, and co-oversight.⁶¹⁷ This can be supplemented by the new Embedded regulatory and supervisory models referred to where appropriate with authorities being involved or incorporated more directly into markets such as through the use of blockchains with official access permissions.

Authorities within and across countries must also coordinate their activities and decision taking more effectively. This is to ensure more consistent and effective monitoring and enforcement action. This could be achieved through the adoption of new para-prudential control working structures or environments. These could be extended to consist of para-prudential regulation, para-prudential supervision, para-prudential resolution, para-prudential support, and para-prudential oversight⁶¹⁸ which could be given effect to through new forms of ParaTech. This can be built on top of existing Supervisory College networks.

This could be further extended to incorporate the treatment of other core public policy fields or issues on a single, integrated, and consistent basis. This may be necessary with the emergence of such new stablecoins as Facebook's Libra or other Super-coins or Super-apps over time. This

615. See discussion *supra* Section VI.E.

616. Global Affairs Canada, *supra* note 603.

617. Walker, *BigTech, CoinTech and Facebook LibraTech*, *supra* note 7.

618. *Id.* at Section VII.I.

requires the monitoring in practice of a series of related public policy responses or prescriptions such as in relation to monetary, competition, data, consumer protection and taxation policies.⁶¹⁹ All of this could be carried out through the adoption of a new types of Multi-prudential, Poly-prudential, or Poly-modal regulation, which would operate on a consistent and integrated basis. This could be supported through new types of PolyTech.

These new co-prudential, para-prudential, and poly-prudential regulatory models could be brought forward through the innovative new forms of CoTech, ParaTech, and PolyTech. This would assist markets and authorities operate more closely together with control systems becoming more effective and efficient. The full range of possible policy impacts have to be assessed together which would produce a major shift in more traditional or legacy supervisory and regulatory policy and practice.

Authorities could still go further in new digital, online, and borderless markets. New sets of higher ethical standards of conduct and behaviour can be established beyond the enforceable limits of hard regulation. It may not always be possible to enforce specific legal and regulatory requirements in all markets and technological conditions, fields, or environments. Additional measures must be applied based on higher levels of expectation and voluntary adoption and adherence. New ethical codes or protocols can then be developed to apply appropriate standards in all markets and all conditions.

Separate or connected integrated sets of standards may be adopted over time incorporating, for example, relevant social, financial, and technological objectives. Existing formulations are available in each of these areas which can be restated and integrated. A set of new codified digital protocols can be produced to support the governance of market conduct and the design and use of new technology which standards can be revised over time to reflect changing social culture and expectations.

L. INTERNATIONAL REGULATORY CONVERGENCE AND MARKET STABILITY

Regulatory and supervisory reform will only be effective if appropriate measures are adopted at the cross-border and international level as markets have become increasingly globalised and virtualised. A number of important initiatives have already been adopted in developing cross-border cooperation in relation to regulatory sandboxes especially under the GFIN initiative set up at the instigation of the FCA in the United Kingdom.⁶²⁰ This creates a framework for cooperation for new innovative FinTech platforms to enjoy the benefits of sandbox treatment in more than one jurisdiction at a particular time where each country has a sandbox facility. This will help firms comply with the specific requirements of more than one jurisdiction while it would also help authorities understand important innovations in

619. *Id.* at Section VII.H.

620. *See* discussion *supra* Section V.E.

markets and in regulatory and supervisory practice elsewhere as well as benefit consumers and service receivers more widely. This has to be strongly encouraged.

The regulatory sandbox tool nevertheless also creates the opportunity for creating a more substantial national or international Regulatory Box, Control Box, or Technology Box.⁶²¹ Rather than simply be used to support innovation and competition, cross-border sandbox cooperation could be extended to develop new strengthened cooperative regulatory and supervisory techniques for significant online digital platforms. These could also operate with designated Control Zones or Regulatory Zones which would specify the full range of licences or permissions available to any firm or platform in the financial and other policy areas.⁶²² Longer term, participation in a regulatory, control, or technology box could be made a condition for local and cross-border operation. Multi or combination licenses or authorisations could be issued which would detail the range of specific financial and other policy permissions granted and relevant conditions. Large technology firms, including specifically BigTech companies, Stablecoins, or other Supercoins or Super-apps, could specifically be required to join a control box or control zone. This could create a form of proto-global regulation for advanced technology and technology firms.

This could be further supported by the production of a virtual FinTech and RegTech Compendium of Standards following the Financial Stability Board (FSB) model which provides hypertext mark-up language (html) links to the principal financial document standards produced by other standard setting agencies or committees or international organisations.⁶²³ A parallel FinTech and RegTech Directory could also be made available of all relevant implementing national measures which would be updated by relevant domestic authorities. This could be extended to include relevant regulatory enforcement or disciplinary decisions and other binding authorities. This could also cover all relevant policy areas within the multi or combination licensing system provided.

All of this can be considered to form part of an emerging new GlobalTech model or solution which can operate and be developed in parallel with emerging FinTech, FinReg, RegTech, and RegTech 3.0.

VIII. Regulatory Technology Close

Financial markets have been subject to radical change and transformation in recent times. They have been impacted by massive underlying developments in market and social experimentation. Further and continuing technological change and advance has to be expected including in the areas

621. Walker, *BigTech, CoinTech and Facebook LibraTech*, *supra* note 7, at VII.L.

622. *Id.*

623. George A. Walker, *International Financial Instability and the Financial Stability Board*, 47 INT'L LAW. 1, 37 (2013).

of MarketTech, BigTech, DataTech, NewTech, and FutureTech. A largely fixed and static but also costly and onerous new regulatory framework has been constructed following the Global Financial Crisis. It is against this background that radical transformation has to take place in terms of new technology and data driven market reform and new product and service provision. A new regulatory balance or relationship must be established.

Such a new approach can be constructed based on new forms of dynamic regulation and supervision. The new model can be constructed using revised forms of official ControlTech and SuperTech with private FirmTech and CompTech. Official RegTech or ControlTech would include strengthened PolicyTech, SuperTech, ResTech, SupTech, and MacroTech components with FirmTech and CompTech being adjusted to reflect each of these new sets of aspirations and requirements. More Embedded forms of market regulation and supervision can be experimented with. Innovative forms of automated, assisted, cognitive, predictive, and formative risk management and client service tools can be developed within regulated institutions and with the authorities adopting more adaptive, inclusive, iterative, resilient, and emergent approaches to regulatory relationships and control. This would create a dynamic new form of Co-prudential regulation and supervision or Co-control.

International market growth and expansion with continued financial innovation and advance requires a further response as part of a larger GlobalTech solution. This would specifically apply in relation to new Stablecoins, such as Facebook's Libra, Supercoins, and other Super-apps. Additional forms of cross-sector and cross-border Para-prudential regulatory coordination and cross-issue Poly-prudential or Poly-modal control can be constructed over time to bring all relevant agencies and policy areas together into a single or integrated assessment and response. The underlying objective would in all cases be to maximise the potential value of technological innovation in a fully engaged reflexive and responsive manner in advanced modern complex financial markets and economies.

Continued technological advance and evolution creates a continuing challenge especially with the relentless progress expected in NewTech and FutureTech. This can bring substantial benefit and advantage but also correspondingly significant risk and exposure. All of this has to be managed and contained. The adoption of a new dynamic and adaptive form of RegTech may be the future of FinTech and new technology more generally. With this, it is necessary to find a new relationship between law and technology and code and regulation. This is the possibly the real and proper promise or potential of RegTech 3.0.

