



THE LONDON SCHOOL
OF ECONOMICS AND
POLITICAL SCIENCE ■



Regulatory Technology

Eva Micheler
Anna Whaley

SRC Special Paper No 14

April 2018



Systemic Risk Centre

Special Paper Series

Abstract

Technology changes society. Financial services and their regulation is not immune from this. Indeed, distributed ledger technology and artificial intelligence have the potential to change the way in which financial services are delivered and regulated. This paper discusses the use of technology for the purpose of financial regulation. The hope is that this will increase the effectiveness and efficiency of financial regulation.

At present regulatory technology is in the very early stages of development. The authors therefore start by reviewing the technology that is inspiring those who are attempting to create regulatory technology. They analyse distributed ledger technology, which was originally developed for cryptocurrencies, but can also be used to maintain and share records of other assets or of anti-money-laundering information. They also discuss the use of artificial intelligence and machine learning for the purpose of financial regulation.

After that the current work of the UK Financial Conduct Authority (FCA) on model driven and machine executable regulation will be examined. This work has so far not been analysed in the literature. Distributed ledger technology has shown ways of sharing information that could be used to enable the regulator to access records held by regulated entities. This could remove manual processes from current reporting requirements. It would enable the regulator to access data held by regulated entities in real time.

Going further into the future the regulator could stop reviewing individual data points and use artificial intelligence and machine learning to analyse the data held by regulated entities. Software could be developed that identifies patterns and flags anomalies helping the regulator and regulated entities to identify risk as it emerges. This would create a new way of evaluating the risk profile of regulated entities.

At present the regulator issues rules in natural language. Regulated entities develop their own individual solutions of compliance. They take the risk of falling short of the expectations of the regulator. In the future compliance could be as easy as for the regulated entity as uploading regulatory software which collects and reports data automatically and perhaps even autonomously.

The paper highlights that there will be a learning period during which the limitations of the technology will reveal themselves. An important contribution of the article is that the translation of natural language into computer code changes meaning. Programming involves policy choices. This point has so far not been articulated in the literature or in the communications issued by the UK Financial Conduct Authority or the Bank of England.

The article contributes further to the existing debate by arguing that the regulator's response needs to be informed by five criteria that have been developed to evaluate the quality of regulation: democratic legitimacy; accountability of the regulator; fair, accessible and open procedure; expertise and efficiency. These criteria need to be built into regulatory technology. Programming is more than an exercise in computer science. The regulator needs to determine an appropriate level of involving itself in the creation and maintenance of regulatory software. It needs to invest resources enabling its staff to understand the technology, anticipate problems and develop an appropriate response.

The paper then connects the five quality criteria with five regulatory strategies: command regulation, meta-regulation, co-regulation, enforced self-regulation and self-regulation. It shows how each of these could be used for regulatory technology and analyses the respective advantages and disadvantages against the background of possible use cases for regulatory technology.

The article points out that the precision inherent in computer language comes at the price of a reduction in flexibility which, if only for the time being, will limit potential use cases. Moreover any application needs to be designed in a way that allows human actors to take into account factors that do not easily reveal themselves in data. Regulatory technology needs to be designed in a way that allows both the regulator and regulated entities to retain a view of the overall picture. There is also a risk that high levels of standardisation influence the business

model of regulated entities making them more similar and leading to higher levels of systemic risk. Another trap to be avoided is regulatory capture which makes it all the more important that the regulator invests in its own expertise.

Following the financial crisis self-regulatory strategies have been unpopular. The command approach that has followed the crisis has been criticised for being too limiting and expensive. It is tempting to use the availability of new technology as an occasion to go modify the overall approach to regulation. The article makes the point that the availability of new technology does not affect the incentives of regulated entities. Technology is neutral. It serves those who develop it. There is no technological reason allowing us to have more faith in the ability of regulated entities to align business interests with regulatory standards. Moreover the use of technology will introduce a new type of service provider to this area of the law. Technology firms have their own business model which affects the type of services they are able to provide. In addition the market for the analysis of data is already very concentrated. This limits the bargaining power of all but the largest regulated entities and also affects the ability of the regulator to represent the public interest.

The regulator is currently at the stage of testing possible technological solutions in consultation with regulated entities. It will need to invest further enabling it to adequately oversee the application and maintenance of regulatory technology as it emerges.

This paper is published as part of the Systemic Risk Centre's Special Paper Series. The support of the Economic and Social Research Council (ESRC) in funding the SRC is gratefully acknowledged [grant number ES/K002309/1].

Eva Micheler, Department of Law and Systemic Risk Centre, London School of Economics and Political Science
Anna Whaley, Department of Law and Systemic Risk Centre, London School of Economics and Political Science

Published by
Systemic Risk Centre
The London School of Economics and Political Science
Houghton Street
London WC2A 2AE

All rights reserved. No part of this publication may be reproduced, stored in a retrieval system or transmitted in any form or by any means without the prior permission in writing of the publisher nor be issued to the public or circulated in any form other than that in which it is published.

Requests for permission to reproduce any article or part of the Working Paper should be sent to the editor at the above address.

© Eva Micheler and Anna Whaley, submitted 2018

Regulatory Technology

This paper is available from https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3164258

Eva Micheler, Associate Professor (Reader), LSE

Anna Whaley, LLM candidate, LSE

Abstract

Technology changes society. Financial services and their regulation is not immune from this. Indeed, distributed ledger technology and artificial intelligence have the potential to change the way in which financial services are delivered and regulated. This paper discusses the use of technology for the purpose of financial regulation. The hope is that this will increase the effectiveness and efficiency of financial regulation.

At present regulatory technology is in the very early stages of development. The authors therefore start by reviewing the technology that is inspiring those who are attempting to create regulatory technology. They analyse distributed ledger technology, which was originally developed for cryptocurrencies, but can also be used to maintain and share records of other assets or of anti-money-laundering information. They also discuss the use of artificial intelligence and machine learning for the purpose of financial regulation.

After that the current work of the UK Financial Conduct Authority (FCA) on model driven and machine executable regulation will be examined. This work has so far not been analysed in the literature. Distributed ledger technology has shown ways of sharing information that could be used to enable the regulator to access records held by regulated entities. This could remove manual processes from current reporting requirements. It would enable the regulator to access data held by regulated entities in real time.

Going further into the future the regulator could stop reviewing individual data points and use artificial intelligence and machine learning to analyse the data held by regulated entities. Software could be developed that identifies patterns and flags anomalies helping the regulator and regulated entities to identify risk as it emerges. This would create a new way of evaluating the risk profile of regulated entities.

At present the regulator issues rules in natural language. Regulated entities develop their own individual solutions of compliance. They take the risk of falling short of the expectations of the regulator. In the future compliance could be as easy as for the regulated entity as uploading regulatory software which collects and reports data automatically and perhaps even autonomously.

The paper highlights that there will be a learning period during which the limitations of the technology will reveal themselves. An important contribution of the article is that the translation of natural language into computer code changes meaning. Programming involves policy choices. This point has so far not been articulated in the literature or in the communications issued by the UK Financial Conduct Authority or the Bank of England.

The article contributes further to the existing debate by arguing that the regulator's response needs to be informed by five criteria that have been developed to evaluate the quality of regulation: democratic legitimacy; accountability of the regulator; fair, accessible and open procedure; expertise and efficiency. These criteria need to be built into regulatory technology. Programming is more than an exercise in computer science. The regulator needs to determine an appropriate level of involving itself in the creation and maintenance of regulatory software. It needs to invest resources enabling its staff to understand the technology, anticipate problems and develop an appropriate response.

The paper then connects the five quality criteria with five regulatory strategies: command regulation, meta-regulation, co-regulation, enforced self-regulation and self-regulation. It shows how each of these could be used for regulatory technology and analyses the respective advantages and disadvantages against the background of possible use cases for regulatory technology.

The article points out that the precision inherent in computer language comes at the price of a reduction in flexibility which, if only for the time being, will limit potential use cases. Moreover any application needs to be designed in a way that allows human actors to take into account factors that do not easily reveal themselves in data. Regulatory technology needs to be designed in a way that allows both the regulator and regulated entities to retain a view of the overall picture. There is also a risk that high levels of standardisation influence the business model of regulated entities making them more similar and leading to higher levels of systemic risk. Another trap to be avoided is regulatory capture which makes it all the more important that the regulator invests in its own expertise.

Following the financial crisis self-regulatory strategies have been unpopular. The command approach that has followed the crisis has been criticised for being too limiting and expensive. It is tempting to use the availability of new technology as an occasion to go modify the overall approach to regulation. The article makes the point that the availability of new technology does not affect the incentives of regulated entities. Technology is neutral. It serves those who develop it. There is no technological reason allowing us to have more faith in the ability of regulated entities to align business interests with regulatory standards.

Moreover the use of technology will introduce a new type of service provider to this area of the law. Technology firms have their own business model which affects the type of services they are able to provide. In addition the market for the analysis of data is already very concentrated. This limits the

bargaining power of all but the largest regulated entities and also affects the ability of the regulator to represent the public interest.

The regulator is currently at the stage of testing possible technological solutions in consultation with regulated entities. It will need to invest further enabling it to adequately oversee the application and maintenance of regulatory technology as it emerges.

1. Introduction

The idea of replacing humans with 'intelligent' machines is no longer limited to the realm of science fiction. Artificial intelligence and machine learning are seen as tools that already do and will increasingly shape our society in the future.¹ Distributed ledger technology has been described as having the potential to disrupt how and by whom financial services are delivered.² Technology changes society. The law needs to adapt to this change.

This is at present particularly true for financial regulation. Academic scholars have observed that the combination of the increase in regulation after the financial crisis of 2008 and the availability of new technology have inspired the idea of combining regulation with technology.³ The increase in regulatory requirements has made compliance costly both for regulated entities and for regulators. Technological advances make it possible to develop new tools that assist regulated entities and regulators. These tools have been referred to as regulatory technology which can be defined as 'technological solution ... to facilitate compliance with and monitoring of regulatory requirements'.⁴ An increasing number of start-ups are attempting to take advantage of this opportunity.⁵

The regulators are interested in regulatory technology because they too would like to save cost.⁶ They are also interested because it is their role to promote growth and support innovation.⁷ Regulatory technology has been described as a 'game changer'.⁸ It is said to have the potential to streamline compliance and increase efficiency for both the regulator and the regulated entities in

¹ Two recent covers of the *The Economist* focus on Artificial Intelligence: 4 January 2018: The Next Frontier – When Thoughts Control Machines and 3 February 2018: Doctor You – A Revolution in Health Care is Coming. The issue of 14 February 2018 contains seven articles that use the term 'artificial intelligence': pages 12, 30, 60, 68, 69, 78 and 79.

² Philip Paech, 'Blockchain Financial Networks', (2017) 80 (6) *Modern Law Review* 1073.

³ Packin, Nizan Geslevich, 'Regtech, Compliance and Technology Judgment Rule' (September 26, 2017). *Chicago-Kent Law Review*, forthcoming, <<https://ssrn.com/abstract=3043021>> accessed 25 February 2018; Zetzsche, Dirk A. and Buckley, Ross P. and Arner, Douglas W. and Barberis, Janos Nathan, 'Regulating a Revolution: From Regulatory Sandboxes to Smart Regulation' (August 14, 2017), 23 *Fordham Journal of Corporate and Financial Law* 31-103 (2017); Arner, Douglas W. and Barberis, Janos Nathan and Buckley, Ross P., 'The Emergence of Regtech 2.0: From Know Your Customer to Know Your Data' (2016) 44 *Journal of Financial Transformation* 79; UNSW Law Research Paper No. 63.

⁴ Packin, Nizan Geslevich, 'Regtech, Compliance and Technology Judgment Rule' (September 26, 2017). *Chicago-Kent Law Review*, forthcoming, <<https://ssrn.com/abstract=3043021>> accessed 25 February 2018, page 194 – citing the Financial Conduct Authority, 'Call for Input: Supporting the Development and Adoption of RegTech' (23 November 2015), available at <<https://www.fca.org.uk/news/news-stories/call-input-supporting-development-and-adoption-regtech>> accessed 25 February 2018.

⁵ Institute of International Finance, 'RegTech in Financial Services: Solutions for Compliance and Reporting' 5-8 (March 22, 2016), <<https://www.iif.com/publication/research-note/regtech-financial-services-solutions-compliance-and-reporting>> accessed 25 February 2018.

⁶ Financial Conduct Authority, Business Plan 2018/19, page 27 <https://www.fca.org.uk/publications/corporate-documents/our-business-plan-2018-19> accessed 16 April 2018.

⁷ Zetzsche, Dirk A. and Buckley, Ross P. and Arner, Douglas W. and Barberis, Janos Nathan, 'Regulating a Revolution: From Regulatory Sandboxes to Smart Regulation' (August 14, 2017), 23 *Fordham Journal of Corporate and Financial Law* 31-103 (2017).

⁸ Enriques, Luca, Financial Supervisors and Regtech: Four Roles and Four Challenges (December 13, 2017). *Revue Trimestrielle de Droit Financier*, forthcoming, <<https://ssrn.com/abstract=3087292>> accessed 25 February 2018.

the financial market.⁹ An example of a regulatory requirement that could benefit from improvements in technology is regulatory reporting.¹⁰

In Section 2 the technology will be examined. After that the implications of this technology for regulation will be discussed (section 3). Then criteria that have been developed to measure regulatory quality will be analysed against the background of regulatory technology (section 4). Section 5 will discuss five strategies that are available to the regulator. Section 6 will conclude and make recommendations.

2. The Technology

At present neither the FCA nor the Bank of England have adopted or endorsed any particular technological solution. They are, however, holding themselves ready and are proactively engaging with market participants.¹¹ Because regulatory technology is at an early stage of its development it is worth considering what those attempting to create such tools are using for inspiration.

i. Distributed Ledger Technology [DLT] - Cryptocurrencies

The mothership of the quest for combining technology with financial services and their regulation is Bitcoin. Bitcoin is a currency that is not backed by the government of any state. It is referred to as a cryptocurrency because bitcoins exist only electronically and are transferred by the use of cryptographic tools.¹²

Fiat money is also recorded electronically. Account holders have accounts with commercial banks. But each bank only maintains accounts for their respective customers. There is a central bank, but that keeps accounts for commercial banks rather than retail customers. The commercial banks and the central bank are regulated. They each operate their own computer systems.

Bitcoin is different in a number of ways. There is one ledger recording ownership of all issued coins, but there is no central bank or other central authority. The ledger is distributed. It is

⁹ Arner, Douglas W. and Barberis, Janos Nathan and Buckley, Ross P., 'The Emergence of Regtech 2.0: From Know Your Customer to Know Your Data' (January 1, 2016). (2016) 44 Journal of Financial Transformation 79; UNSW Law Research Paper No. 63, page 5.

¹⁰ FCA Feedback Statement FS 16/4 to Call for input on supporting the development and adopters of RegTech (July 2016 page 7, <<https://www.fca.org.uk/publication/feedback/fs-16-04.pdf>> accessed 5 March 2018; Arner, Douglas W. and Barberis, Janos Nathan and Buckley, Ross P., 'The Emergence of Regtech 2.0: From Know Your Customer to Know Your Data' (January 1, 2016). (2016) 44 Journal of Financial Transformation 79; UNSW Law Research Paper No. 63; and Zetsche, Dirk A; and Buckley, Ross P. and Arner, Douglas W. and Barberis, Janos Nathan, 'From FinTech to TechFin: The Regulatory Challenges of Data-Driven Finance' (April 28, 2017). New York University Journal of Law and Business, Forthcoming; European Banking Institute Working Paper Series 2017 - No. 6; University of Hong Kong Faculty of Law Research Paper No. 2017/007; University of Luxembourg Law Working Paper No. 2017-001, <<https://ssrn.com/abstract=2959925>> accessed 25 February 2018, page 6.

¹¹ FCA Feedback Statement FS 16/4 to Call for input on supporting the development and adopters of RegTech (July 2016 pages 13 – 14, <<https://www.fca.org.uk/publication/feedback/fs-16-04.pdf>> accessed 5 March 2018

¹² For a definition see also Maupin, Julie A., 'Mapping the Global Legal Landscape of Blockchain and Other Distributed Ledger Technologies' (July 16, 2017), <<https://ssrn.com/abstract=2930077>> accessed at 25 February 2018, page 3 and Pilkington, Marc, 'Blockchain Technology: Principles and Applications' (September 18, 2015), Research Handbook on Digital Transformations, edited by F. Xavier Olleros and Majlinda Zhegu. Edward Elgar, 2016, <<https://ssrn.com/abstract=2662660>> accessed 25 February 2018.

maintained by nodes. These are referred to as 'miners'. Anyone can become a node and participate in the maintenance of the ledger. Each node holds an authentic record of the ledger. Coin owners send transfer instructions to the nodes. These are processed in blocks. Each of the nodes checks against the record of all previous transactions if there is sufficient credit. There is a consensus mechanism through which they form an agreement to update the ledger. The ledger is only updated following that consensus mechanism. The technology is therefore referred to as distributed ledger technology. In addition Bitcoin uses a cryptographic tool referred to as hashing to ensure that the ledger is not interfered with by hackers attacking the ledger from the outside of the system.¹³

No government is involved in overseeing the processes that are operated by the Bitcoin distributed ledger. It is therefore possible to describe it as 'unregulated'. There is nevertheless a team of software developers who maintain and update the software. These software developers have no power to enforce updates. The nodes forming the distributed ledger decide on whether to accept updates. Forks can occur when nodes who reject an update continue the ledger under unrevised rules, while the majority, who have accepted the update, continue the ledger under updated rules. It is possible to characterise Bitcoin as a self-regulated system, albeit unsupported by governmental endorsement.

ii. Distributed Ledger Technology – Assets

Bitcoin is a libertarian project but the technology also lends itself to non-libertarian applications. There is no technological reason that prevents the technology from serving incumbent market participants or the state. A distributed ledger can, for example, be used to record ownership to assets other than money, such as land, securities or diamonds.

It is also possible to change the balance of power between the nodes and those who design, maintain and update the software. Distributed ledgers can be organised in a way that looks very much like a central ledger which is owned and updated by an operator, and in this sense is easy to translate the technology into a setting that serves the government or the financial services industry. It would, for example, be possible to operate the land register on a distributed basis where an identical record is held by several nodes. In such a system an update would only occur after the nodes had checked their record and formed a consensus that the update was consistent with that record. This would be more secure than a central database because any hacker would have to manipulate all of these records to compromise the information recorded there. If a record is maintained by one central authority, the same hacker only has to focus on attacking that authority.

¹³ The fact that ledger is encrypted through a hashing mechanism combined with the fact that transfer instructions are processed in blocks explains why the technology is also referred to as blockchain technology.

Notwithstanding the distributed nature of the ledger the system operator could have a significant amount of control over the software.

The use of distributed ledger technology for assets other than electronic coins is currently being explored by start-ups as well as incumbent market participants. It is at present unclear if and how the technology will be adopted more widely for financial assets.¹⁴ It is possible that we are experiencing a hype that will lead to modest if any change. There are however so many ongoing trials, sprints and experiments with the technology that incumbent and aspiring market participants as well as their regulators, advisors and academic observers need to pay attention.¹⁵ The FCA has announced that it expects to see industry efforts investigating DLT to result in movement from 'proof of concept' to real-world deployments in 2018.¹⁶

As the regulator, the FCA must strike a balance between supporting innovation and protecting consumers, markets and competition. The FCA have begun a conversation with market participants about the use of DLT in the markets it oversees. They published a discussion paper in April 2017 stating that they are 'particularly interested to explore where the balance of risk and opportunities may lie in relation to DLT.'¹⁷

In December 2017 they issued a 'Feedback Statement on Discussion Paper 17/03'.¹⁸ The Feedback Statement highlights that respondents were, overall, supportive of the FCA's 'proactive new approach to technology'.¹⁹ Respondents believed that under the FCA's current regulatory rules there were no immediately apparent barriers to adoption of DLT by regulated firms, and many noted that the benefits of DLT would differ given its particular application. They also noted the global nature of DLT – and encouraged the FCA to 'collaborate even more proactively' with regulatory authorities around the world, to facilitate a globally harmonised approach to DLT use.

If market participants develop a DLT system through which they hold and transfer financial assets, the regulator could get involved in a number of ways. It is possible that the technology improves the current system by providing the regulator 'with the opportunity to monitor, supervise and audit trades and agreements in real time'.²⁰

iii. Distributed Ledger Technology – Sharing Anti-money Laundering Information

¹⁴ Trautman, Lawrence J., 'Is Disruptive Blockchain Technology the Future of Financial Services?' (May 28, 2016) 69 *The Consumer Finance Law Quarterly Report* 232 (2016).

¹⁵ Ammous, Saifedean, 'Blockchain Technology: What is it Good for?' (August 8, 2016), <<https://ssrn.com/abstract=2832751>> accessed 25 February 2018, page 1.

¹⁶ Financial Conduct Authority, *Discussion Paper on Distributed Ledger Technology* (DP17/3, April 2017), page 6 <<https://www.fca.org.uk/publication/discussion/dp17-03.pdf>> accessed 25 February 2018.

¹⁷ Ibid.

¹⁸ Financial Conduct Authority, *Distributed Ledger Technology: Feedback Statement on Discussion Paper 17/03* (FS17/4, December 2017), <<https://www.fca.org.uk/publication/feedback/fs17-04.pdf>> accessed 25 February 2018.

¹⁹ Ibid, page 4.

²⁰ Hileman, Garrick and Rauchs, Michel, 2017 Global Blockchain Benchmarking Study (September 22, 2017), <<https://ssrn.com/abstract=3040224>> page 64, accessed 25 February 2018.

In addition to using the technology for holding and transferring assets distributed ledger technology can also be used to share information. In that case a distributed ledger could, for example, record anti-money laundering information. The updates would involve some form of a consensus mechanism in which the nodes participate. Once the information is on the ledger it can be shared between nodes who can rely on it without performing their own AML checks. Cryptography would enable the individuals to which the information relates to decide who their information is shared with. The FCA notes in this context that implementation would involve the same risks as implementing any other new solution, which are likely to involve significant cost. It also highlights that regulatory activity that is reliant on tracking clients, would require adoption by multiple firms to be effective. They have indicated that their next steps will include continuing to both monitor DLT-related market developments and to engage with industry participants, particularly on potential DLT use cases.²¹

iv. Model Driven and Machine Executable Regulations

The possibilities of distributed ledger technology combined with recent technological advances in machine learning and artificial intelligence have inspired work on model driven and machine executable regulation. This is a step away from a distributed ledger that records assets or information and that is updated by a consensus mechanism.

The FCA are currently working with the Bank of England to explore whether model driven machine executable regulatory reporting could address the 'increasing challenges financial institutions face implementing their regulatory reporting obligations.'²² In what are referred to as 'TechSprints' they explore the possibilities for linking technology to 'regulation, compliance procedures, firms' policies and standards together with firms' transactional applications and databases.'²³

Under SUP 16.11 of the FCA Handbook regulated entities need to submit information relating to mortgage lending to the FCA. These rules served as a test case for TechSprints that occurred in November 2016, in August 2017 and in November 2017.

At present the FCA operates a database referred to as Gabriel. Regulated entities collect the information required and submit it to Gabriel. This has a number of disadvantages. Each entity operates its own computer system. It is possible for an entity to operate more than one such system. When regulated entities merge or restructure in other ways, computer systems often continue to operate as separate silos within the entities that have emerged from the restructuring. To comply with reporting requirements regulated entities need to produce an electronic report collecting their internal information. This involves manual processes collecting information

²¹ Financial Conduct Authority, *Distributed Ledger Technology: Feedback Statement on Discussion Paper 17/03* (FS17/4, December 2017), <<https://www.fca.org.uk/publication/feedback/fs17-04.pdf>> accessed 25 February 2018.

²² FCA "Model driven machine executable regulatory reporting" <<https://www.fca.org.uk/firms/our-work-programme/model-driven-machine-executable-regulatory-reporting>> accessed 25 February 2018.

²³ Ibid.

internally which take time and are prone to mistakes. When the FCA receives these reports they need to be checked for completeness and compliance with the requirements. When the rules are updated each entity reads the new regulations, takes a view on how to implement them and updates their systems accordingly adding data fields or making other modifications.

Regulated entities as well as the regulator feel that they would benefit from a system that removes manual processes from regulatory reporting. Gabriel, which came live in 2011, is likely to benefit from an upgrade in the not so distant future. Brexit gives the UK greater freedom to develop a framework of its own. Distributed ledger technology has shown ways of sharing information. Machine learning and artificial intelligence are underpinned by programming tools that could be used for regulatory purposes. Now seems like a very good time to develop regulatory technology.

In the TechSprint that occurred in 2016 and 2017 software was used to translate the requirements for mortgage reporting from English into computer code.²⁴ This software mapped the 'regulatory requirements directly to the data ... creating the potential for automated, straight-through-processing of regulatory returns.' The TechSprint was successful. The conclusion was that, from a computer science perspective, it is possible to translate rules on mortgage reporting into a machine readable and executable form. Software exists that can retrieve data held by regulated entities, create a report automatically and submit it to the FCA. That software can also be updated reflecting regulatory changes.²⁵

Going forward other parts of the FCA Handbook, perhaps even its entire content could be translated into code. Regulated entities would then make available their computer systems to receive regulatory software investigating compliance, make suggestions for sanctions or perhaps even automatically enforce.²⁶

3. Implications for Regulation

At present the FCA regulates the outcome, rather than process, in accordance with the statutory objectives of ensuring consumer protection, market integrity and competitive markets. The regulator acts on the basis of legislation. Based on their mandate they issue regulations and publish them. Regulated entities employ human beings that read and interpret these regulations. Each entity takes a view on how to implement them. They may seek legal advice and/or liaise with the regulator.

²⁴ <https://www.fca.org.uk/events/techsprints/model-driven-machine-executable-regulatory-reporting-techsprint>, accessed 5 March 2018.

²⁵ Ibid.

²⁶ Financial Conduct Authority, RegTech Work Programme <<https://www.fca.org.uk/firms/regtech/our-work-programme>> accessed 5 March 2018; Financial Conduct Authority, Feedback Statement FS 16/4 to call for input on supporting the development and adopters of RegTech, July 2016 page 8-9 <<https://www.fca.org.uk/publication/feedback/fs-16-04.pdf>> accessed 5 March 2018; Philip Treleaven, 'Financial Regulation of Fintech' (7 November, 2015) Journal of Financial Perspectives, Vol. 3, No. 3, 2015; for a paper on software that draws conclusions on risk by investigating emails and news see Das, Sanjiv Ranjan and Kim, Seoyoung and Kothari, Bhushan, 'Zero-Revelation RegTech: Detecting Risk through Linguistic Analysis of Corporate Emails and News' (April 27, 2017), <<https://ssrn.com/abstract=2909380>> or <<http://dx.doi.org/10.2139/ssrn.2909380>> accessed 5 March 2018.

The FCA is neutral towards the technology used by the entities it regulates.²⁷ It does not matter how firms maintain records or otherwise organise themselves as long as they produce the reports required and comply otherwise with rules contained in the Handbook and its underlying legislation. Regulated firms therefore carry the risk of interpreting the rules and putting in place a system that ensures that they comply. Compliance is ultimately assessed by the courts.

It would be possible for the FCA to change this. Instead of putting in place their own compliance system regulated entities would run regulatory software over their data and would not risk having taken the wrong approach when interpreting the rules.

A system of this type would change the current framework in a number of ways. The software would directly access the information held on the computers operated by regulated entities. It could be programmed to focus on certain elements of that information such as information relating to mortgage lending. It could also be programmed to carry out a more general analysis making independent choice about which data are relevant.

Another effect associated with the adoption of regulatory technology is an increase in precision of the rules. Two points are made here. The first one is that the process of translating rules written in English into code will involve a review of the rules removing ambiguities. The second one is that the need to make rules self-executable will encourage regulators to make regulation as clear as possible from the outset.²⁸

Writing these programmes therefore involves policy choice. Replacing ambiguous terms with precise terms changes meaning. By becoming more precise the scope of a rule can narrow. Removing ambiguity can also cause meaning to shift away from its original focus. In addition computer code has its own albeit more limited ambiguities. Coding is a process of working with the limitations of the respective programming language.²⁹ Replacing ambiguous natural language with code is more than an exercise in computer science.

Regulatory technology can also change how quickly information is available to the regulator. Automated reporting can provide the regulator with close to real time information on regulated entities.³⁰

²⁷ Financial Conduct Authority, *Discussion Paper on Distributed Ledger Technology* (DP17/3, April 2017) accessible at: <<https://www.fca.org.uk/publication/discussion/dp17-03.pdf>>, page 5, accessed 5 March 2018.

²⁸ Andrew Burt, Jeremy Aron-Dine, Eugene Kim, Catherine Martinz and Xiangong (George) Wang, *2017 Model Driven and Machine Executable Regulations and Tech Sprint: Success Criteria and Recommendations* page 4 <<https://www.immuta.com/download/recommendations-for-the-fca-and-boes-2017-model-driven-and-machine-executable-regulations-tech-sprint/>> accessed 5 March 2018.

²⁹ Firas Al Khalil, Marcello Ceci, Leona O'Brien and Tom Butler, 'A Solution for the Problems of Translation and Transparency in Smart Contracts' (February 2017) <<http://www.grctc.com/wp-content/uploads/2017/06/GRCTC-Smart-Contracts-White-Paper-2017.pdf>> accessed 5 March 2018.

³⁰ Andrew Burt, Jeremy Aron-Dine, Eugene Kim, Catherine Martinz and Xiangong (George) Wang, '2017 Model Driven and Machine Executable Regulations and Tech Sprint: Success Criteria and Recommendations', page 4, <<https://www.immuta.com/download/recommendations-for-the-fca-and-boes-2017-model-driven-and-machine-executable-regulations-tech-sprint/>> accessed 5 March 2018.

When new technology emerges our knowledge is initially and invariably limited. Those trained in law do not normally know about the characteristics and limitations of computer software. Those trained in computer science are not normally familiar with the scope and subtleties of legal terms. Neither group is well placed to anticipate problems that may arise when the two are combined. They may not even be in a good position to appreciate what it is they do not know. This makes it difficult for either group of experts to at least ask the right questions. Innovation creates risks that can't be solved by relying on historical knowledge.³¹

One example is the risks of errors in the software.³² Lawyers are not in a good position to imagine potential fact patterns. Computer scientists can imagine much better what could go wrong, but are not well placed to predict implications for the legal context. Another example that has been mentioned in this context is that complex software tends to be opaque. This can make it difficult for computer scientist to predict outputs.³³ The risk stemming from this opacity needs to be managed using legal as well as computer science tools.

There are a myriad of other risks that arise from reliance on software – risks that are increasing as our reliance on the technology increases. Indeed, the advances in and proliferation of artificial intelligence technology has seen calls for governments to regulate its development and restrict its operation.³⁴ What is 'striking' about concerns around artificial intelligence is that many concerns appear to be voiced by industry leaders, and go beyond the 'familiar fears of technological unemployment'³⁵ – from figures as prominent as Bill Gates.³⁶ Scherer suggests that many of the practical challenges that are caused by the increasing role of artificial intelligence in society, including in regulation, 'stems from the manner in which AI is researched and developed and from the basic problem of controlling the actions of autonomous machines.'³⁷ In particular artificial

³¹ U. Beck 'The Politics of Risk Society' and A. Giddens 'Risk Society: the Context of British Politics', both in J. Franklin (ed.), *The Politics of Risk Society* (Cambridge, 1998), U. Beck *Risk Society* (London, 1992); id., *The Reinvention of Politics* (Cambridge, 1997) and A. Giddens, *Beyond Left and Right* (Cambridge, 1994) as summarised in Baldwin, R & Cave, *Understanding Regulation* (Oxford, Oxford University Press (1999)), Chapter 3 "What is good regulation", page 80.

³² Andrew Burt, Jeremy Aron-Dine, Eugene Kim, Catherine Martinz and Xiangong (George) Wang, '2017 Model Driven and Machine Executable Regulations and Tech Sprint: Success Criteria and Recommendations', page 5, <<https://www.immuta.com/download/recommendations-for-the-fca-and-boes-2017-model-driven-and-machine-executable-regulations-tech-sprint/>> accessed 5 March 2018.

³³ Andrew Burt, Jeremy Aron-Dine, Eugene Kim, Catherine Martinz and Xiangong (George) Wang, '2017 Model Driven and Machine Executable Regulations and Tech Sprint: Success Criteria and Recommendations', page 4, <<https://www.immuta.com/download/recommendations-for-the-fca-and-boes-2017-model-driven-and-machine-executable-regulations-tech-sprint/>> accessed 5 March 2018; see also Matthew U. Scherer, 'Regulating Artificial Intelligence Systems: Risks, Challenges, Competencies, and Strategies' (May 30, 2015). *Harvard Journal of Law & Technology*, Vol. 29, No. 2, Spring 2016 page 359, <<https://ssrn.com/abstract=2609777>> or <<http://dx.doi.org/10.2139/ssrn.2609777>> accessed 5 March 2018.

³⁴ See for example John Frank Weaver, We Need to Pass Legislation on Artificial Intelligence Early and Often, SLATE <http://www.slate.com/blogs/future_tense/2014/09/12/we_need_to_pass_artificial_intelligence_laws_early_and_often.html> accessed 5 March 2018.

³⁵ Matthew U. Scherer, 'Regulating Artificial Intelligence Systems: Risks, Challenges, Competencies, and Strategies' (May 30, 2015). *Harvard Journal of Law & Technology*, Vol. 29, No. 2, Spring 2016 page 355.

³⁶ Eric Mack, 'Bill Gates Says You Should Worry About Artificial Intelligence', FORBES (January 28, 2015), <<http://www.forbes.com/sites/ericmack/2015/01/28/bill-gates-also-worries-artificial-intelligence-is-a-threat/>> accessed 5 March 2018.

³⁷ Matthew U. Scherer, 'Regulating Artificial Intelligence Systems: Risks, Challenges, Competencies, and Strategies' (May 30, 2015). *Harvard Journal of Law & Technology*, Vol. 29, No. 2, Spring 2016 page 358.

intelligence can operate in ways that are unforeseen by programmers. It can also exceed the control of both the regulator and regulated entities.³⁸

The regulator nevertheless needs to consider how to respond. It needs to understand and, based on this understanding, manage the risks that arise from the use of the technology. It also needs to work out which problems will arise when the technology is used in a regulation context. To develop an understanding of these it is useful to start with examining criteria that have been developed for assessing the quality of regulation will be analysed against the background of regulatory technology. After that it will be examined how the classic strategies that are available to the regulator could be implemented for regulatory technology.

4. Quality of regulation

When considering how the regulator should respond to regulatory technology, it is helpful to examine criteria that have been developed to evaluate the quality of regulation. Professor Baldwin has identified five criteria that good quality regulation should meet.³⁹ These are democratic legitimacy; accountability of the regulator; fair, accessible and open procedures; expertise; efficiency.

First, regulation should be supported by legislative authority. The acts of the regulator need to be legitimised by a mandate from a democratically elected parliament. The requirement for democratic legitimacy also affects the breath of the mandate. For example, a statute that requires a regulator to collect reporting information on mortgages to ensure lending is being carried out in accordance with capital and other regulatory requirements, gives more specific legitimacy to the regulator than a statute which simply instructs the regulator to 'promote financial stability'. Considerations of democratic legitimacy also affect the extent to which the regulator should delegate decision making. In the context of regulatory technology the regulator needs to work out how to address the fact that coding involves policy choices. The extent to which such policy choices are involved depends on the context. Automating the reporting of transactions is likely to involve fewer policy choices than a tool that assesses risk based on the intelligent analysis of data. The regulator needs to determine the extent to which the context requires their involvement.

Second, there should be an appropriate scheme of accountability. If a regulator is accountable to a democratic institution or other representative body it may claim a legitimacy deserving of the support of the public. Determining the appropriate level and form of accountability can be challenging. It requires a decision of whether a particular regulatory scheme is suitable for private

³⁸ Ibid, page 359.

³⁹ Baldwin, Cave and Lodge, *Understanding Regulation: Theory, Strategy and Practice* (2nd ed., Oxford University Press, 2011), page 25.

or governmental oversight and of their respective levels of involvement.⁴⁰ Here again the regulator needs to work out how much discretion the respective technology entails and form a view on the appropriate level of their involvement.

Third a regulator may also claim legitimacy if it uses fair, accessible and open procedures, ensuring democratic legitimacy for regulation through due process. This requires the regulator to examine both data driven analysis and enforcement based on data driven analysis to determine how to integrate notions of due process into the technology.

Fourth, regulatory functions like financial services regulation require expert judgment. A regulator with appropriate expertise can claim legitimacy based on its knowledge. The regulator needs to invest in staff and technology to acquire an understanding of the characteristics and limitations of the technology to be able to develop an appropriate regulatory strategy.

The final criterion against which regulation can be assessed is efficiency. Efficiency can be either determined by reference to the implementation of the legislative mandate. Another way of assessing efficiency would be by reference to the results delivered by the regulatory process. Either way efficiency often conflicts with social aims of regulation which are difficult to quantify and is therefore a contested criterion.⁴¹ In relation to regulatory technology both the regulator and regulated entities are engaging in the process because they expect cost savings. It remains to be seen if these savings outperform the cost involved in setting up and overseeing the mechanism that will evolve going forward.

At present there have only been tests which have shown that a type of software that automates the reporting of one data point works. The use of regulatory technology is nevertheless in the FCA's business plan.⁴² The regulator is consulting with regulated entities but has not yet developed a strategic position. It is suggested here that the criteria referred to above should inform and guide the thought process that determines the level of the regulator's involvement.

5. Strategies for Regulation

There are a variety of regulatory strategies available to a government considering implementation of financial regulation, and choosing the most appropriate type of regulation is key to a regulatory scheme's legitimacy.⁴³ A conventional view of regulation involves a choice somewhere between freedom and control. Governments can either leave businesses with complete freedom, or can

⁴⁰ Baldwin, Cave and Lodge, *Understanding Regulation: Theory, Strategy and Practice* (2nd ed., Oxford University Press, 2011), page 143.

⁴¹ For example, see Prosser, *Law and the Regulators* (Oxford, 1997).

⁴² Financial Conduct Authority, Business Plan 2018/19, page 27 <https://www.fca.org.uk/publications/corporate-documents/our-business-plan-2018-19> accessed 16 April 2018.

⁴³ Baldwin, R & Cave, *Understanding Regulation* (Oxford, Oxford University Press (1999)), Chapter 4 "Regulatory Strategies", page 34.

take away that freedom by imposing control in the form of regulation, backed by sanctions.⁴⁴ Options particularly relevant for financial regulatory reporting networks, in order of the most governmental involvement to the least, include:

- i. Command (also known as ‘control’) regulation;
- ii. Meta-regulation;
- iii. Co-regulation;
- iv. Enforced self-regulation; and
- v. Self-regulation.

In the subsections below it will be discussed how each of these strategies could be used for regulatory technology.

i. Command regulation

The essence of a command regulatory strategy is in its control of the achievement of certain standards by imposing sanctions where standards are not met. It is typically the government setting these standards and sanctions through primary or secondary legislation, and often a regulatory body enforces them.⁴⁵ Command regulation is frequently used in situations where risks from non-compliance are high (such as transport safety) or where a minimum standards are thought to be in the public interest (such as employment law). The regime that was put in place after the financial crisis can in large parts be characterised as a command regime.

A command approach could be adopted to regulatory technology. Taking advantage of the technology the government could issue regulation in the form of software requiring regulated entities to run that software on their systems. This would address the problem that the coding involves policy choices. Making these choices would remain with the regulator.

Command regulation is said to be expensive for both the government and for regulated entities. The government needs to both set appropriate standards and develop an enforcement mechanism.⁴⁶ Under a command approach to regulatory technology the government would develop the technology either itself or through outsourcing.⁴⁷ It would also oversee its maintenance and updates at an operational level.

⁴⁴ C. Coglianese and E. Mendelson, ‘Meta-Regulation and Self-Regulation’ in R. Baldwin, M. Cave, and M. Lodge (eds.), *The Oxford Handbook on Regulation* (Oxford, 2010), page 1.

⁴⁵ Baldwin, R & Cave, *Understanding Regulation* (Oxford, Oxford University Press (1999)), p 35.

⁴⁶ Baldwin, R & Cave, *Understanding Regulation* (Oxford, Oxford University Press (1999)), Chapter 4 “Regulatory Strategies”, page 38; see also Burt, Andrew et al, page 8.

⁴⁷ Enriques, Luca, Financial Supervisors and Regtech: Four Roles and Four Challenges (December 13, 2017). *Revue Trimestrielle de Droit Financier*, forthcoming, <<https://ssrn.com/abstract=3087292>> accessed 25 February 2018 page 5.

From the perspective of regulated entities command regulation compliance tends to regulate to a fairly granular level and that creates complexity. This makes compliance costly. For this reason, a command strategy can be 'disproportionately burdensome to small firms'.⁴⁸ Regulatory Technology is designed to fix this cost problem for regulated entities.⁴⁹ It could shift the burden of interpreting rules and developing a compliance regime to the regulator. Regulated entities would run compliance software instead. The hope is that this will make compliance cheaper for them.⁵⁰ It is difficult to predict the extent to which cost savings are going to materialise.

It remains to be seen, for example, how easy it will be to connect existing IT systems to new regulation software. It is possible that regulated entities will need to spend significant amounts of money to make their legacy systems compatible with any new mechanism. Making such investments will invariably be more challenging for smaller than for larger market participants. Not all firms are in a position to invest in new technology.⁵¹

Command regulation has a reputation for being inflexible.⁵² This can strangle competition and stunt enterprise and growth.⁵³

Flexibility can also be a problem with regulatory technology. It has already been mentioned that regulatory technology is capable of delivering more precise regulation.⁵⁴ While precision is desirable in financial regulation as in any other area of the law, it comes at the price of flexibility.⁵⁵ This may be a temporary issue that will be solved by computer scientists developing software that operates flexible legal terms. The ability of software to incorporate flexibility may nevertheless limit if only for the time the use cases for regulatory software.

While being perhaps inflexible in some ways regulatory technology has been said to provide for more flexibility than the current regime in other ways. When the FCA Handbook is updated each regulated entity needs to interpret the update and implement compliance. This makes it hard to change course. If the regulator uses regulatory software that step would fall away. The regulated entity would only have to install the update provided for by the regulator.

⁴⁸ Better Regulation Task Force, 'Imaginative Thinking for Better Regulation' (Cabinet Office, 2003) <<http://webarchive.nationalarchives.gov.uk/20100812083626/http://archive.cabinetoffice.gov.uk/brc/upload/assets/www.brc.gov.uk/imaginativeregulation.pdf>> accessed 25 February 2018, page 15.

⁴⁹ Andrew Burt, Jeremy Aron-Dine, Eugene Kim, Catherine Martinz and Xiangong (George) Wang, '2017 Model Driven and Machine Executable Regulations and Tech Sprint: Success Criteria and Recommendations', <<https://www.immuta.com/download/recommendations-for-the-fca-and-boes-2017-model-driven-and-machine-executable-regulations-tech-sprint/>> accessed 5 March 2018.

⁵⁰ Ibid.

⁵¹ Financial Conduct Authority, Feedback Statement FS 16/4 to Call for input on supporting the development and adopters of RegTech (July 2016 page 11 and 14 <<https://www.fca.org.uk/publication/feedback/fs-16-04.pdf>> accessed 5 March 2018.

⁵² Diver CS, 'The Optimal Precision of Administrative Rules.' (1983) 93(1) Yale LJ 65.

⁵³ Ibid, page 37.

⁵⁴ Andrew Burt, Jeremy Aron-Dine, Eugene Kim, Catherine Martinz and Xiangong (George) Wang, '2017 Model Driven and Machine Executable Regulations and Tech Sprint: Success Criteria and Recommendations', page 4, <<https://www.immuta.com/download/recommendations-for-the-fca-and-boes-2017-model-driven-and-machine-executable-regulations-tech-sprint/>> accessed 5 March 2018.

⁵⁵ Ibid, page 5.

In order to delivery such an update, however, the regulator would have to monitor the market and take decisions on how to respond to new developments. Regulatory technology can assist the regulator in analysing markets and detecting risks. But that analysis is only as good as the data that it is based on. Market participants would, of course, continue to be able to alert the regulator to areas where the existing process has proven to be inadequate or is stifling growth. But there is a risk that decision makers will find it difficult to respond to concerns that are not visible in the data. That could create a new source of inflexibility.

Inflexibility could also arise if the technology used is highly standardised. At the moment each regulated entity develops its own understanding of how to comply. The current rules allow for different interpretations which are all equally lawful. This facilitates a variety of business models within the financial services industry. If highly standardised financial technology is used across regulated entities the room for variety may be reduced. This can facilitate herding. There is therefore a risk that regulated entities become increasingly similar causing systemic problems to arise.⁵⁶

Another observation that has been made for a command system and that is useful to keep in mind here is that its complexity, cost and inflexibility can discourage compliance.⁵⁷ Regulated entities engage in box-ticking rather than in maintaining standards.⁵⁸ In theory regulatory technology would improve compliance. If all regulated entities are required to do is run regulatory software over their computer systems it is hard to see how they could fail to perform that step. But regulatory software also ticks boxes. The challenge for computer scientists is to develop software that is able to also observe the big picture.

If this can be achieved we are nevertheless not much closer to raising standards in the real world. The human actors within regulated entities have a choice. They can orient themselves towards the standards required by regulation or alternatively they can appear to be compliant by working out how to avoid detection from the algorithms.

Command regulation has been criticised as potentially leading to high levels of unintended consequences.⁵⁹ This problem can also arise in the context of regulatory technology. For example, the availability of real time transactional information to the regulator could encourage regulated entities to become more focused on short term results and thereby overlook long-term risks. Moreover, if the regulator focuses its analysis on data driven information there is a risk that it does

⁵⁶ Danielson, Jon, 'Artificial intelligence and the stability of financial markets', VOXEU, 15 November 2017 <<https://voxeu.org/article/artificial-intelligence-and-stability-markets>> accessed 5 March 2018.

⁵⁷ Better Regulation Task Force, 'Imaginative Thinking for Better Regulation' (Cabinet Office, 2003) <<http://webarchive.nationalarchives.gov.uk/20100812083626/http://archive.cabinetoffice.gov.uk/brc/upload/assets/www.brc.gov.uk/imaginativeregulation.pdf>> accessed 25 February 2018, page 16.

⁵⁸ Ibid.

⁵⁹ Ibid; Andrew Burt, Jeremy Aron-Dine, Eugene Kim, Catherine Martinz and Xiangong (George) Wang, '2017 Model Driven and Machine Executable Regulations and Tech Sprint: Success Criteria and Recommendations', page 5, <<https://www.immuta.com/download/recommendations-for-the-fca-and-boes-2017-model-driven-and-machine-executable-regulations-tech-sprint/>> accessed 5 March 2018, see reference to the risk of 'incorrect disambiguation'.

give sufficient weight to the scope of the data informing the analysis. Relying on data collected from male patients doctors have, for example, overlooked heart attacks that occurred in female individuals. There is an additional risk that factors that are difficult to measure quantitatively will be overlooked altogether.

Command regulation is susceptible to capture. Capture can occur if the regulator becomes too close to the entities it is regulating, and as a result prioritises 'the pursuit of the regulated firms' interests, rather than those of the public at large.⁶⁰ Capture is thought to have the potential to occur over time in a command based regulatory model particularly, more so than other models. This is because the regulator needs to rely on information provided by the industry to set appropriate standards. In providing information to the regulator, entities can exercise a 'degree of leverage over regulatory procedures',⁶¹ which can, over time, produce capture. This would, of course, also be possible in a world where the regulator uses software rather than natural language for regulatory purposes.

Finally command regulation has also been criticised by scholars who believe market-based influence is preferable to government regulatory influence.⁶²

ii. *Meta-regulation*

Meta-regulation has been described as 'the state's oversight of self-regulatory arrangements',⁶³ and also as 'interactions between different regulatory actors or levels of regulation'.⁶⁴ It involves a regulatory authority overseeing a control or risk management system rather than carrying out regulation directly – with the regulatory authority 'steer[ing] rather than row[ing]'.⁶⁵

It occupies a middle ground somewhere between command regulation with a high level of government involvement and self-regulation with minimal amount government involvement. Under this model the regulator delegates risk control to the regulated entities themselves – giving them primary responsibility for the risk management systems, while the regulator audits, monitors and incentivises the systems.

Under this model the regulator would not design and maintain the software himself, but oversee and validate the software produced by private providers. For regulatory reporting the regulator at

⁶⁰ C. Hood, 'Explaining Economic Policy Reversals' (Buckingham, 1994), at 21, as discussed in Baldwin, R & Cave, *Understanding Regulation* (Oxford, Oxford University Press (1999)), Chapter 4 "Regulatory Strategies", page 36.

⁶¹ Baldwin, R & Cave, *Understanding Regulation* (Oxford, Oxford University Press (1999)), Chapter 4 "Regulatory Strategies", page 36.

⁶² *Ibid.*

⁶³ Hutter, B. 'Risk, Regulation and Management', in P. Taylor-Gooby and J. Zinn (eds.), *Risk in Social Science*, (Oxford University Press, 2006).

⁶⁴ C. Coglianese and E. Mendelson, 'Meta-Regulation and Self-Regulation' in R. Baldwin, M. Cave, and M. Lodge (eds.), *The Oxford Handbook on Regulation* (Oxford, 2010), page 2.

⁶⁵ The case for 'steering rather than rowing', see D. Osborne and T. Gaebler, *Reinventing Government* (Boston, 1992) as discussed in Baldwin, Cave and Lodge, *Understanding Regulation: Theory, Strategy and Practice* (2nd ed., Oxford University Press, 2011), page 147.

present specifies the information they would like to receive. Under a meta-regulatory model it could continue to specify this information but would no longer receive data. Making use of regulatory technology the regulator could issue a machine readable version of certain regulations without developing particular application.⁶⁶ It would rather leave the development and maintenance of regulatory software to private providers but maintain some level of oversight over this software.

The regulator could even step back further and refrain from specifying which data is to be analysed leaving to autonomous algorithms to work out patterns and information that is relevant for measuring risk. They would nevertheless remain involved in overseeing the development and maintenance of that software.

They could also adopt an approach somewhere in between by issuing technical specifications for software that collects the information and carries out the analysis and in addition overseeing its development and maintenance.

A meta-regulation model can allow firms to create industry specific rules that ensure compliance costs are minimised, and at the same time that rules are neither too lax nor overly burdensome,⁶⁷ allowing maximisation of resources. Further, it has the potential to prompt a positive compliance culture, 'as firms are asked to think for themselves about the challenges of controlling' particular risks.⁶⁸

Advocates of this model highlight that certain criteria must be present to enable meta-regulation to fulfil its potential – specifically firms must have both the 'capacity for self-regulation' and the 'internal resolve to self-regulate'.⁶⁹

Problems may of course still arise under a meta-regulation approach. These include the possibility that firms fail to create appropriate rules because they are either uninformed or ill-intentioned. There is also a risk that managers view these rules as less imperative than they would in a command regime. The rules may not be regarded as requirements that need to be maintained regardless of their contribution to the business's overall advancement. Managers may be tempted to characterise rules as one of many factors informing business decisions. This could undermine standards across the industry and cause the approach to become unfair and illegitimate.

There is also potential for the regulator to incur substantial cost in approving software or otherwise overseeing its development. Implementation of a meta-regulation strategy requires significant trust in the integrity of regulated entities and in their ability to align business interests with public interests to achieve effective regulation.

⁶⁶ FCA Feedback Statement FS 16/4 to Call for input on supporting the development and adopters of RegTech (July 2016 page 12 <<https://www.fca.org.uk/publication/feedback/fs-16-04.pdf>> accessed 5 March 2018.

⁶⁷ Baldwin, Cave and Lodge, *Understanding Regulation: Theory, Strategy and Practice* (2nd ed., Oxford University Press, 2011), page 147.

⁶⁸ *Ibid*, page 148.

⁶⁹ *Ibid*, page 149.

Moreover in the context of regulatory technology a further problem arises. There are at present a small number of business who lead the market in data analysis.⁷⁰ These are bound to also take an interest in serving the financial services industry. They bring business interests of their own to the table which do not necessarily align with the interests of regulated entities or with the public interest. The regulator will require a robust amount of expertise to be able to act as an effective auditor of software developed in this context.

iii. *Co-regulation*

Co-regulation refers to 'industry-association self-regulation, with some oversight and/or ratification by government.'⁷¹ It typically involves the government backing standards that have been created by associations of market participants and also relying on these associations for enforcement.

One advantage of this approach is that the government does not pay for the design of the standards or for their enforcement.⁷² Further, as enforcement does not rely on the courts co-regulation standards can be enforced with flexibility and specialist expertise by the industry itself to include industry appropriate sanctions.⁷³

Under a co-regulation approach the regulator could appoint an industry association and leave it to them to create software that manages risk. It could validate these standards at some high level but would not get proactively involved in setting them. It would stand back and let the industry make suggestions.

This would involve the regulator rowing back from the granular levels of regulation that were produced after the financial crises. The regulator could take the view that the reforms have proven to be too expensive and limiting. It could take the fact that new technology is available as an opportunity to modify its regulatory approach. That is a matter for policy choice. It is worth pointing out, however, that the technology is neutral. It serves those who develop it. There is no technological reason allowing us to have more faith in the ability of regulated entities to align business interests with regulatory standards.

⁷⁰ Google, IBM, Facebook and Microsoft are engaged in an arm's race in artificial intelligence and are busy acquiring other smaller technology companies, see Matthew U. Scherer, 'Regulating Artificial Intelligence Systems: Risks, Challenges, Competencies, and Strategies' (May 30, 2015). Harvard Journal of Law & Technology, Vol. 29, No. 2, Spring 2016 page 374-375.

⁷¹ Ayres, I. & Braithwaite, J. *Responsive Regulation* (Oxford University Press, 1992), page 102.

⁷² Andrew Burt, Jeremy Aron-Dine, Eugene Kim, Catherine Martinz and Xiangong (George) Wang, '2017 Model Driven and Machine Executable Regulations and Tech Sprint: Success Criteria and Recommendations', <<https://www.immuta.com/download/recommendations-for-the-fca-and-boes-2017-model-driven-and-machine-executable-regulations-tech-sprint/>> accessed 5 March 2018.

⁷³ Better Regulation Task Force, 'Imaginative Thinking for Better Regulation' (Cabinet Office, 2003) <<http://webarchive.nationalarchives.gov.uk/20100812083626/http://archive.cabinetoffice.gov.uk/brc/upload/assets/www.brc.gov.uk/imaginativeregulation.pdf>> accessed 25 February 2018, page 46.

A major hurdle for co-regulation is its potential to be ineffective if submission to it is voluntary and it does not cover an entire industry. It is also at risk of being influenced and captured by the self-interests of an industry's largest market players.

Here to and perhaps more so than in a meta-regulatory model the problem arises that the market for data analysis has its own business models and is quite concentrated.

iv. *Enforced self-regulation*

Enforced self-regulation is similar to co-regulation. One difference is that under this approach individual firms rather than industry associations are required to adopt appropriate rules. There is government oversight.⁷⁴ Enforced self-regulation has been described by Ayres and Braithwaite as an 'extension and individualisation' of co-regulation.⁷⁵ Where co-regulation 'establishes industry-wide voluntary standards through negotiation with industry associations'⁷⁶ – enforced self-regulation is a negotiation between the government and a particular firm, resulting in flexible, particular (and therefore arguably more enforceable) standards. The government involves itself in three ways. It requires firms to write their own rules, and it approves them. It also causes these rules to be publically enforceable.⁷⁷ State involvement in monitoring compliance and punishing violations has been described as essential for the efficacy of an enforced self-regulatory regime.⁷⁸

Under this approach the regulator would also reduce its current level of prescriptive involvement and instead approve software designed for regulated entities. The regulator could do this by validating and endorsing software created by private operators for regulated firms. There would be no industry body involved in the process.

Enforced self-regulation has a variety of advantages. Rules are tailored to each individual company's activities. This facilitates regulatory innovation.⁷⁹ Further, it is posited that companies are more likely to comply with rules they have created themselves and that such rules would be more precise making it easier for prosecutors to obtain convictions.⁸⁰

For regulatory technology these advantages may materialise. It is possible for regulated entities to develop their own bespoke software. That is, however, not likely. Financial services providers are not necessarily interested in becoming software developers. Pooling their resources market participants have tried to co-operate to develop technology. R3 is an example of such an industry

⁷⁴ Baldwin, Cave and Lodge, *Understanding Regulation: Theory, Strategy and Practice* (2nd ed., Oxford University Press, 2011), page 146.

⁷⁵ Ayres, I. & Braithwaite, J. *Responsive Regulation* (Oxford University Press, 1992), page 102.

⁷⁶ *Ibid.*

⁷⁷ *Ibid.*, page 101-103.

⁷⁸ *Ibid.*, page 105.

⁷⁹ *Ibid.*, page 111.

⁸⁰ *Ibid.*, page 113.

driven co-operation.⁸¹ This has not had much success. The interests of industry participants appear to be too diverse to allow for the development of common technology.

There is, on the other hand, a vibrant market of start-ups who are developing regulatory software. It has been suggested that market participants could be incentivised to engage in this work by allowing them preferential access if only for a limited time.⁸² This could lead to a market with bespoke products tailored to the requirements of individual firms. Ultimately, however, it is more likely that the existing providers of data analysis will occupy a significant share of the market for regulatory technology.

Again, the availability of new technology does not change the fact that enforced self-regulation relies largely on trusting regulated entities to adopt robust mechanisms that they either develop themselves or purchase from third party providers. They may find it even more difficult than industry associations to enforce regulation where that would negatively affect their business or reputation.⁸³

v. *Self-regulation*

Self-regulation is a system where the regulated entities make rules, monitor compliance and organise enforcement.⁸⁴ Self-regulation may be supported by a government or regulator through their approval of industry created codes of practice, which companies within the industry can then voluntarily join. The scheme and the standards are not set by the government, and nor is the government involved in monitoring compliance with them.

The Banking Code is an example. It supplements the FCA's regulation of banks' relationships with their customers. It is approved by the Banking Code Standards Board which consists of ten directors the majority of whom are independent from the organisations that sponsor the board.⁸⁵ The Banking Code Standards Board maintains a list on their website of entities that have and of entities that have not signed up to the Code. It also has a monitoring team who assesses compliance with the Code by writing reports assessing the compliance of each subscriber to the Code.⁸⁶

⁸¹ [].

⁸² Andrew Burt, Jeremy Aron-Dine, Eugene Kim, Catherine Martinz and Xiangong (George) Wang, '2017 Model Driven and Machine Executable Regulations and Tech Sprint: Success Criteria and Recommendations', page 8, <<https://www.immuta.com/download/recommendations-for-the-fca-and-boes-2017-model-driven-and-machine-executable-regulations-tech-sprint/>> accessed 5 March 2018.

⁸³ [], page 125.

⁸⁴ Ogus A, 'Rethinking Self-Regulation.' (1995) 15(1) Oxford J Legal Stud 97, 97.

⁸⁵ Banking Code Standards Board, BCSB Directors and Staff <<http://www.bcsb.co.uk/bcsb-directors-and-staff/>> accessed 25 February 2018.

⁸⁶ Banking Code Standards Board, <<http://www.bcsb.co.uk>> accessed 25 February 2018.

Under this approach the regulator would endorse a self-regulatory entity or a system developed by that entity. Regulated entities would be free to join the association and to adopt that system. The regulator also does not involve itself in enforcement or in approving standards at a granular level.

When the model was first conceived it was credited with many advantages. It has since been discredited culminating in a statement by Joseph Stiglitz who referred to the idea that markets can self-regulate as an oxymoron.⁸⁷ Self-regulation has also been described as a model 'in retreat'.⁸⁸ The financial crises has demonstrated that a light touch regulatory approach has significant limitations.

An analysis of the advantages and disadvantages of the model is nevertheless useful here. The model is likely to resurface in the context of regulatory technology.

Self-regulation allows specialised knowledge to be built into regulation. Moreover, the government does not pay for the setting of standards or for their enforcement.⁸⁹

Self-regulation assumes that regulated entities have business and reputational incentives to ensure the safety and quality of their products or services. Membership of a self-regulatory scheme acts as a signalling device helping companies to impress their customers.

There is, however, a concern that regulated entities focus on being seen to be compliant rather than on ensuring that they actually meet the standards. Self-regulatory systems are particularly susceptible to gaming because there is no independent regulator monitoring compliance.

Moreover because the system is voluntary it does not cover all market participants. It is possible for spill-over effects to occur with non-members feeling bound to abide by self-regulatory standards. Two problems nevertheless arise. There are concerns about fairness as non-members are unable to represent their interests.⁹⁰ Notwithstanding the possibility of spill-over effects the voluntary nature of a self-regulatory system may leave the public exposed to unsafe practices.⁹¹

There are also concerns about democratic legitimacy when rules are made by self-regulatory bodies that are not bound by legislation or accountable to the government.⁹² The same problem

⁸⁷ Ferran, 'Institutional Design: the Choices for National Systems' in Moloney, Ferran and Payne (eds.), *The Oxford Handbook of Financial Regulation* (Oxford University Press, 2015), page 110; see also Ogus, A, 'Rethinking Self-Regulation' (1995) 15 *Oxford Journal of Legal Studies* 97; Black, J, 'Decentring Regulation: Understanding the Role of Regulation and Self-Regulation in a "Post-Regulatory" World' (2001) 54 *Current Legal Problems* 103; Gunningham, N and Rees, J, 'Industry Self-Regulation: An Institutional Perspective' (1997) 19 *Law & Policy* 363; Carson, J, *Self Regulation in Securities Markets* (2011), World Bank Policy Research Working Papers No 5542; Omarova, ST, 'Rethinking the Future of Self-Regulation in the Financial Industry' (2010) 35 *Brooklyn Journal of International Law* 665.

⁸⁸ Ferran, 'Institutional Design: the Choices for National Systems' in Moloney, Ferran and Payne (eds.), *The Oxford Handbook of Financial Regulation* (Oxford University Press, 2015), page 110.

⁸⁹ Baldwin, Cave and Lodge, *Understanding Regulation: Theory, Strategy and Practice* (2nd ed., Oxford University Press, 2011), page 139; see also Ogus A, 'Rethinking Self-Regulation.' (1995) 15(1) *Oxford J Legal Stud* 97, 98..

⁹⁰ NCC, *Self-Regulation*, discussed in Baldwin, Cave and Lodge, *Understanding Regulation: Theory, Strategy and Practice* (2nd ed., Oxford University Press, 2011), page 143.

⁹¹ Baldwin, Cave and Lodge, *Understanding Regulation: Theory, Strategy and Practice* (2nd ed., Oxford University Press, 2011), page 139.

⁹² See for example Baldwin, Cave and Lodge, *Understanding Regulation: Theory, Strategy and Practice* (2nd ed., Oxford University Press, 2011), page 141-146, and Ogus A, 'Rethinking Self-Regulation.' (1995) 15(1) *Oxford J Legal Stud* 97, 98.

arises in relation to enforcement. If regulators are more accountable to their members than general public, this is likely to prompt trust issues.⁹³

Capture is another problem. Self-regulatory bodies can have a tendency to act anti-competitively by setting access requirements or prices that suit the interests of their members rather than the general public.⁹⁴ This may stifle competition. There is also a concern that members with influence on the self-regulatory body will be able to escape enforcement. For example, many UK banks do not issue basic bank accounts to every citizen who requests one, despite the British Banking Association having a mandate to enforce this.⁹⁵ There is no evidence of any enforcement action against the banks concerned.

It is important to keep in mind that both the advantages and the disadvantages of self-regulation also apply in the context of regulatory technology. It has already been mentioned that the technology is neutral. It lends itself to any approach to regulation. It would be wrong to assume that regulatory technology will allow us to have greater faith in the ability of regulated entities to override their business interest.

6. Conclusions

All types of regulation have advantages and disadvantages. In most regulatory contexts, a combination of various strategies of regulation are employed.⁹⁶ The decision on the extent to which regulatory technology is used should be informed by considerations of democratic legitimacy and accountability and the requirement for due process. Regulatory expertise and efficiency are also of crucial importance.

The regulator has a number of options available

- It could develop and own regulatory software either in house or through outsourcing but retaining full control at an operational level.
- It could adopt a meta-regulatory approach overseeing the development and maintenance of regulatory by private providers without having full control at an operational level.

⁹³ Baldwin, Cave and Lodge, *Understanding Regulation: Theory, Strategy and Practice* (2nd ed., Oxford University Press, 2011), page 143.

⁹⁴ Baldwin, Cave and Lodge, *Understanding Regulation: Theory, Strategy and Practice* (2nd ed., Oxford University Press, 2011), page 143, discussing S. Domberger and A. Sherr, 'The Impact of Competition on Pricing and Quality of Legal Services' (1989) 9 *International Review of Law and Economics* 41; A Shaked and J. Sutton, 'The Self-Regulating Profession' (1981) 47 *Review of Economic Studies* 217.

⁹⁵ As discussed in Better Regulation Task Force, 'Imaginative Thinking for Better Regulation' (Cabinet Office, 2003) <<http://webarchive.nationalarchives.gov.uk/20100812083626/http://archive.cabinetoffice.gov.uk/brc/upload/assets/www.brc.gov.uk/imaginativeregulation.pdf>> accessed 25 February 2018, page 43.

⁹⁶ Baldwin, Cave and Lodge, *Understanding Regulation: Theory, Strategy and Practice* (2nd ed., Oxford University Press, 2011), page 132.

- It could step back and appoint an industry association to create software that manages risk. The regulator would validate that software at a fairly high level of abstraction but would not proactively involve itself in its development.
- It could validate the software produced by individual developers.
- It could return to a self-regulatory model encouraging the industry to adopt suitable technology.

Which strategy the regulator adopts is a matter of choice which will also depend on the context. When making these choices it is important to keep in mind that coding is not an exercise in computer science. It involves policy decisions some of which may require the involvement of a democratically legitimised and publically accountable regulator.

Regulatory technology can give regulators access to real time information about regulated entities. This could orient regulated entities towards the short term encouraging them to ignore longer term risks. Any application based on real time information should be designed in a way that avoids this problem.

Users of regulatory technology that is based on data analysis need to be alerted to the necessary limitations of the underlying data sets. They also need to be enabled to consider factors that cannot be measured through data.

While the use of software for regulation has the potential to remove unwelcome ambiguity, there is also a risk that regulatory technology introduces inflexibility. Ambiguity in natural language can be useful to allow the regulator to exercise discretion in response to future developments. It is unclear to what extent appropriate levels of flexibility can be replicated in software. Connected to this is the risk that the technology could cause entities to become too similar. This could be a source of systemic risk.

Regulated entities are not necessarily in the business of developing software. Regulatory technology is likely to introduce a new type of service provider into financial markets. These come with their own business model. Moreover a small number of businesses currently have a leading role in data analysis. They are likely to also take an interest in providing technology services to financial service providers. The regulator needs to develop a robust understanding of the technology and the business models of its providers to develop an adequate response.

And finally the regulator needs to keep in mind that technology is neutral. It is programmed to reflect the preferences of those who oversee its development. While regulatory technology can change the game, it will not be able to change the fact that business interests do not always align with the interests that the regulator has been set up to serve. It would be wrong to assume that regulatory technology is a silver bullet that will make it easier for regulated entities to align their interests with regulatory standards.



THE LONDON SCHOOL
OF ECONOMICS AND
POLITICAL SCIENCE ■



The London School of Economics
and Political Science
Houghton Street
London WC2A 2AE
United Kingdom

Tel: +44 (0)20 7405 7686
systemicrisk.ac.uk
src@lse.ac.uk



Systemic Risk Centre