Willis Towers Watson

The future of financial services:
how work is impacted by the connection and convergence of people and technology

The algorithmic future of regulation

Professor Philip Treleaven, Director of the UK Centre for Financial Computing & Analytics and Professor of Computing at University College London (UCL)

Algorithms have fundamentally changed how financial markets operate and soon they will change the face of regulation, says Philip Treleaven, Professor and Director of the UK Financial Computing Centre at University College London. Every aspect of our regulatory system will be impacted – people, processes and technology.

The issues with our current regulatory system for financial services are many and well known: there is a large and ever-growing body of regulation; it is difficult to interpret and understand, time consuming to navigate and costly to comply with. For example, the *Financial Times* stated that "Big banks, such as HSBC, Deutsche Bank and JPMorgan, spend well over $1bn a year each on regulatory compliance and controls. The Spanish bank BBVA recently estimated that on average financial institutions have 10 to 15% of their staff dedicated to this area"[1].

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*An **algorithm** is a self-contained sequence of actions to be performed. It specifies the inputs needed and the exact calculations to be performed to calculate an output.*

Algorithms are most often associated with mathematics and computers. Indeed, they are essential to the way computers process data. But they are also an essential part of our daily lives – think about the process of baking a cake, it's just an algorithm with tastier outputs.

Although we can read consultation documents on our tablets, watch live-streamed political and legislative debates on our smart phones and submit regulatory data directly to the regulator by XML via APIs, we still follow essentially the same time-consuming, paper-based processes to make, implement and monitor regulation from the last century (if not the one before).

Indeed, in a US presidential debate around nine years ago, the then-candidate Barack Obama suggested that: "The problem is we still have an archaic, twentieth-century regulatory system for twenty-first century financial markets"[2].

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But no complex system is static. Even a system as seemingly immoveable as financial services regulation is subject to the force of change. And change is coming. I have no doubt that the frustrations so eloquently expressed above by the then-candidate Barack Obama have been part of the driver for change. But I have also observed a *willingness* to embrace change in the wider aspects of our regulatory systems. In part, this has been helped by increasing the span of people who are impacted by regulation. In the past it was mainly lawyers, compliance experts and regulators; now it includes fintech professionals who see an exciting business opportunity, existing financial institutions wanting to drive down operating costs and technology-focused academics, like myself, who see an exciting new application of technologies that have reached commercial maturity.

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[1] *Financial Times*, 'Market grows for 'regtech', or AI for regulation', October 2016
[2] *New York Times*, 'The Second Presidential Debate', October 2008

Which technologies are important for financial services regulation?

Change has often been driven by technology. Think about how the combinations of technologies in our smartphones have fundamentally changed our communications – beyond the pervasiveness of the emoji, it has also changed when, where and how we communicate.

For financial services, there are several important technologies that could help, many of which have reached commercial maturity. Any one of these technologies could have a material impact on the work that we do in financial services regulation and on the mix of skills we would need going forward to do that work.

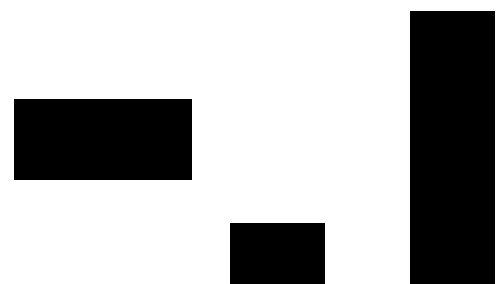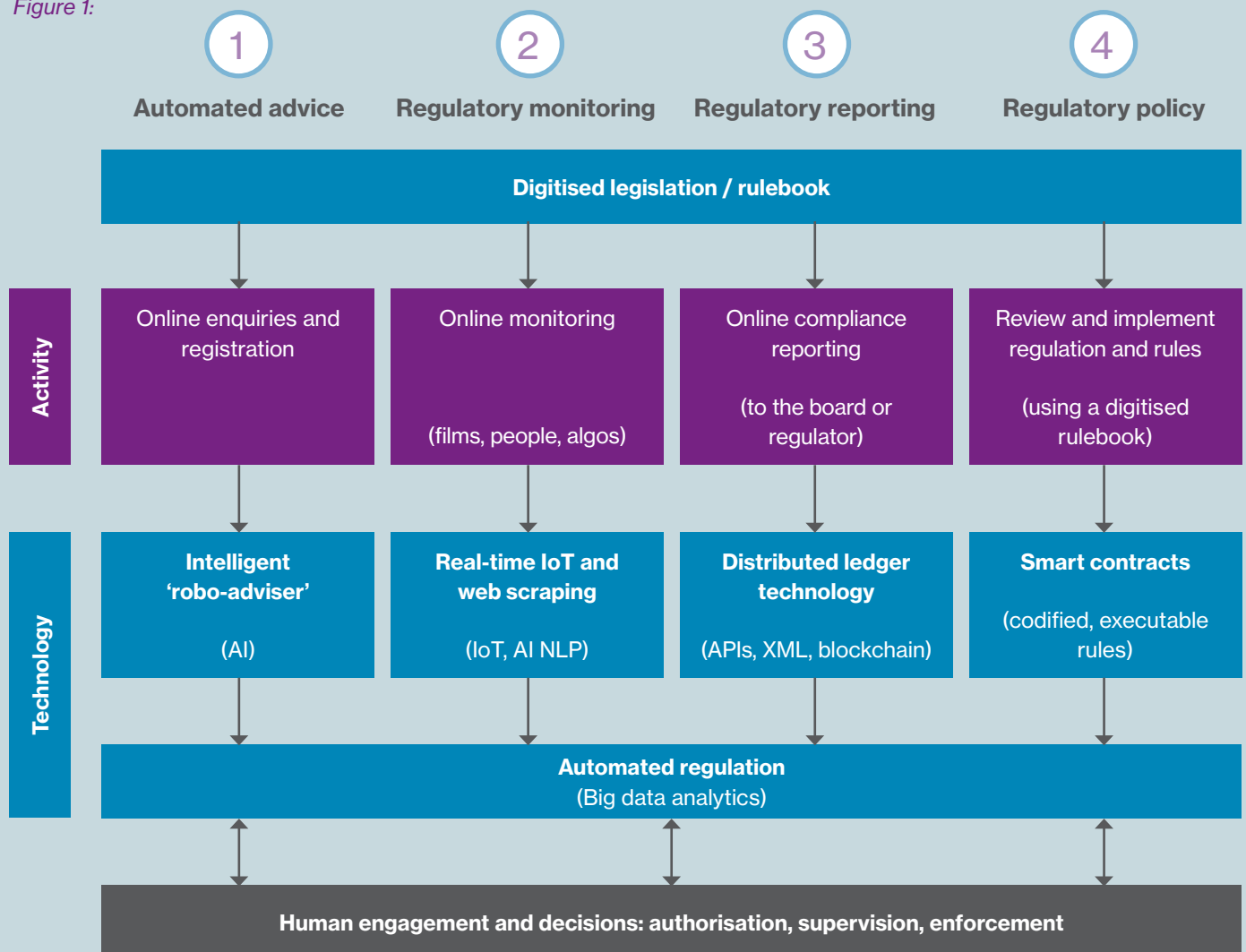|	
Artificial intelligence (AI)	A branch of computer science dealing with the simulation of intelligent behaviour in computers. 'Intelligence' is taken to mean an ability to perceive its environment and take actions that maximise its chance of success at some goal.
Automated fraud detection	Techniques used to identify suspicious patterns in credit card transactions, identity theft, insurance claims, money laundering or insider dealing.
Blockchain	A form of distributed ledger or database that stores a permanent and tamper-proof record of transaction data. Unlike traditional databases, blockchain does not have a central point of data storage.
Data scraping	The technique in which a computer program extracts data from human-readable output coming from the Internet or another program. This involves searching and retrieving information (scraping) from social networking sites such as Twitter and Facebook, but also web pages, forums, blogs, RSS feeds, online newspapers and product/service reviews or feedback.
Natural language processing	Content interpretation of natural language by means of algorithms mainly based on machine learning.
Sentiment analysis (or opinion mining)	The process of computationally identifying and categorising opinions expressed in a piece of text. It is used to determine whether the writer's attitude towards a particular topic or product is positive, negative or neutral.

Using technology to rethink regulation: *Algorithmic Regulation*

I believe that a regulatory system fit for this century (and the next) will need to use all of the above technologies. I have created a theoretical framework that achieves this, called *Algorithmic Regulation*.

This *Algorithmic Regulation* framework comprises four main limbs that feed into a spine of 'automated regulation' (*figure 1*). The framework uses a blockchain solution to record compliance reports and smart contract technology to codify, computerise and automate financial regulation and compliance.

Figure 1:

	1 Automated advice	2 Regulatory monitoring	3 Regulatory reporting	4 Regulatory policy
	Digitised legislation / rulebook			
Activity	Online enquiries and registration	Online monitoring (films, people, algos)	Online compliance reporting (to the board or regulator)	Review and implement regulation and rules (using a digitised rulebook)
Technology	**Intelligent 'robo-adviser'** (AI)	**Real-time IoT and web scraping** (IoT, AI NLP)	**Distributed ledger technology** (APIs, XML, blockchain)	**Smart contracts** (codified, executable rules)
	Automated regulation (Big data analytics)			
	Human engagement and decisions: authorisation, supervision, enforcement			

> **"** This Algorithmic Regulation framework comprises four main limbs which feed into a spine of 'automated regulation'. **"**

1 **Advice and registration:** it is hard for new and existing financial services firms to navigate the maze of legislation and regulatory rulebooks in order to complete (or update) the authorisation process with a national regulator. Firms often require expensive external regulatory advice from specialist legal or compliance firms to complete the authorisation process.

- *Solution*: provide an AI front end to the regulation that helps a new firm/user locate relevant information and guides them through authorisation. If successful, a robo-adviser could significantly reduce (but not eliminate) what firms pay lawyers and compliance specialists for authorisation advice. There could be several robo-advisers in the market provided by private sector firms – in addition to any that a regulator might choose to provide.

2 **Monitoring:** regulators monitor and supervise regulated firms on an ongoing basis, generally in a risk-based way so that the firms that pose the greatest risk to the financial system receive the greatest attention with specific teams allocated to them and a form of thematic or portfolio approach to the remainder.

But regulators often have thousands of firms to monitor. The monitoring challenges faced by regulators can be illustrated by looking at the UK Financial Conduct Authority (FCA) – with essentially the same resources as when it was created, the FCA now has to supervise an additional 21,000 small firms – 56,000 firms in total.

- *Solution:* monitor online and social media by using natural language processing and sentiment analysis. The intention would be to monitor consumer opinions, concerns and level of trust and to identify market abuses. Developed for brand management and customer profiling, there are several sophisticated data scraping and sentiment analysis tools that could equally be deployed by regulators for automated monitoring. Examples include Adobe Social, Brandwatch, Google Alerts, and Mention.

3 **Reporting:** firms provide data to regulators, on a monthly/quarterly/ad-hoc basis. It is an expensive and complex activity for regulated firms. New regulation may require significant changes to underlying processes and regulatory reporting requirements. For example, research from the American Action Forum has suggested US banks have so far paid US$24bn and allocated 61 million employee hours to comply with Dodd-Frank Wall Street Reform and Consumer Protection Act[3].

- *Solution:* use the fintech paradigms of APIs, online communication, big data analytics and distributed ledger technology (DLT) to automate compliance and regulatory reporting to an equivalent form of 'straight through processing'[3].

4 **Policy:** regulated firms, advisory firms and regulators engage in a range of written and personal interactions, sometimes spanning years, to draft new or amended rules. Sometimes, it is not until after the new policy is implemented that the full impact of the proposals is fully understood. For example, it is now appreciated that a number of the regulatory proposals considered after the 2010 Flash Crash (for example, lodging algorithms with regulators, best price quotes, trading pauses and tick sizes), if implemented, might have actually increased systemic risk.

- *Solution:* use smart contract technology to digitise and codify regulations. Then use computational modelling (such as agent-based systems) to assess the potential market impact of a regulatory proposal before deployment (for example, Basel IV, MiFID III, Solvency III).

[3] www.americanactionforum.org

Moving from 'thinking' to 'doing' – it's already happening

But this is not an abstract theory. Several aspects of the *Algorithmic Regulation* framework are already being tested and implemented.

For example, the Blockchain technology for Algorithmic Regulation And Compliance (BARAC[4]) initiative that I am involved in has already started to develop and test this framework as a whole. The group is testing the feasibility of using blockchain technology for automating regulation and compliance by producing a proof-of-concept platform. It comprises industry participants, regulators and academics across a range of disciplines in order to investigate the technological, legal and managerial aspects related to the use of blockchain across the regulation of financial services industry. The BARAC platform will be constructed around the requirements articulated by our industry and regulatory partners including BT, R3[5] and the FCA.

Other practical initiatives abound. For example, on **automated advice** regulated firms are developing and using advice bots for a range of activities. Reuters reported in May that Credit Suisse has deployed 20 robots within the bank, some of which are helping employees answer basic compliance questions[6]. The bank said that the technology may help reduce the number of calls coming into the bank's compliance call centre by as much as 50%. In addition, my team at UCL is already working with the UK law firm Clyde & Co on a proof of concept for a robo-adviser for registration and authorisation advice in the UK.

Progress in **megulatory monitoring** is coming from regulators and the private sector. According to the London School of Economics, national regulators have already begun to codify conduct offences and group them under conceptual headings, such as market abuse, oversight failure, customer care failure or careless reporting or recordkeeping[7]. Firms such as Corlytics are using this global taxonomy to generate *predictive* power by taking enforcement and other regulatory data to pick out emerging risks and trends months before they crystallise in the market.

A range of **regulatory reporting** solutions were presented at the FCA's 2016 TechSprint on 'Unlocking Regulatory Reporting'[8]. Some proposed that firms changed from 'pushing' reports into the regulator, with the regulator storing all this data, to a possible scenario of the regulator 'pulling' the agreed data instantaneously from firms as required. Indeed, the Austrian Central Bank (Oesterreichische Nationalbank, OeNB) already has a version of such 'pull' regulatory reporting in place which, according to the provider BearingPoint, is "achieving saving across the country upward of 30%"[9]. In Asia, the Monetary Authority of Singapore (MAS) has funded a blockchain-based record keeping system as part of its five-year US$225 million investment plan aimed at financial technology[10].

Finally, in **policy** we have seen that some regulators are using technology to help make the regulations themselves more navigable – for humans and ultimately for machines. In the 2017 Our Mission feedback statement, the FCA announced that "we are seeking ways to make the FCA Handbook easier to navigate, and have already progressed work in in this area"[11]. The FCA has already introduced some practical improvements, including topic-based navigation and searching[12].

The profound people impact

So far, I have focused on the technology aspects of the changes that algorithmic regulation could bring. But technology does not operate in isolation. I believe that the people impact (for individuals and organisations as a whole) from algorithmic regulation will be equally profound – not least in terms of the type of work that we humans will perform and the skills we will need to do it. With the pace of technological change ever accelerating, it may be time to start thinking about how best to enhance your own skills to this new regulatory framework.

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[4] http://blockchain.cs.ucl.ac.uk/barac-project/
[5] R3 is a distributed database technology company. It leads a consortium of more than 70 of the world's largest financial institutions in research and development of blockchain database usage in the financial system.
[6] *Reuters*, 'Credit Suisse has deployed 20 robots within bank, markets CEO says', May 2017
[7] http://eprints.lse.ac.uk/66934/
[8] www.fca.org.uk/firms/innovate-innovation-hub/regtech
[9] BearingPoint press release, March 22 2017
[10] *Coindesk*, Singapore Central Bank Funds Blockchain Recordkeeping Project, July 2015
[11] FCA, 'Our Mission 2017: feedback statement' April 2017
[12] www.handbook.fca.org.uk/news/54

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About the author

Philip Treleaven is Director of the UK Centre for Financial Computing & Analytics and Professor of Computing at UCL in London. Twenty years ago his research group developed much of the early fraud detection technology and built the first insider dealing detection system for the London Stock Exchange.

For the past 12 years Prof. Treleaven's research group has developed algorithmic trading systems with many of the leading investment banks and funds and for the past four years they have worked on HFT trading risk and systemic risk with the Bank of England and FCA. Current research includes the application of blockchain technology to financial 'Algorithmic Regulation'; and working with BUPA/Boots on mHealthcare.

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