

Alison Lui^{a*} and George William Lamb^b

^a Corresponding author, School of Law, Liverpool John Moores University, Liverpool, United Kingdom; ^b School of Law, Liverpool John Moores University, Liverpool, United Kingdom

Dr Alison Lui, Senior Lecturer in Law, A.Lui@ljmu.ac.uk, 0151 2313288

Alison Lui is a Senior Lecturer of Law at Liverpool John Moores University. Her first degree is from the University of Bristol. She subsequently obtained a LL.M from the London School of Economics and a PhD from the University of Liverpool. She qualified as a Solicitor and practised commercial law before entering academia.

George William Lamb; Research Assistant, G.W.Lamb@ljmu.ac.uk

George is a Research Assistant at Liverpool John Moores University. He obtained a first class LL.B degree and a distinction in Masters of Law at Liverpool John Moores University. He is currently studying for a PhD at Liverpool John Moores University.

Abstract

Robots and chatbots are sophisticated. Artificial intelligence (AI) is increasingly popular in the financial industry due to its ability to provide customers with cheap, efficient and personalised services. This article uses doctrinal sources and a case study to show that many banks and FinTech start-ups are investing in AI. Yet, there are a number of challenges arising from the use of AI which could undermine trust and confidence amongst consumers. This article features the issue of bias and discrimination in banking. There is evidence that algorithms discriminate against certain races and gender. Legislative gaps in the Equality Act 2010 and the General Data Protection Regime will be analysed. Ultimately, human beings are still needed to input, train and help machines to learn. Fortunately, the FCA are leading in regulating technology, from the launch of regulatory sandboxes to their co-operative collaboration with FinTech start-ups on regulatory matters. Augmented intelligence collaboration is needed to enable industry players and regulators to provide seamless regulation and financial stability. The future of AI regulation is inter-disciplinary in approach.

Keywords: Artificial intelligence; augmented intelligence collaboration; financial regulation; FinTech; RegTech

Artificial intelligence and augmented intelligence collaboration: Regaining trust and confidence in the financial sector

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In L. Frank Baum's *The Wonderful Wizard of Oz*,¹ readers may be familiar with the following dialogue:

Dorothy: "How can you talk if you don't have a brain?"

Scarecrow: "I don't know...But some people without brains do an awful lot of talking...don't they?"

In the twenty-first century, robots and chatbots, can do more than talking to bank customers. Artificial intelligence (AI), in the forms of machine learning, voice recognition and predictive analysis, enable robots and chatbots to provide financial advice; analyse risks; manage assets and engage in algorithmic trading.² DeepMind, Google's artificial intelligence division, is developing AI that can plan and interpret their own decisions. DeepMind says its "Imagination-Augmented Agents" are sophisticated enough to foresee the consequences from their choices³. During the global financial crisis of 2007-2009, BlackRock, the world's largest asset management firm, assisted the American federal government with its critical decisions concerning Bear Stearns, AIG, Citigroup, Fannie Mae and Freddie Mac.⁴ After the GFC, trust and confidence amongst consumers in the financial sector dived to a low point.⁵ A comparison of confidence is illustrated a report of 2016 in the percentage of customers having confidence in banks. In the UK, only 33% of customers had confidence in banks. The percentage is 37% in the US compared to 72% in China and 70% in India.⁶ Global efforts in restoring trust and confidence in the financial industry can be seen by a plethora of reforms in financial regulation and corporate governance. There are now more stringent requirements on liquidity, capital and leverage under the Basle III Accord. The structure of the financial regulators has been reformed in countries such as the United Kingdom and United States.⁷ The Walker Review⁸ on corporate governance in the UK made 39 recommendations to the corporate governance mechanisms of banks.

¹ L. F. Baum, *The Wonderful Wizard of Oz* (First published 1900, Chicago: Geo. M. Hill Co)

² T. C. Lin, 'The New Financial Industry' [2014] *Alabama Law Review* 65(3) 567

³ A. Sulleyman, 'Google creates AI that can make its own plans and envisage consequences of its actions', (London, 30 July 2017) <<http://www.independent.co.uk/life-style/gadgets-and-tech/news/google-deepmind-ai-artificial-intelligence-research-imagination-augmented-agents-sokoban-a7863061.html>> accessed 30 July 2017

⁴ S. Kolhatkar and S. V. Bhaktavatsalam, 'The Colossus of Wall Street' [2010] *Business Week* 62, 66

⁵ T. C. Earle, 'Trust, Confidence, and the 2008 Global Financial Crisis' [2009] *Risk Analysis* 29(6) 785

⁶ Burnmark 'Challenger Banking' [2016] <<https://burnmark.com/wpcontent/uploads/2016/10/Burnmark%20Report%20Oct2016.pdf>> accessed 27 July 2017

⁷ A. Lui, *Financial stability and prudential regulation: A comparison between the regulators and central banks of the United Kingdom, the United States, Canada, Australia and Germany* (Routledge, 2016)

⁸ HM Treasury, Walker Review of Corporate Governance of UK Banking Industry, <http://www.hm-treasury.gov.uk/walker_review_information.htm> accessed July 21, 2017

Increased compliance costs⁹ due to the regulatory and governance reforms have driven banks to find ways to increase their profit margins. Challenger banks outperform the Big Five banks in terms of return on equity. The statistics are clear. The big five banks have a return on equity ratio of 4.6%. The figure with smaller challenger banks such as Metro Bank and Close Brothers is 17% whilst larger challenger banks such as Paragon and Virgin Money have a return on equity ratio of 9.5%.¹⁰ Further, the Big Five banks now face tougher competition from challenger banks. The UK government has implemented measures to improve competition because the UK financial market became more concentrated as a result of the GFC.¹¹ In 2011, the Vickers Report¹² thus recommended micro measures to improve competition, namely easier switching between accounts; more transparent pricing and greater use of comparison websites. The Financial Conduct Authority has a mandate to promote competition and the Prudential Regulatory Authority has a secondary mandate to facilitate competition is a positive step. Both regulators have worked to make the new bank application process easier and have reduced both the capital and liquidity requirements for new banks. The challenge faced by the big five banks is the completely different business model used by digital challenger banks such as Atom Bank, Fidor Bank, Monzo Bank and Starling Bank. These banks target mainly millennials who rely heavily on modern technology such as smartphones for banking; as well as filling the needs of student lending; some categories of mortgage lending and lending to small to medium sized businesses.¹³ Digital challenger banks tend to be asset-light and leverage customer data and technology to drive their customer-centric strategy. Therefore, the use of algorithms, predictive analytics and machine learning are likely to drive the business models of challenger banks. As such, these factors have created an impetus for the Big Five banks to the use of financial technology (FinTech) such as AI in the financial sector.

The above dialogue from *The Wonderful Wizard of Oz* captures the interesting concept of the use of artificial intelligence, especially robo-advice in the financial industry. In this article, it is submitted that AI can benefit banking customers as it provides flexibility; cost efficiency; convenience and more personalised products and services. On the other hand, it can also bring new challenges such as regulation of financial advice; bias; privacy and security. For the purpose of financial stability, it is crucial to have an innovative and suitable framework to regulate AI in the financial sector. A new regulatory approach needs to take into account the fact that industry stakeholders are increasingly relying on computer programmes and algorithms to advise customers.¹⁴ To restore trust and confidence in the financial sector, the authors thus introduce an augmented intelligence collaboratory approach to regulation of AI in the financial sector. The structure of the paper is as follows: Section 1 examines the use of artificial intelligence in the financial industry; section 2 evaluates the specific use of robo-advice in the financial industry; section 3 is a case study of Barclays Plc; section 4 deals with

⁹ Compliance costs and direct costs of regulatory penalties amount to \$200 billion globally since the GFC; Jeff Cox, 'Misbehaving banks have now paid \$204B in fines' (*CNBC*, 30 October 2015) <www.cnbc.com/2015/10/30/misbehaving-banks-have-now-paid-204b-in-fines.html> accessed 19 July 2017

¹⁰ KPMG, A New Landscape: Challenger banking annual results [2016] <www.kpmg.com/uk/banking> accessed July 27, 2017)

¹¹ N. Cetorelli, 'Real Effects of Bank Competition' [2004] *Journal of Money, Credit and Banking* 36(3) 543

¹² J. Vickers, Independent Commission on Banking Final Report Recommendations (Vickers Report) 2010, p. 3, <<http://bankingcommission.independent.gov.uk/>> accessed 23 July 2017

¹³ Burnmark (n 6)

¹⁴ Lin (n 2)

the challenges of AI in the financial industry; section 5 considers how we should regulate AI in the financial industry; section 6 concludes.

Section 1: Artificial intelligence in the financial industry

The ubiquity of AI is clear. From virtual assistants, wearable products to driverless cars, the almost omnipresent status of AI has been revolutionary. Alan Turing's question of whether computers can persuade humans that they are human prompted students at Princeton University to build the world's first artificial neural network¹⁵. Unfortunately, this enthusiasm was not sustained in the 1970s due to cuts in research funding. Nevertheless, the developments of deep learning; faster computers and Big Data triggered a revival of interest in AI in the twenty-first century.¹⁶ Companies such as Tesla, Uber and Alphabet (Google's parent company) are investing heavily into driverless cars.¹⁷ As such, the extant literature on AI is predominantly on this topic. There is also interest in robots used in healthcare; surgery and care robots.¹⁸ Over the past few years, governments across the world have created committees and published reports on the legal and policy considerations of AI. In 2016, The Japanese Ministry of Economy, Trade and Industry published its Final Report on the New Industrial Structure Vision as a 'forecasting compass' to address AI issues.¹⁹

At the European level, the European Parliament published a report on robotics in the same year. It recommended an advanced robot registration system managed by a European Union Agency for Robotics and AI.²⁰ It also suggested rules on damages caused by robots²¹. In the UK, the House of Commons Select Committee on Science and Technology's report of October 2016 called the government to establish a Committee on Artificial Intelligence to examine the social, ethical and legal implications of recent and potential developments in AI. The House of Lords Select Committee on Artificial Intelligence's report of April 2018 states that the UK is in a position to be a pioneer in AI but we should focus on ethics when developing AI.²² The Bank of England governor's Mansion House speech in June 2016 called for a FinTech Accelerator to be set up in the Bank of England ('the Bank'). This allows the Bank to work with FinTech companies and find solutions to problems such as managing data, cyber and security threats. Financial stability is a key priority for the Bank of England and the Bank is engaging with

¹⁵ J. Bughin and others, 'Artificial intelligence the next digital frontier?' (McKinsey Global Institute, 2017) <https://www.mckinsey.de/files/170620_studie_ai.pdf> accessed 22 July 2017

¹⁶ B. Buchanan, 'A (very) brief history of artificial intelligence,' *AI Magazine* (October 2005) 26(4)

¹⁷ A. Tovey, 'Forget Tesla, Google's self-driving Waymo business is the future of cars' *The Telegraph* (23 May 2017) <<http://www.telegraph.co.uk/business/2017/05/23/forget-tesla-googles-self-driving-waymo-business-future-cars/>> accessed 30 July 2017

¹⁸ C. Holder, 'Robotics and law: Key legal and regulatory implications of the robotics age' (Part I of II) [2016] 32 Computer Law & Security Review 383

¹⁹ A Final Report on the New Industrial Structure Vision was compiled (METI, May 2017) <http://www.meti.go.jp/english/press/2017/0530_003.html> accessed 15 July 2017

²⁰ European Parliament Committee on Legal Affairs, 'European Civil Rules in Robotics' [2016] <[http://www.europarl.europa.eu/RegData/etudes/ATAG/2017/599250/EPRS_ATA\(2017\)599250_EN.pdf](http://www.europarl.europa.eu/RegData/etudes/ATAG/2017/599250/EPRS_ATA(2017)599250_EN.pdf)> accessed 31 July 2017

²¹ Ibid (n 20)

²² House of Lords Select Committee, 'AI in the UK: ready, willing and able?' (April 2018) <<https://publications.parliament.uk/pa/ld201719/ldselect/ldai/100/10002.htm>> accessed 17 April 2018

FinTech companies to understand emerging financial stability risks better as banking is re-shaped by technology.

Many banks are starting to integrate FinTech into their services because customers in the twenty-first century want more choices, flexibility and control over banking. AI is a branch of FinTech specialising in the intelligence of machines. The extant academic literature on AI in the financial industry is predominantly in investment banking. Academics and scholars have written about automated trading of investments and flash crashes.²³ The flash crash on 10 May 2010 demonstrates that problematic algorithms can produce very rapid losses in the financial market. In this case, the automated algorithms sold \$4.1 billion worth of E-mini futures contracts without taking into account of price or time.²⁴ Blockchains, a type of FinTech useful in clearing and settlement of financial assets after transactions, have also received increasing attention from academics.²⁵ The financial sector is an area where AI and FinTech can offer banks improved efficiency and costs. More on AI in the retail banking sector however, needs to be explored and discussed. The benefits and challenges of AI in retail banking have not been investigated in depth.

Section 2: Robo-advice in the financial industry

In the UK, Santander Bank and HSBC have launched banking applications which use voice recognition. RBS will roll out its “Luvo” AI customer service assistant more widely following its successful trial earlier this year. Bank of America, Capital One, Société Générale and Swedbank have been experimenting with chatbots. Chatbots are virtual customer assistants which advise customers with queries via texts or online web chat. AI is the technology underpinning chatbots. Chatbots which offer customer service are often more cost-effective and faster at humans when performing repetitive tasks.²⁶ The question of whether customers trust chatbots can be seen from the experiences of Société Générale and Swedbank. Swedbank’s chatbot, Nina, interacts with customers via the bank’s website. Jam, the chatbot of Société Générale, targets customers of 18-30 year olds.²⁷ The underlying AI software, Personetics, specialise in helping banks create personalised digital experiences for their customers. Due to the robotic nature of Jam, the main advantage is that it guides customers through disclosure and compliance questions more carefully than humans.²⁸ Jam also collects conversational data from customers. Data on customer preferences and interests enable Société

²³ G. Scopino, ‘Do Automated Trading Systems Dream of Manipulating the Price of Futures Contracts? Policing Markets for Improper Trading Practices by Algorithmic Robots’ [2015] 67 FLA. L. REV. 221; A. Campbell, ‘Artificial Intelligence and the Future of Financial Regulation’ *Risk.net* (16 October 2014) <www.risk.net/operational-risk-and-regulation/feature/2374890/artificial-intelligence-and-the-future-of-financial-regulation> accessed 18 July 2017; J. Markham & D. Harty, ‘For Whom the Bell Tolls: The Demise of Exchange Trading Floors and the Growth of ECNs’ [2008] 33 J. CORP. L. 865

²⁴ G. Scopino ‘Preparing financial regulation for the second machine age: The need for oversight of digital intermediaries in the futures markets’ [2015] *Columbia Business Law Review* 339

²⁵ Y. Guo and C. Liang, ‘Blockchain application and outlook in the banking industry’ [2016] 2:24 *Financial Innovation* 12

²⁶ A. Shevat, *Designing Bots-Creating Conversational Experiences* (First edition, O’Reilly Media Incorporation 2017) 72

²⁷ Société Générale, ‘Société Générale s’associe au chatbot Jam pour mieux comprendre les Millénials’ [2017] <<https://www.societegenerale.com/fr/Soci%C3%A9t%C3%A9-G%C3%A9n%C3%A9rale-chatbot-Jam-comprendre-les-Mill%C3%A9nials>> accessed 31 July 2017

²⁸ P. Crosman, ‘Can AI chat with customers like a teller-and should it?’ [2017] 182 (11) *American Banker* 1

Générale to offer relevant, tailored and personalised products to customers. Interestingly, customers seem to trust AI more on certain types of financial advice such as bank accounts and certain investments. The absence of self-interests from chatbots appears to be the reason behind this trust amongst consumers.²⁹ The desire to improve interaction with customers, to rebuild trust and confidence by making chatbots more human thus creates a paradox. One of the reasons why customers appear to trust chatbots is because of the inherent absence of self-interests. The well-established theory behind law and economics is that humans are selfish. They often act in their own interests. The neoliberalist principle of 'homo economicus' is reflected in the agency problem in corporate governance. The financial crisis of 2007-2009 demonstrated that some bank directors did not act in the bank's interests. The Royal Bank of Scotland, Barclays and HBOS provide examples of greed, recklessness and dishonesty during the financial crisis of 2007-2009.³⁰ Alignment of the interests of directors and shareholders has been the foundation of corporate governance scholarship and debates. Mechanisms such as shareholders acting as stewards are required to monitor company directors, minimising the risk of the latter acting in self-interests. As such, a real advantage of AI, in the form of chatbots, is the absence of self-interests. This is subject to the caveat that programmers do not manipulate chatbots to reflect their self-interests. If this happens, the inherent absence of self-interests will disappear.

Impartiality and the lack of judgement are reasons why customers like robo-advice in wealth management.³¹ Algorithms are increasingly playing a role in analysing customers' financial savings and devising retirement plans. Money is a potentially difficult and embarrassing topic for some people to discuss, especially spending habits. Speaking to a robot thus takes away the embarrassment. A recent survey reveals that 68% of customers would be happy and prepared to use robo-advice in their retirement planning.³² Efficiency in robo-advice leads to fee reduction for customers. Companies such as Betterment and Wealth Wizards offer a fraction of the fees compared to human advisers. For advice on a retirement pot of £100,000, Wealth Wizards charge £300; Betterment charge 0.2% for a year and human advisers charge between £1,000-£2,000. Further, markets are unpredictable and no matter how well-qualified financial advisers are, the evidence to date is that only around 25% of fund managers outperform the market.³³ Human beings can make poor financial decisions due to emotions, over-confidence³⁴ and irrationality.³⁵ Empirical evidence of investment performance by robots is still emerging, but the cost savings by robo-advisers should attract some customers. Research by Dhar³⁶ reveals that although robots do not have common sense or intuition, robo-advice is useful where there is sufficient data for robots to learn and make decisions. Dhar analysed the performance results of the 'Automated Quant Trading' machine of Deutsche Bank between 2009-2015. One limitation of this analysis is that it is not clear what proportion of the programmes is performed

²⁹ Scopino (n 23)

³⁰ A. Lui, 'Greed, Recklessness, Dishonesty: and/or dishonesty? An investigation into the culture of five UK banks between 2004 and 2009', [2015] 16(2) *Journal of Banking Regulation* 106

³¹ J. Brown, 'Should you let a 'robot' manage your retirement savings?' *BBC News* (8 September 2017) <<http://www.bbc.co.uk/news/business-41159944>> accessed 12 September 2017

³² Ibid (n 31)

³³ Brown (n 31)

³⁴ T. Odean, S. Gervais 'Learning to be overconfident.' (2001) 14(1) *Rev Finance Stud* 27

³⁵ D. Kahneman D, A. Tversky 'On the psychology of prediction.' (1973) 80 *Psychol Rev* 237

³⁶ V. Dhar 'Should You Trust Your Money to a Robot?' (2015) *Big Data* June, 3(2): 55-58 DOI: 10.1089/big.2015.28999.vda

by robots, humans or both. Nevertheless, there is evidence that algorithms performed well in 2014. Dhar also believes that the unemotional, systemic decision-making process by robo-advisers will appeal to millennials. From a macro social policy perspective, robots can help fill the extant retirement savings gap. World Economic Forum's White Paper of 2016 estimates that the global retirement savings gap is approximately \$7 trillion.³⁷ The United States have retirement savings gap of 28% compared to 8% in the UK. Longevity and insufficient savings have contributed to this savings gap. It is therefore important that people start saving early and AI can offer simple, cheap and non-judgemental financial advice.

Nevertheless, humans are still preferred to advise customers in relation to complex financial products such as equity derivatives. Humans are also preferred when customers wish to complain or discuss a complicated matter or situation.³⁸ A common criticism of chatbots and robots is that they cannot empathise.³⁹ It is true that they cannot display real emotions such as happiness, sadness or anger. Nor can they sense the customer's emotional state. Conversing is a skill. From a technical perspective, conversation management is a high level of AI. Chatbots need to understand the context of a conversation and refer back to previous sentences. Further, one can infer different contexts of a term. For example, 'credit card' can refer to my personal credit card in one conversation but the company credit card in another conversation.⁴⁰ Conversation management is still in its infancy where a lot of progress can be made. Equally, sentiment analysis is also in an embryonic stage. Sentiment analysis enables chatbots to predict a customer's emotional status in a conversation. Emotions are important to create successful and natural conversations. Capital One's chatbot, Eno can display emotions through the use of 'emojis' and has been programmed to recognise certain 'emojis'. Eno understands that the "bag of money" 'emoji' represents a request of account balance while a "thumbs up" 'emoji' symbolises confirmation from a customer.⁴¹

Although chatbots will learn over time and improve⁴², it is evident that chatbots have their limitations. Complex advice seems to be outside the current expertise of robo-advisers and chatbots. Tax-planning involving multiple jurisdictions is still the domain of human advisers. There is a real danger of chatbots providing wrong answers to customers. The seriousness of such an incident can lead to financial mis-selling of products and claims of negligence. Humans therefore need to work with chatbots. Opinions are divided regarding the degree of transparency of informing customers about the use of chatbots. Both Swedbank and Société Générale agree that it is best not to deceive customers in thinking that they are dealing with humans. Transparency is important to them. Contrast this with IBM Watson's approach of preferring not to tell customers that they are dealing with chatbots.⁴³ The rationale behind this

³⁷ World Economic Forum 'We'll Live to 100 – How Can We Afford It?' (2017) World Economic Forum White Paper, May 2017 <http://www3.weforum.org/docs/WEF_White_Paper_We_Will_Live_to_100.pdf> accessed 12 September 2017

³⁸ M. Hosea, 'How brands are using artificial intelligence to enhance customer experience' [2016] Marketing Week (18 May 2016) 1

³⁹ M. Reid, 'Rethinking the Fourth Amendment in the Age of Supercomputers, Artificial Intelligence, and Robots' [2017] (119) West Virginia Law Review 100

⁴⁰ Shevat (n 26)

⁴¹ A. Irrera, 'Capital One launches Eno, gender-neutral virtual assistant' [2017] <<http://uk.reuters.com/article/us-capital-one-fin-chatbot-idUKKBN16H1Q8>> accessed 31 July 2017

⁴² P. Calvert, 'Robots, the Quiet Workers, Are You Ready to Take Over?' [2017] 36(2) Public Law Quarterly

⁴³ Interview with Raza Salim and Jennifer Macdonald, Barclays Bank (Radbroke Hall, Cheshire, 23 March 2017)

is that there is a fear factor amongst the western world of AI. To counter this fear, IBM Watson believe that seamless interaction between humans and chatbots is key. This is achieved through humans training the chatbots with the use of reliable data. Augmented intelligence, not artificial intelligence, is the way forward.⁴⁴ This philosophy is endorsed by the United Services Automobile Association's (USAA) virtual assistant. Employees at the USAA create answers to members' questions, which are logged in the libraries. When a customer asks a question, the chatbot searches the libraries. If the answer is there, the chatbot will deliver it. If not, the chatbot will refer the customer to a human assistant.⁴⁵ Barclays Bank are of the same view. The debate is no longer about humans *versus* AI. The issue is about integrating both so that customers will receive a seamless service. Debates and discussions about AI have become more popular in the media in the past few months. They are essential to educate and inform the public, remove the fear factor of AI⁴⁶ and improve transparency in AI. Training robots and chatbots is equally important to provide a personalised, seamless and efficient customer experience.

Two financial technology (FinTech) start-ups have revolutionised the experience of mortgage application by using chatbots and algorithms. Applying for a mortgage or remortgage can be time-consuming due to credit checks and evaluations of income and expenditure. MortgageGym claims to be the world's only regulated mortgage robo-adviser. The CEO and co-founder, John Ingram, said the consumers were confused by the new rules of affordability after the financial crisis of 2007-2009. Many consumers were not entirely certain how much they could borrow and the application process was very bureaucratic.⁴⁷ Ingram posits that MortgageGym is attractive as it empowers customers and put them in control. They offer fast, free, tailored and accurate advice through a combination of robo-advice and access to an online broker community. Another FinTech start up, Habito, combines the mortgage advice through 'digital mortgage advisers' with human advisers. Similar to MortgageGym, Habito is able to provide fast, personalised advice. They claim that their digital mortgage advisers can provide a quick overview of a client's mortgage in just five minutes. Human advisers then take over and provide more detailed guidance on the application procedure.⁴⁸

Machine learning by chatbots and robots will increasingly place more emphasis on human judgement. In the autonomous vehicles industry, cars have learnt to react initially through programme of answers to hypothetical questions such as 'Stop if there is an object in front of the car'. With improved prediction learning, cars have started to react through sensors. In banking, however, prediction learning is more complicated. Each customer's circumstances are different and therefore, human judgement will become even more valuable. According to Agrawal et al⁴⁹, all human activities can be divided into five high-level elements: data, prediction, judgment, action and outcomes. AI, in the form of machine learning, predictive analytics can deal with the first two components of 'data' and 'prediction'. In the context of banking, especially mortgage advice, robots and chatbots can conduct due diligence; credit checks and read documents quicker than humans. Machine learning enables robots and chatbots

⁴⁴ Interview with Robert Morris, IBM Watson (Telephone interview, 15 June 2017)

⁴⁵ Crosman (n 23)

⁴⁶ Interview with Robert Morris (n 44)

⁴⁷ A. Temkin, 'Apply for a loan in less than 15 minutes' *The Times* (8 April 2017)

<<https://www.thetimes.co.uk/article/fe8ec664-1b98-11e7-a725-c619aa6571c2>> accessed 25 September 2017

⁴⁸ Ibid (n 47)

⁴⁹ A. Agrawal, J. Gans & A. Goldfarb, 'The Simple Economics of Machine Intelligence' (2016)

<<https://hbr.org/2016/11/the-simple-economics-of-machine-intelligence>> accessed 9 October 2017

to react to ‘what if’ questions: What should I advise when the customer’s credit score is poor? What if the customer has been declared bankrupt previously? There are naturally limits and weaknesses with data processing by robots and chatbots such as biases, which will be discussed in more detail later. The third element of ‘judgement’ however, poses more of a challenge to current AI capabilities. Judgement involves assessing all the facts given by the customer; recommending and advising on suitable financial products and services as well as discussing the risks of such products. This is more difficult to machines as it involves assessment, empathy and lateral thinking if there needs to be a different solution. Human judgement will therefore, become more important in the future, especially in the financial services sector.

The following in-depth case study on Barclays Bank demonstrates the current thoughts and implementation of AI in their retail banking. Part of the case study relies on an interview with Raza Salim, Head of Content Transformation at Barclays Bank Plc. The methodology of a case study is used in addition to doctrinal methodology because case studies are particularly suitable when the phenomenon being studied has no distinct boundaries with the context under scrutiny. Case studies provide descriptions of phenomena, develop and test theory.⁵⁰ It provides evidence for hypothesis generation and for investigating areas where little is known. Adopting the case study methodology would lead to an exploratory and explanatory journey. Questions beginning with ‘how and why?’ would be answered. Direct causal links in social science are difficult to establish because links are strongly influenced by the context.⁵¹ The complex causal links in the context of a situation are known as ‘causal tendencies’ or powers.⁵² Case study research is thus an in-depth qualitative research strategy used to investigate causal links and generate theory. In this paper, the authors have adopted a case study to answer questions such as Barclays’s motivation to use AI and what legal, ethical challenges the bank faces with the implementation of AI. It also provides an opportunity to study FinTech and AI at a micro level. A frequent criticism faced by case study researchers is ‘how can one generalise when $x=1$?’ Simons said that she welcomes the paradox between the study of the singularity and the search for generalisation.⁵³ Studying both the unique and generalised seems paradoxical, but living with paradox is crucial to understanding a phenomenon.⁵⁴ The use of other sources such as articles, book chapters, books and an interview with a key figure behind IBM Watson would enhance data reliability and validity through triangulation of sources. In an ideal world, the authors would like to interview more banks on the use of AI in the financial industry. However, access to banks is difficult and there are time constraints in writing this paper.

Section 3: Case study on Barclays Bank

In recent years, Barclays has sought to establish itself amongst the Big Five banks in the UK as one of the leading investors in AI. Similar to most banks, Barclays aim to find the most cost effective ways of improving its services by adapting them to make it easier for its customers to access, navigate and use. Barclays have not been alone in recognising the potential AI offers for delivering on this aim, particularly now that the cognitive abilities of robots are improving.

⁵⁰ P. Darke, G. Shank & G. Broadbent, ‘Successfully completing case study research: Combining rigour, relevance and pragmatism’ (1998) 8 *Information Systems Journal* 273

⁵¹ C. Perry, ‘Case Research in Marketing’ (2000) 1 *The Marketing Review* 303

⁵² R. Bhaksar, *Realist Theory of Science*, (London: Routledge, 2008)

⁵³ H. Simons ‘The Paradox of Case Study’ (1996) 26 *Cambridge Journal of Education* 225

⁵⁴ *Ibid* (n 50)

With the huge amount of data that banks such as Barclays possess, AI will enable financial institutions to process such data at record speeds and capacities. Furthermore, as the cognitive capabilities of AI improves, the solutions it will be able to offer will expand and will provide customers with a much more immersive and personalised customer experience.⁵⁵

One of Barclays's first major steps into the world of AI was back in 2012, which saw the launch of its online banking app 'Pingit'. The app enabled customers of any bank to send money to each other via their mobile devices and on social media platforms such as Twitter. The app was subsequently developed to enable customers to make in-shop purchases using the app.⁵⁶ Increasing investment in AI appears to be the general trend at Barclays. Barclays claim that the intentions behind this investment is to provide an increasingly personalised service for its customers. As well as its online banking app, Barclays have used AI to develop and improve its capabilities in other areas. One area in which it is seeking to use AI is in the management of online customer queries, using chatbots to address customer queries in an almost instantaneous manner.⁵⁷ Barclays UK are not using this particular type of technology in practice yet. However, they are running a number of trials in their South African subsidiary 'Absa'.

The culture at Barclays has been clearly orientated towards encouraging greater use of AI. In branches where their services have been streamlined, Barclays have set up 'Eagle Labs'. In these labs, Barclays hold sessions for its customers in which they can learn how to use new digital services such as online banking.⁵⁸ Barclays are seeking to use AI to replace back office tasks with robots for efficiency reasons.⁵⁹ Another piece of technology which Barclays have invested in is voice recognition, utilising it in the provision of telephone based customer service and helping it improve customer security.⁶⁰ Finally, Barclays are investing in the use of AI in monitoring customer transactions and fraud prevention.⁶¹ By identifying patterns in the historical data the bank retains, AI can detect unusual behaviours such as money laundering, illicit transactions and security threats.

The main catalysts behind Barclays's move into the tech-world appear to be two-fold: Firstly, Barclays recognise the cost benefits that AI provides in the provision of financial services. In simple terms, whilst AI takes longer to learn than humans, AI can perform some tasks more effectively and efficiently than humans in the long-term. Barclays possess a huge amount of data on their customers' financial history and activity. In respect of certain tasks such as fraud detection and prevention for example, data that would take a human hours, if not days to identify and analyse, whereas it takes a robot only seconds. Furthermore, the most obvious

⁵⁵ Barclays PLC, Annual Report (2016) 28

⁵⁶ M, Warman, Barclays Pingit: Should you trust your mobile with your money? *The Telegraph* (16 February 2012) <<http://www.telegraph.co.uk/technology/news/9086152/Barclays-Pingit-should-you-trust-your-mobile-with-your-money.html>> accessed 16 June 2017

⁵⁷ A. Moyo, 'Absa banks on robotics, artificial intelligence' (*IT Web*, 2 May 2017) <http://www.itweb.co.za/index.php?option=com_content&view=article&id=161393> accessed 9 June 2017

⁵⁸ Ibid (n 55)

⁵⁹ Banking Technology Vision 2017 Accenture Banking Report 14
https://www.accenture.com/t20170322T205838Z_w_us-en/acnmedia/PDF-47/Accenture-Banking-Technology-Vision-2017.pdf#zoom=50

⁶⁰ Ibid (n 55)

⁶¹ Banking Technology Vision 2017 Accenture Banking Report 5
https://www.accenture.com/t20170322T205838Z_w_us-en/acnmedia/PDF-47/Accenture-Banking-Technology-Vision-2017.pdf#zoom=50

advantage of using a robot to perform such tasks is that it does not need to be remunerated. As a result, customers are receiving faster, cheaper and better services at Barclays.

The other catalyst driving Barclays's investment in AI appears to be a response to new competition on the market. Challenger banks such as Monzo, Atom and Fidor, which are purely technology driven, are drawing current and potential customers away from Barclays and the other 'Big Five' banks. Many millennials and people under 40 years old do most, if not all of their banking online.⁶² It is considered that only on rare occasions do these age groups go into a branch to bank. In recent years, challenger banks have taken full advantage of this and have dominated these niche markets. Monzo's sole product is their prepaid Mastercard, so why are there already 400,000 customers at Monzo, with a waiting list of 25,000?⁶³ Its unique selling point is the alerts on money management. Drawing on its mobile application, Monzo alert their customers on their spendings and utilise software to prepare budgets for customers automatically. Although Monzo do not offer mortgages, ISAs or savings accounts, they can advise customers where they should buy these products and automatically transfer their money into those products.⁶⁴ The convenience and personalised banking experience have won over many customers. The long-term future of challenger banks such as Monzo will be of interest to the financial sector. In July 2017, Monzo reported losses of £7 million.⁶⁵ Start-up businesses often need financial support from venture capitalists to survive in the early years. Otherwise, Monzo might be taken over by one of the big five UK banks. In the meantime, banks such as Barclays are competing with challenger banks by investing in the tech-sphere and in digital financial services in an attempt to appeal to millennials.

From Barclays's perspective, AI offers many advantages. In terms of marketing and advertising, AI's ability to track a customer's spending means that Barclays know when to advertise suitable services to that customer. For example, the bank can advise on what steps to take if predicts or is notified a customer is about to go into financial difficulty. Another example is reward accounts: AI can monitor customer spending behaviour, and depending on how much they are spending and what products they are buying, Barclays can send them relevant information immediately by text or by email. If a customer is buying a television, for example, Barclays can inform them as to the insurance cover it can provide.⁶⁶ Without AI monitoring customer behaviour, this information might not be picked up for a while, if at all. AI allows that information to be sent to the customer immediately. Customers are more likely to take up that insurance as that information is likely to have more meaning at the time. By improving the services Barclays provide to customers, the trust that customers have in the bank can be strengthened and this can ensure that Barclays become the first point of call for its customers who want loans, mortgages and other financial advice.⁶⁷

Whilst there are advantages to using AI, several legal and ethical issues emerge. As more of Barclays's services move online and are carried out by automated machines, the role of branches is going to become less prevalent. Whilst reducing the number of branches and

⁶² Interview with Raza Salim (n 42)

⁶³ P. Collinson, 'Monzo? It might just be the future of banking' *The Guardian* (9th September 2017) <https://www.theguardian.com/money/blog/2017/sep/09/monzo-future-of-banking-smartphone-tom-blomfield?CMP=Share_iOSApp_Other> accessed 19th September 2017

⁶⁴ Ibid (n 63)

⁶⁵ Collinson (n 60)

⁶⁶ Interview with Raza Salim (n 43)

⁶⁷ Ibid (n 43)

streamlining the services they provide will save cost, it is inevitable that the consequence of this will be job losses.⁶⁸ In an interview conducted by the authors with Barclays' Head of Content Transformation Raza Salim, Salim stated that whilst he recognised the branch will have a less important status in the services Barclays provide, it does not mean that they will become completely redundant.⁶⁹ Salim states that branches and human interaction will still be important in dealing with certain sensitive tasks. One example is where large sums of money are being transferred. Customers are more likely to want a human to be involved in that transaction so that somebody can be held accountable if something were to go wrong. Salim gives another example where Barclays would not want AI to be involved is when a customer contacts the bank following the death of the family member to organise the finances of the deceased. This begs the question as to what capabilities AI should be given. It is Barclays's view that in these sensitive situations, AI should give way to a human rather than an automated chatbot.⁷⁰

Further, there are serious issues concerning customer privacy and security. Banks have a great deal of sensitive and personal data on their customers. If such data are mishandled or hacked, the consequences can be devastating.⁷¹ The Financial Conduct Authority (FCA), the UK banking regulator, supports the use of AI in the provision of financial services. However, it stresses that this should not be done at the expense of customer privacy and security.⁷² In order to ensure banks are meeting the regulatory standards in its use of such technology, the FCA advocates the use of 'RegTech', technology designed to ensure banks are complying with their regulatory obligations.⁷³ Regulation for AI does not currently exist and is covered only by general regulatory requirements. As a result, AI could escape regulatory oversight by the FCA.

Section 4: Challenges of AI in the financial industry

Extant literature and the above case study highlighted a number of legal and ethical challenges posed by AI. Scientists have realised that machine learning programmes can discriminate on the protected characteristics of race and gender. Men receive more high-paying Google search job advertisements than women- a phenomenon commonly known as the 'white guy' syndrome in algorithms.⁷⁴ Microsoft's chatbot Tay.ai tweeted racist and sexist comments when it tried to imitate the language patterns of a 19-year-old American girl.⁷⁵ This section focuses on the issue of bias and algorithms, as it illustrates the hurdles which Big Data, algorithms and machine learning can bring. The perennial dangers of transparency and privacy will also be

⁶⁸ Ben Chapman, 'Lloyds Bank announces locations of 100 branch closures and 325 job losses' *The Independent* (5 April 2017) <<http://www.independent.co.uk/news/business/news/lloyds-bank-100-branches-close-200-jobs-lost-cuts-halifax-bank-of-scotland-a7667681.html>> accessed 10 June 2017

⁶⁹ Interview with Raza Salim (n 43)

⁷⁰ Ibid (n 43)

⁷¹ J. Powles and H. Hodson 'Google DeepMind and healthcare in an age of algorithms' (2016) *Health and Technology* <<https://link.springer.com/article/10.1007%2Fs12553-017-0179-1>> accessed 27 November 2017

⁷² M. Arnold, 'Market grows for 'regtech', or AI for regulation' *Financial Times* (14 October 2016) <<https://www.ft.com/content/fd80ac50-7383-11e6-bf48-b372cdb1043a?mhq5j=e1>> accessed 10 June 2017

⁷³ Financial Conduct Authority. Innovate: RegTech. <<https://www.fca.org.uk/firms/innovate-innovation-hub/regtech>> accessed 18 July 2017.

⁷⁴ A. Datta, M. Tschanta and A. Dutta, 'Automated Experiments on Ad Privacy Settings: A Tale of Opacity, Choice, and Discrimination' (2015) *Proceedings on Privacy Enhancing Technologies* (1), 92

⁷⁵ A. Karanasiou and D. Pinotsis, 'A study into the layers of automated decision-making: emergent normative and legal aspects of deep learning' (2017) *International Review of Law, Computers & Technology* 31(2), 170

⁷⁶ H. Bergen, 'I'd Blush if I Could': Digital Assistants, Disembodied Cyborgs and the Problem of Gender' (2016) *A Journal of Literary Studies and Linguistics* Vol VI 95

discussed. Bias in algorithms can occur in three stages: input, training and programming. The data input can be potentially biased or the information is insufficient for the algorithms to make fair decisions. Machine learning encompasses the training and programming stages. Dealing first with input, lenders no longer rely on traditional data such as the likelihood of repayment; debt-to-income and loan-to-value ratios; credit history and scores of potential borrowers to assess them. Instead, internet searches; shopping patterns and social media activities provide lenders with new data. They include a potential borrower's preferences on holidays; hobbies; interests; job related searches; connections; social activities...etc.

Using non-traditional data can open financial access to borrowers who have insufficient financial records or credit histories. For example, the 'Tala' app (formerly Mkopo Rahisi) uses mobile data to create a financial identity to borrowers in emerging countries such as Africa and Asia. Financial identity is established through data such as a borrower's stability in key relationships; connections; network diversity; location consistency; financial transactions. According to the founder Shivani Siroya, a borrower with at least 58 contacts are more likely to repay his/her loan.⁷⁷ Tala's repayment rate of 90% is impressive.⁷⁸ These are all encouraging news but non-traditional data attracts the problems of data reliability and privacy. If machine learning algorithms programmed that the average credit score of a 'friend' on social media platforms is used as a predictor of creditworthiness, how can they tell whether the friendship is genuine or not? What if the 'friends' are the parents of a borrower who have acted as his/her guarantors in the past as a one-off incident? Systemic bias might arise if the machine-learning algorithms are programmed to the effect that financially responsible consumers are likely to socialise with financially responsible people.

Secondly, non-traditional data are collected through a plethora of methods. Borrowers may not be aware that data collected on say internet searches or purchases will be used to assess their creditworthiness. If their loan applications are rejected, then the European General Data Protection Regulations 2016/679 (GDPR) may assist in theory. The GDPR will come into force in May 2018 despite Brexit. The UK government stated that it will implement an equivalent regime. The GDPR gives consumers the right to know when companies are making automated decisions of any importance about them. The GDPR also provides the right to challenge automated decisions. Nevertheless, once there is any form of human intervention in the decision-making process, the right to challenge will not apply. It only applies to decisions which are automated wholly or partially throughout the entire process (Articles 2 and 22). As seen earlier, chatbots and robo-advisors will need human advisers to assist with more complex, sensitive matters. It is therefore unlikely that robo-advice in financial services will be completely automated, certainly in the near future. Therefore in reality, the right to challenge decisions under the GDPR is unlikely to provide much help to consumers.

The second and third stages of where bias can occur are in training and learning. Training can take the form of supervised learning; unsupervised learning or reinforcement learning.⁷⁹ Supervised learning takes place when computers are fed with both inputs and outputs. For

⁷⁷ S, Siroya 'A smart loan for people with no credit history (yet)' (*TED Talks*, February 2016) <https://www.ted.com/talks/shivani_siroya_a_smart_loan_for_people_with_no_credit_history_yet> accessed 8 November 2017

⁷⁸ Ibid (n 75)

⁷⁹ M. Mohri., A. Rostamizadeh, and A. Talwalkar, 'Foundations of Machine Learning' (1st edition, Cambridge, MA: MIT Press 2012)

example, computers can detect credit fraud by learning from fraud scores generated a list of successful transactions and illegal transactions. Computers in supervised learning will be given both inputs and decisions. In unsupervised learning however, computers have to make their own decisions about credit fraud. This is where potentially, computers can make biased decisions depending on which data the developers think are important. Bias can also take place in reinforcement learning. Here, computers combine several decisions to make the most out of them. The DeepMind algorithm uses a variant of the Q-learning algorithm to beat human opponents in three out of seven games of Atari.⁸⁰ In March 2016, the AlphaGo programme of DeepMind beat the human champion in Go by four games to one.⁸¹ The programme was able to learn unsupervised from its own mistakes and self-play.

Machine learning is so sophisticated that even developers who have created the algorithms might not fully comprehend how they have evolved. The danger of this is that the algorithms might inadvertently create bias even where there is no intention to do so. Let us consider two hypothetical scenarios where algorithms are used to predict consumers' creditworthiness. Algorithms which use educational levels of consumers as a criterion for creditworthiness monitor their spelling mistakes on internet searches. If educational levels are lower in women in a particular race, then this can lead to indirect sex discrimination.⁸² Algorithms which monitor consumers' online shopping at discount stores predict that there is a higher risk of default of loans amongst such shoppers. If these discount stores are disproportionately located in ethnic minority communities, again, this can lead to indirect discrimination.⁸³ In the United States, the Supreme Court held in a 2015 case of Texas Department of Housing and Community Affairs v. Inclusive Communities Project Inc⁸⁴ that housing and lending policies which indirectly discriminate against race and gender violated the Fair Housing Act.⁸⁵

In the UK, although the Equality Act 2010 covers parties in an employment relationship and service users in the public sector, it does not protect borrowers in a private firm. Further, there is a lacuna in the law. The current wording of the Equality Act 2010 states that discrimination only takes place when 'a person' treats another unfavourably. Although 'person' is not defined in the Equality Act, a 'relevant person' is defined under section 52 of the Equality Act. 'Relevant person' is in reference to a human being. As such, automated decisions by chatbots or robo-advisers will not be caught under the Equality Act 2010. Protection is however, available if a policy or decision from a government agency or the regulator is discriminatory. Intention to discriminate is irrelevant to liability under the Equality Act 2010.⁸⁶ The disproportionate adverse impact of one group in indirect discrimination can be justified by the defence of a 'proportionate means of achieving a legitimate aim' under section 19 of the Equality Act 2010. Successful justification include hygiene, health and safety⁸⁷ and business

⁸⁰ V. Mnih et al, 'Playing Atari with Deep Reinforcement Learning' DeepMind Technologies' (2017) <<https://deepmind.com/research/publications/playing-atari-deep-reinforcement-learning/>> accessed 13 November 2017

⁸¹ D. Silver et al, 'Mastering the game of Go with deep neural networks and tree search' (2016) Nature 529, 484

⁸² K. Petrasic, B. Saul, J. Greig and M. Bornfreund 'Algorithms and bias: What lenders need to know' (2017) White and Case < <https://www.whitecase.com/publications/insight/algorithms-and-bias-what-lenders-need-know>> accessed 8 November 2017

⁸³ Ibid (n 82)

⁸⁴ 576 US _ (2015)

⁸⁵ 42 U.S.C. 3601-3619

⁸⁶ Amnesty International v Ahmed [2009] EAT 0447/08/ZT

⁸⁷ Panesar v Nestle Co [1980] ICR 144

needs.⁸⁸ It would be interesting to see how relevant government bodies use this defence, if in the future, their decisions are held to be indirectly discriminatory due to the machine learning algorithms. Unless the banking culture and regulation evolve, bias will remain. The Financial Conduct Authority sets out in Principle 6 of PRIN 2.1 FCA Handbook that: ‘A firm must pay due regard to the interests of its customers and treat them fairly’. This principle has to be taken seriously for the removal of bias. Finance and IT experts need to work with regulators to eliminate bias.

Section 5: Regulating AI in the financial industry

To establish trust and confidence amongst consumers in AI, industry players and the regulator have to work together in augmented intelligence collaboration. There will always be a ‘human in the loop’.⁸⁹ At the current stage of AI development, it is clear that human developers and advisers are required in the input, training and learning stages of algorithms. In the Government Office for Science Report in 2015, the government emphasised that “public trust is a vital condition for artificial intelligence to be used productively”.⁹⁰ It also called for a focus on preventing biased outcomes. Prevention starts from the early stages of testing. Under the Financial Services Act 2012, the FCA has an overriding strategic objective of ensuring the relevant markets function well. To support this, it has three objectives: first, to secure an appropriate degree of protection for consumers. Secondly, to protect and enhance the integrity of the UK financial system. Finally, to promote effective competition in the interests of consumers. The FCA’s Advice Unit has been supportive in encouraging FinTech startups to test their business models in a safe, friendly environment known as the regulatory sandbox. The Advice Unit’s main purpose is to promote firms to offer low cost, innovative financial advice which partially or wholly adopt automated online advice. Launched in June 2016, the sandbox allows FinTech startups and banks to test their new products, services and business models in a live market environment with regular feedback on whether their products and services comply with consumer protection measures.

To date, the FCA’s Advice Unit received 146 applications in two cohorts.⁹¹ 50 were accepted and 41 applicants’ propositions were or are currently in the process of being tested. For FinTech startups, the sandbox provides them with useful feedback, allows them to modify their models and 40% of sandbox participants secured funding either during or after the testing. The sandbox also provides reassurance to potential investors. More importantly, risks to consumers are minimised by two methods when robo-advice models are tested. First, qualified financial advisers are used to check the automated advice. They will also advise on any amendments to the algorithms. Secondly, in order to ensure that consumers receive suitable advice, they will receive notifications to act after consumers have received suitability reports.⁹² Nevertheless,

⁸⁸ *Hardys & Hansons v Lax* [2005] EWCA Civ 846

⁸⁹ Government Office for Science ‘Artificial intelligence: opportunities and implications for the future of decision making’ (2015)

<https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/566075/gs-16-19-artificial-intelligence-ai-report.pdf> accessed 7 November 2017

⁹⁰ *Ibid* (n 89)

⁹¹ Financial Conduct Authority provides update on regulatory sandbox, Financial Conduct Authority, 15th June 2017, <<https://www.fca.org.uk/news/press-releases/financial-conduct-authority-provides-update-regulatory-sandbox>> accessed 7 November 2017

⁹² *Ibid* (n 91)

firms are under greater supervisory control from the FCA under the sandbox. If the FCA are unhappy with a firm's progress, it can stop the business. Further, firms need to have sufficient capital to compensate clients in the event of losses arising from unsuitable advice.⁹³ From the perspective of consumer protection, there are strong safeguards in place for testing automated advice. It is too early to speculate the impact of the sandbox on promoting competition in the financial sector.

There is therefore, early evidence that the FCA is exercising tight supervisory control over firms on automated online advice. Consumer trust and confidence should be boosted by this proactive supervisory style. Meanwhile, industry players such as banks and FinTech startups can also help reduce bias and discrimination by a combination of preventative measures. Scherer's scholarly work on AI regulation argues that ex ante regulation would be difficult because AI research and development may be "discreet, discrete, diffuse and opaque".⁹⁴ It is "discreet" because there is not much physical infrastructure in place yet; "discrete" because of the complexity of AI systems that unconscious co-ordination takes place; "diffuse" due to the number of people involved and geographical diversity, and "opaque" due to complexity of machine learning algorithms.⁹⁵ Scherer's opinion is correct. Nevertheless, AI regulation is possible despite these hurdles. The authors believe that there are some ex ante steps which can be taken to minimise potential problems arising from AI.

First, it is important that machine learning developers in banks and FinTech startups receive regular training on fair treatment of customers, data protection and equality laws. These legal domains are very important to building consumer trust and confidence in AI. Regular training is required so that the developers receive updates on the law. Secondly, the developers should regularly test and monitor the algorithmic programmes. If there are any problems, they should try and resolve them at the earliest opportunity. One example is the Quantitative Input Influence method, which can detect potential bias in a machine learning algorithm. Using a range of possibilities, this method tests the algorithm many times and will decide which inputs have the greatest effects on the outputs.⁹⁶ Another example is the mirror image method to reduce the chances of bias. This involves using known biases in algorithms to build a mathematical formula. The formula will then create a mirror image of the biases, thus eradicating the original biases when the mirror image is merged.⁹⁷ Thirdly, firms should keep all documents regarding the discussion of AI criteria in for example, lending money to customers. Safe documentation can provide evidence of discussions of fair and clear AI criteria if a decision is challenged.

The current position of regulatory technology (RegTech) also helps build trust and confidence amongst consumers in AI. This is because RegTech increasingly blurs the line between industry and policymakers. In America, there is evidence that FinTech startups in Silicon

⁹³ J. Casanova, Y.M. Tham, J. Law, G. Lam, M. Savoie and M. Feehily, 'FinTech and Regulatory Sandboxes in the UK, Hong Kong and Singapore' (2017) < <https://www.lexology.com/library/detail.aspx?g=50903321-0281-4682-a1c3-f19c9bfd395> > accessed 7 November 2017

⁹⁴ M. Scherer, 'Regulating artificial intelligence systems: Risks, challenges, competencies, and strategies' (2016) *Harvard Journal of Law & Technology* 29(2) 354

⁹⁵ *Ibid* (n 94)

⁹⁶ Petrasic et al (n 82)

⁹⁷ *Ibid* (n 96)

Valley are working with regulators at local, state and federal levels on law and regulation.⁹⁸ Collaboration so far has taken the forms of information exchange and facilitating innovative companies with the necessary resources to flourish. In the UK, the FCA has been working closely with FinTech startups through several work programmes. They include working on a machine readable version of the FCA Handbook; developing Intelligent Regulatory Assistant and Advisers to provide advice on the authorisation process; use natural language processing and machine learning to interpret the Markets in Financial Instruments Directive II Regulations, as well as automatically build a compliance programme.⁹⁹

Emerging from the latest works on RegTech is that of a collaborative and responsive regulatory style.¹⁰⁰ The unique feature of this regulatory style is that industry players and regulators participate and collaborate together, as well as share responsibility in achieving policy goals. The authors agree that augmented intelligence collaboration is the way forward to RegTech in AI. Humans will work with machines in the foreseeable future. The complexity of AI requires both industry players, which includes IT experts, to work with regulators to achieve a balanced and effective regulatory approach. Boardrooms will need AI expertise to monitor any potential risks arising from machine learning algorithms. Banks and FinTech startups should have experts in AI and FinTech to be able to explain to directors and regulators what potential risks there are with their products, services and models.

Section 6: Conclusion

Banking in the next century will become more personalised, customer-centric and efficient with the use of AI. Already, we have seen that many banks and FinTech startups are investing heavily in AI. Robots and chatbots will increasingly take over the more routine and straightforward tasks in banking. Yet, humans still play an essential role, because robo-advisers cannot provide human judgement or real time sensitivity. To a large extent, robo-advisers can take care of our financial matters but they cannot care about us. Humans will, and should control machines to deliver reliable and trustworthy financial services. A number of challenges such as bias, discrimination, privacy and use of Big Data have to be regulated through an augmented intelligence collaborative style. London has been voted in 2016 as the most FinTech friendly jurisdiction. The FCA balances innovation with consumer protection well to date. The future of banking is exciting.

⁹⁸E. Pollman, 'The Rise of Regulatory Affairs in Innovative Startups' *The Handbook of Law and Entrepreneurship in the United States* (D. Gordon Smith & Christine Hurt eds, Cambridge University Press 2018)

⁹⁹ Financial Conduct Authority, 'Our Work Programme' <<https://www.fca.org.uk/firms/regtech/our-work-programme>> accessed 10 November 2017

¹⁰⁰ I. Ayres and J. Braithwaite, 'Responsive Regulation: Transcending the Deregulation Debate' (1992); J. Black, 'Decentering Regulation: Understanding the Role of Regulation and Self-Regulation in a 'Post-Regulatory's World' 54 *Current Legal Probs.* 103 (2001)

