

RegTech and SupTech for Robo-Advisers: Alternative Regulatory Methods for Enhancing Compliance

I H S A N I B R A H I M D A L D A B A N *

ABSTRACT

Robo-advisers are one of the most controversial products of the financial technology. In the absence of regulations governing the use of artificial intelligence in investment advisory services, it is highly complicated to determine whether the algorithms employed by robo-advisers are sufficiently capable of performing the requirements set forth in the investment adviser regulations. In order to maintain market stability and protect investors in the capital markets from the unforeseen consequences that occur at the intervention of artificial intelligence, robo-advisers' capability of observing the regulatory standards should be comprehensively assessed and tested by securities regulators.

As in many other countries, in the USA and Canada, securities regulations, in order to protect investors, require investment advisers to comply with certain standards while serving their clients. These standards include several obligations such as disclosure of material information to clients, obtaining Know-Your-Client ("KYC") information, providing a suitable investment advice, and avoiding conflicts of interest. One of the main concerns about robo-advisers is whether the algorithms used for providing investment advice are complying with the standards set forth in the investment adviser regulations. Indeed, in today's world, similar concerns related to the compliance of automation arise in many different sectors and areas where Artificial Intelligence and Machine Learning algorithms are used.

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The use of Artificial Intelligence in investment advisory has become possible by virtue of the recent advancements in technology. Artificial Intelligence and Machine Learning will certainly keep developing, and it is likely that robo-advisers will be more and more advanced based on the developments in this area. Therefore, before the technology these algorithmic investment advisers use becomes much more intricate and complex, regulators should understand the underpinnings of the robo-adviser technology and develop regulations both for today's and the future's robo-advisers. Nevertheless, traditional regulatory methods may not effectively address the issues arising from the use of algorithms in investment advisory. In order to create optimal regulations for these state-of-the-art investment tools, regulators should consider using technology as it may provide a considerable convenience to understand and analyze different aspects of robo-adviser algorithms. Two specific terms, RegTech and SupTech, have already been coined for the use of technology for regulatory and supervisory purposes. In this Article, the possibilities of using RegTech and SupTech as a mechanism for regulating robo-advisers will be discussed. In this line, this Article, firstly, illustrates important aspects of robo-advisers, then it analyzes the current regulatory framework that is applicable to robo-advisers in the USA and Canada; and finally, it discusses the use of RegTech and SupTech, in particular online surveys, user testing, and AI algorithms, for enhancing robo-advisers' compliance with certain regulatory requirements.

Keywords: artificial intelligence; machine learning; capital markets; investment advisory; fiduciary duty; FinTech; RegTech, SupTech

I. INTRODUCTION

We may hope that machines will eventually compete with men in all purely intellectual fields. But which are the best ones to start with? Even this is a difficult decision. Many people think that a very abstract activity, like the playing of chess, would be best. It can also be maintained that it is best to provide the machine with the best sense organs that money can buy, and then teach it to understand and speak English. This process could follow the normal teaching of a child. Things would be pointed out and named, etc. Again, I do not know what the right answer is, but I think both approaches should be tried.

Alan Turing, "Computing Machinery and Intelligence" (1958) 59:236 *Mind* 433 at 460

Financial markets have been subject to major changes due to the recent advancement of technology; and as smart phones and tablets have become extremely common among people and businesses, the Internet has become a significant medium in commerce.¹ The growing number of innovations and new business models in recent years has, in particular, facilitated the use of technology in banking and finance.² Today, we use the term “FinTech” to indicate the use of technology by means of electrification and digitalization of banking and financial services.³

Early versions of FinTech companies were providing services and selling their products mainly to traditional financial firms, however, modern products of FinTech are now made available directly to consumers.⁴ Consumers are preferring FinTech tools due to the fact that FinTech services have low transaction costs,⁵ allow consumers to compare different financial products very easily,⁶ and grant access to financial products without having to physically visit traditional financial institutions.⁷

Although FinTech is greatly favorable for consumers, it poses a significant threat to the financial markets and users because its development is unpredictable, path-dependent,⁸ and most importantly, it has not been extensively regulated so far.⁹ After the 2008 financial crisis,¹⁰ lawmakers mainly

¹ Christopher G. Bradley, “Fintech’s Double Edges” (2018) 93:1 Chicago-Kent L Rev 61 at 61.

² George Walker, “Financial Technology Law – A New Beginning and a New Future” (2017) 50:1 Intl Law 137 at 137-139.

³ *Ibid* at 140.

⁴ Liz Moyer, “From Wall Street Banking, a New Wave of Fintech Investors”, *The New York Times* (6 April 2016), online: <<https://www.nytimes.com/2016/04/07/business/dealbook/from-wall-street-banking-a-new-wave-of-fintech-investors.html>> [perma.cc/N6HV-74AT].

⁵ William Magnuson, “Regulating Fintech” (2018) 71:4 Vand L Rev 1167 at 1178.

⁶ Bradley, *supra* note 1 at 67; Rory Van Loo, “Helping Buyers Beware: The Need for Supervision of Big Retail” (2015) 163:5 U Pa L Rev 1311 at 1328.

⁷ Bradley, *supra* note 1 at 67.

⁸ *Ibid* at 95.

⁹ Magnuson, *supra* note 5 at 1169-1170.

¹⁰ For more information about the background of the 2008 financial crisis See Paul Ramskogler, “Tracing the origins of the financial crisis” (2015) 2014:2 OECD J Financial Market Trends 47 online: <<https://www.oecd.org/finance/Tracing-the-origins-of-the-financial-crisis.pdf>> [perma.cc/4GY2-EPCM]; Ouarda Merrouche and Erlend Nier, *What Caused the Global Financial Crisis? – Evidence on the Drivers of Financial Imbalances 1999-2007*,

focused on remedying the factors threatening the financial markets by creating regulations targeting traditional mechanisms of financial services.¹¹ However, the influx of technological advancement in the financial markets that has occurred in years since the 2008 financial crisis could not have been predicted when drafting these regulations.¹² Accordingly today, FinTech regulation remains insufficient.

This Article will review one of the most controversial products of FinTech: robo-advisers. Robo-advisers appeared in the financial markets as an alternative to the traditional investment advisers;¹³ and since their introduction to the markets, they have attracted great interest from both investors¹⁴ and regulators.¹⁵ As the name “robo-adviser” suggests, these alternative investment advisers have different mechanisms than that of traditional investment advisers;¹⁶ nevertheless, they are still investment advisers and must be

IMF Working Paper 10/265 (2010) online: <<https://www.imf.org/en/Publications/WP/Issues/2016/12/31/What-Caused-the-Global-Financial-Crisis-Evidence-on-the-Drivers-of-Financial-Imbalances-1999-24370>> [perma.cc/84P6-WC39].

¹¹ Magnuson, *supra* note 5 at 1168-1169.

¹² *Ibid* at 1169.

¹³ Andy Robertson, “Beyond the Robo-Advisor hype – where to from here?” *Chelmer* (4 March 2019), online: <<https://chelmer.co/news/beyond-the-robo-advisor-hype/>> [perma.cc/KQS5-DQLG].

¹⁴ See John Maher, “Robo-advisors set to disrupt UK wealth management industry” *ETF Strategy* (27 July 2015), online: <<https://www.etfstrategy.com/robo-advisors-set-to-disrupt-uk-wealth-management-industry-63744/>> [perma.cc/6B7E-Z2RR].

¹⁵ See SEC, *IM Guidance Update*, No 2017-02 (February 2017), online: <<https://www.sec.gov/investment/im-guidance-2017-02.pdf>> [perma.cc/Z4P4-AUW6] at 6 [SEC, *IM Guidance Update*]; SEC, “Investor Bulletin: Robo-Advisers” SEC (23 February 2017), online: <https://www.sec.gov/oiea/investor-alerts-bulletins/ib_robo-advisers.html> [perma.cc/M6TQ-FTNA] [SEC, “Investor Bulletin: Robo-Advisers”]; SEC, “Investor Alert: Automated Investment Tools” SEC (8 May 2015), online: <<https://www.sec.gov/oiea/investor-alerts-bulletins/autolistingtoolshtm.html>> [perma.cc/6AMX-EE4N] [SEC, “Investor Alert: Automated Investment Tools”]; FINRA, “Automated Investment Tools” FINRA (8 May 2015), online: <<https://www.finra.org/investors/alerts/automated-investment-tools>> [perma.cc/KS97-F3ZX] [FINRA, “Automated Investment Tools”]; FINRA, *Report on Digital Investment Advice* (March 2016), online: <<https://www.finra.org/sites/default/files/digital-investment-advice-report.pdf>> [perma.cc/Q9ZU-56VH] [FINRA, *Digital Investment Advice*]; CSA *Staff Notice 31-342: Guidance for Portfolio Managers Regarding Online Advice*, OSC CSA Notice, (2015) 38 OSCB 8197 at 8198 [CSA *Staff Notice 31-342*].

¹⁶ See Eric Jansen, “When a robo-advisor is, or isn’t, the right choice” *CNBC* (5 June 2018),

approached in the light of securities regulations that govern the activities and responsibilities of investment advisers in the capital markets.¹⁷

Investment adviser regulations, both in the USA and Canada, in order to ensure investor protection and maintain the stability in capital markets, set forth certain standards such as registration requirements with securities regulators¹⁸ and impose several duties and obligations on investment advisers regarding the service they provide to their clients such as disclosure of material information to clients,¹⁹ obtaining Know-Your-Client (“KYC”) information before generating an investment advice,²⁰ providing suitable advices to clients,²¹ and avoiding conflicts of interest.²² While robo-advisers are still not the dominating financial intermediaries in the capital markets²³ and are still evolving following the advancements in Artificial Intelligence (“AI”) and Machine Learning (“ML”) technology, securities regulators, in order to maintain market stability and protect consumers, should effectively analyze robo-advisers’ capability of performing these obligations as compliant investment advisers and create optimal regulations specifically pertaining to robo-advisers that will find a balance between encouraging innovation and

online: <<https://www.cnbc.com/2018/06/04/when-a-robo-advisor-is-or-isnt-the-right-choice.html>> [perma.cc/QJ6L2P3D].

¹⁷ See John Lightbourne, “Algorithms & Fiduciaries: Existing and Proposed Regulatory Approaches to Artificially Intelligent Financial Planners” (2017) 67:3 Duke LJ 651 at 653.

¹⁸ See 15 USC § 80b-3, 80b-3a; See e.g. *The Securities Act*, CCSM c S50, s 6(1); *Securities Act*, RSO 1995, c S-5, s 25(3).

¹⁹ See SEC, “Investor Bulletin: Form ADV Investment Adviser Brochure and Brochure Supplement” SEC (24 June 2016), online: <https://www.sec.gov/oiea/investor-alerts-bulletins/ib_formadv.html> [perma.cc/L36N-C6BM]; *National Instrument 31-103 Registration Requirements, Exemptions and Ongoing Registrant Obligations* (12 June 2018) s 14.2 [National Instrument 31-103].

²⁰ See SEC, *Commission Interpretation Regarding Standard of Conduct for Investment Advisers*, Release No IA-5248 (5 June 2019) at 13 [SEC, *Commission Interpretation*]; *National Instrument 31-103*, *supra* note 19 s 13.2.

²¹ SEC, *Commission Interpretation*, *supra* note 20 at 12; *National Instrument 31-103*, *supra* note 19 s 13.3.

²² See SEC, *Commission Interpretation*, *supra* note 20 at 23; *National Instrument 31-103*, *supra* note 19 s 13.4.

²³ See Andrea L. Seidt, Noula Zaharis & Charles Jarrett, “Paying Attention to That Man Behind the Curtain: State Securities Regulators’ Early Conversations with Robo-Advisers” (2019) 50:3 U Tol L Rev 501 at 501.

protecting investors.²⁴ Furthermore, robo-adviser regulations, while aiming to address the risks posed by robo-advisers and protect the stability of the markets, should not hinder the development of the robo-adviser innovation.²⁵

Robo-advisers have big promises.²⁶ As will be discussed below, they are making investment available for the people who could not afford receiving an advisory service from a human investment adviser previously.²⁷ They have low costs, are easy to access, and do not get tired and need to rest like human investment advisers.²⁸ However, as robo-advisers use AI and ML algorithms to generate investment advices,²⁹ whether these algorithms are capable of acting as a compliant investment adviser must be discussed.³⁰

So far, AI developed very rapidly in the past few years and have been employed in a variety of areas;³¹ investment advisory is just one of them. While

²⁴ See Megan Ji, “Are Robots Good Fiduciaries: Regulating Robo-Advisors under the Investment Advisers Act of 1940” (2017) 117:6 Colum L Rev 1543 at 1545; Rob Carrick, “The surprising threat to investment innovation” *The Globe and Mail* (17 May 2018), online: <<https://www.theglobeandmail.com/globe-investor/funds-and-etfs/etfs/the-surprising-threat-to-some-of-the-coolest-innovations-in-the-investment-world/article33884109/>> [perma.cc/3Y67-SP2T].

²⁵ See Wolf-Georg Ringe & Christopher Ruof, “A Regulatory Sandbox for Robo Advice” (2018) EBI Working Paper No 26, online: <https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3188828> [perma.cc/E6BB-XNXG] at 7; See also Magnuson, *supra* note 5 at 1215 (discussing that FinTech regulation should find a balance between encouraging innovators to innovate and protecting the markets from the systemic risk).

²⁶ See Ringe & Ruof, *supra* note 25 at 2 (“[t]he advantages for investors are obvious: they promise higher speed and significantly lower costs in comparison with regular investment services provided by humans. Moreover, their availability is around the clock, and automated advice holds the promise on an unbiased and neutral approach that is free from human error or prejudice.”).

²⁷ Julie Verhage, “Robo-advisor startups now targeting wealthy clientele” *BNN Bloomberg* (31 March 2018), online: <<https://www.bnnbloomberg.ca/robo-advisor-startups-now-targeting-wealthy-clientele-1.1040469>> [perma.cc/7RCM-KFM5].

²⁸ Ringe & Ruof, *supra* note 25 at 2.

²⁹ Lightbourne, *supra* note 17 at 652.

³⁰ See OECD, *Robo-Advice for Pensions* (2017), online: <<https://www.oecd.org/pensions/Robo-Advice-for-Pensions-2017.pdf>> [https://perma.cc/9BL6-77W7] at 17; For an analysis of whether robo-advisers comply with the regulatory requirements See generally Ji, *supra* note 24.

³¹ For an analysis of the recent development and the use of AI See Nick Statt, “The AI boom is happening all over the World, and it’s accelerating quickly” *The Verge* (12 December 2018), online: <<https://www.theverge.com/2018/12/12/18136929/artificial-intelligence->

this technology is still evolving, we have to understand how it works and how it can be regulated, hence, before it evolves into a far more complex tool, optimal regulatory approaches must be found.³² In order to create effective regulations for robo-advisers, regulators should, firstly, understand how an algorithm generates an investment advice³³ and analyze whether robo-adviser algorithms are indeed legally compliant advisers and what kind of steps can be taken for ensuring the consumer protection and market stability.³⁴

A. Background and Aim of Article

Tom Baker and Benedict Dellaert, in their oft-cited essay titled “Regulating Robo Advice across the Financial Services Industry” opened a discussion regarding the adoption of an cross-disciplinary approach for regulating robo-advisers.³⁵ In the said essay, Baker & Dellaert recommended establishing a regulatory trajectory that can address the challenges arising in connection with the competence, suitability and honesty of robo-adviser algorithms that are employed in investment, health, and insurance industries.³⁶ In particular, they drew attention to the possible incapability of algorithms in ranking and matching products with consumers³⁷ and in having sufficient access to customer and product data³⁸ as well as the effects of the choice architecture preferred by the creators of robo-advisers.³⁹ In conclusion, they have laid emphasis on the adoption of a cross-disciplinary regulatory

ai-index-report-2018-machine-learning-global-progress-research> [perma.cc/W7MM-FRHT].

³² See Tom Baker & Benedict Dellaert, “Regulating Robo Advice across the Financial Services Industry” (2018) 103:2 Iowa L Rev 713 at 732, 745 [Baker & Dellaert, “Regulating Robo Advice”]; See Ji, *supra* note 24 at 1579.

³³ Nicole G. Iannarone, “Computer as Confidant: Digital Investment Advice and the Fiduciary Standard” (2018) 93:1 Chicago-Kent L Rev 141 at 159 [Iannarone, “Computer as Confidant”].

³⁴ See Baker & Dellaert, “Regulating Robo Advice”, *supra* note 32 at 731-733, 735.

³⁵ *Ibid* at 717.

³⁶ See generally *ibid*.

³⁷ *Ibid* at 734-736.

³⁸ *Ibid* at 736-738.

³⁹ *Ibid* at 739-741.

approach that includes experts from different areas in order to efficiently regulate robo-advisers.⁴⁰

This Article aims to contribute to the discussion opened by Baker & Dellaert. The Author, in parallel with the Baker & Dellaert's arguments, is of the opinion that an effective robo-adviser regulation can be achieved by utilizing the opportunities provided by different disciplines. As will be discussed further below, robo-advisers are employing advanced tools such as AI and ML algorithms. Regulating these tools certainly requires a good understanding of the technology underlying these tools.⁴¹ There has been a growing literature regarding the regulation of robo-advisers,⁴² and several scholars have already emphasized that regulators must be able to understand and analyze the technology robo-advisers are using in order to draft effective regulations.⁴³ This Article aims to take a step further in this expanding discussion and analyze the possible use of RegTech and SupTech, in particular online surveys, user testing and AI algorithms, by regulators for regulating robo-advisers and ensuring and enhancing robo-advisers' compliance with the regulatory requirements. To the best knowledge of the Author, the use of RegTech and SupTech to improve and ensure robo-advisers' compliance with the regulatory requirements has not been particularly discussed in detail so far. By developing the on-going discussion in this line, the Author aims to show potential benefits of employing RegTech and SupTech tools as a mechanism for regulating robo-advisers.

This Article will not discuss or analyze whether robo-advisers are complying with the securities regulations or whether they are competent investment advisers.

The following part of the Article consists of five sections. Section II will explain significant features of algorithms, AI, ML, and robo-advisers. Section III will illustrate the current regulatory framework applicable to robo-advisers

⁴⁰ *Ibid* at 749.

⁴¹ See *ibid* at 716; Ringe & Ruof, *supra* note 25 at 50.

⁴² See e.g. Ji, *supra* note 24 at 1579-1583; Lightbourne, *supra* note 17 at 671-678; Nicole G Iannarone, "Rethinking Automated Investment Adviser Disclosure" (2019) 50:3 U Tol L Rev 433 at 442-445; Caelainn Carney, "Robo-Advisers and the Suitability Requirement: How They Fit in the Regulatory Framework" (2018) 2018:2 Colum Bus L Rev 586 at 607-616; Dominique Payette, "Regulating Robo-Advisers in Canada" (2018) 33 BFLR 423 at 447-472.

⁴³ See e.g. Baker & Dellaert, *supra* note 32 at 716, 735; Ringe & Ruof, *supra* note 25 at 44-45.

in the USA and Canada. Section IV will explain the emergence and implementation of RegTech and SupTech. Section V will explore the possible uses of RegTech and SupTech, in particular online surveys, user testing, and AI algorithms for enhancing and ensuring robo-advisers' compliance with the regulatory requirements. Section VI will conclude.

In this Article, the recommendations regarding the use of RegTech and SupTech tools are not directed to certain securities regulators or supervisory agencies. Yet, for the purpose of providing a sound understanding of the regulatory framework governing robo-advisers and the possible developments in the existing regulations, this Article will base the analysis on the Canadian and the US securities regulations and the robo-advisers operating in the Canadian and the US markets.

II. TECHNICAL ASPECTS OF ROBO-ADVISERS

Robo-advisers are online AI and ML platforms that provide wealth management services to investors through the use of algorithms based on the data collected from investors.⁴⁴ As will be discussed further below, the complexity of robo-adviser algorithms and accordingly the level of sophistication of the method used for providing investment advisory varies among robo-adviser companies;⁴⁵ in other words, while some robo-advisers claim to be using more sophisticated methods such as Deep Learning,⁴⁶ some

⁴⁴ Oleksii Ivanov, Oleksandr Snihoyvi & Vitaliy Kobets, "Implementation of Robo-Advisors for Different Risk Attitude Investment Decisions" (2018) 6th International Workshop on Information Technologies in Economic Research 195 at 197; Jae Yeon Park, Jae Pil Ryu & Hyun Joon Shin, "Robo-Advisors for Portfolio Management" (2016) 141 *Advanced Science and Technology Letters* 104 at 104; Chaman Lal Sabharwal, "The rise of machine learning and robo-advisors in banking" (2018) 2:2 *IDRBT Journal of Banking Technology* 28 at 33.

⁴⁵ See Blackrock, *Digital Investment Advice: Robo Advisors Come of Age* (September 2016), online: <<https://www.blackrock.com/corporate/literature/whitepaper/viewpoint-digital-investment-advice-september-2016.pdf>> [<https://perma.cc/6JZ8-396M>] at 3-4; See also Deloitte, *The expansion of Robo-Advisory in Wealth Management* (August 2016), online: <<https://www2.deloitte.com/content/dam/Deloitte/de/Documents/financial-services/Deloitte-Robo-safe.pdf>> [perma.cc/37WN-3WW2] at 1 (categorizing robo-advisers as Robo-Adviser 1.0, Robo-Adviser 2.0, Robo-Adviser 3.0, and Robo-Adviser 4.0 based on their business models and technology infrastructures) [Deloitte, *Robo-Advisory*].

⁴⁶ See Jacob Wolinsky, "How Soon Will A.I. Replace All The Traders: Q&A With Gaurav Chakravorty, CIO of Qplum" *Value Walk* (20 September 2018), online: <<https://www.valuewalk.com/2018/09/ai-traders-gaurav-chakravorty-cio-qplum/>>

others may be using more basic versions of algorithmic models.⁴⁷ To use a robo-adviser, investors, generally, should fill out an online questionnaire on the robo-adviser platform.⁴⁸ The questionnaires used by robo-advisers collect data from the investors regarding various aspects such as their age, net income, savings rate, value of the current investments, and risk appetite, just to name a few.⁴⁹ Although the service provided to investors is fully automated – except for hybrid robo-advisers discussed further below – as a matter of course, there is still a significant human interference in the system as people design and code the algorithms for these platforms, conduct the maintenance of the system, and market these automated advisers.⁵⁰

Robo-advisers, in their initial phase in the markets, were targeting to provide services to people who have limited income and relatively low experience in capital markets, and later, FinTech companies running these systems have invented a new platform called hybrid robo-advisers to meet the demands of wealthy clientele⁵¹ and in some jurisdictions, for the purpose of complying with regulatory standards.⁵² Hybrid robo-advisers combine the human intelligence with AI by employing human investment advisers to supervise the portfolio and algorithms,⁵³ and provide a more personal investment advisory service.⁵⁴ As hybrid models include human investment advisers in the provision of advisory services, the account minimum and advisory fee of these hybrid models generally differ from that of fully-automated robo-advisers.⁵⁵

[perma.cc/82KV-NCN5].

⁴⁷ See Lightbourne, *supra* note 17 at 663 (“[i]t should be noted that while robo-advisers have become more complex, they are not as complex as intricate deep learning networks like Watson.”).

⁴⁸ See SEC, *IM Guidance Update*, *supra* note 15 at 6.

⁴⁹ Michael Faloon & Bernd Scherer, “Individualization of Robo-Advice” (2017) 20:1 *JWM* 30 at 31.

⁵⁰ Baker & Dellaert, “Regulating Robo Advice”, *supra* note 32 at 715.

⁵¹ Verhage, *supra* note 27.

⁵² For example, in Canada, fully-automated robo-advisers are not allowed to operate in the markets. Therefore, robo-advisers are required to use the hybrid models. See CSA *Staff Notice 31-342*, *supra* note 15 at 8198. See Section III, below, for more on this topic.

⁵³ Bret E. Strzelczyk, “Rise of the Machines: The Legal Implications for Investor Protection with the Rise of Robo-Advisors” (2017) 16:1 *DePaul Bus & Comm LJ* 54 at 80.

⁵⁴ Verhage, *supra* note 27.

⁵⁵ See *ibid*; See e.g. Backend Benchmarking, *The Robo Report: First Quarter 2019* (2019) at 16-

The market share of the robo-advisers is expanding every day. In the USA, Betterment and Wealthfront are leading companies in robo-advising;⁵⁶ and in Canada, companies such as Wealthsimple, Wealthbar, JustWealth, Nest Wealth, Invisor, BMO SmartFolio, and Questwealth Portfolios are operating as robo-advisers in the market.⁵⁷ It is expected that robo-advisers will be managing USD 16 trillion by 2025.⁵⁸ This means that a tiny glitch in the system that robo-advisers operate on may lead to unforeseen results in the financial markets.⁵⁹ Despite numerous studies that proved that algorithms – under normal circumstances – beat humans in a variety of areas, especially at forecasting,⁶⁰ robo-adviser activities cannot be overlooked in terms of their legal outcomes. In order to establish a secure robo-adviser operation in the financial markets, lawmakers must be able to assess the algorithms robo-advisers use, the information technology foundation on which these algorithms are based, the method robo-advisers implement for presenting investment choices, and the systemic risk robo-advisers carry.⁶¹

As a matter of fact, strict regulations and heavy administrative burdens on FinTech firms may impede innovation in financial markets.⁶² As with many other FinTech companies, many of the robo-advisers start their services in the

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⁵⁶ Connie Chen, “Betterment vs Wealthfront: How 2 of the most popular robo-advisors stack up” *Business Insider* (10 July 2018), online: <<https://www.businessinsider.com/betterment-wealthfront-robo-advisor-comparison>> [perma.cc/9R6H-QMD4].

⁵⁷ David Aston, “An investor’s guide to robo-advisors 2018” *MoneySense* (29 April 2018), online: <<https://www.moneysense.ca/save/investing/an-investors-guide-to-robo-advisors-2018>> [perma.cc/6MXB-CGXL]; Bryan Borzykowski, “A guide to the best robo-advisors in Canada for 2019” *MoneySense* (25 February 2019), online: <<https://www.moneysense.ca/save/investing/best-robo-advisors-in-canada/>> [perma.cc/U537-48BT].

⁵⁸ Barbara Friedberg, “6 of the Newest Trends in Robo Advisors” *U.S. News & World Report* (27 June 2018), online: <<https://money.usnews.com/investing/investing-101/articles/2018-06-27/6-of-the-newest-trends-in-robo-advisors>> [perma.cc/GW2H-XRE5]; Deloitte, *Robo-Advisory*, *supra* note 45 at 1.

⁵⁹ See Strzelczyk, *supra* note 53 at 61-62.

⁶⁰ Jennifer M. Logg, Julia A. Minson & Don A. Moore, “Do People Trust Algorithms More than Companies Realize?” *Harv B Rev* (26 October 2018), online: <<https://hbr.org/2018/10/customers-trust-algorithms-more-than-companies-realize>> [perma.cc/7V6Z-C37P].

⁶¹ Baker & Dellaert, “Regulating Robo Advice”, *supra* note 32 at 716.

⁶² Magnuson, *supra* note 5 at 1216.

financial markets as small start-up firms.⁶³ It goes without saying that small FinTech companies, and accordingly robo-advisers, especially at the beginning of their introduction to the markets, may not be able to tolerate heavy administrative burdens and extremely strict regulations.⁶⁴ Therefore, any regulatory attempt on robo-advisers, should find a balance between ensuring investor protection and encouraging innovation.⁶⁵ Furthermore, robo-adviser regulations, while aiming to address the risks posed by robo-advisers and protect the stability of the markets, should not hinder the development of the robo-adviser innovation.⁶⁶

A. Algorithms, Artificial Intelligence, and Machine Learning

Before explaining how robo-advisers work, we must first understand what algorithms, AI and ML are, as algorithms, AI and ML play significant roles in robo-adviser technology.

Firstly, the term “algorithm” refers to “an explicit, precise, unambiguous, mechanically-executable sequence of elementary instructions, usually intended to accomplish a specific purpose.”⁶⁷ Algorithms, as they have been permeating our lives increasingly with the rapid advancement of technology in recent years, may seem to have been created and utilized in late history; in fact, they have been playing important roles in human life since the beginning of time.⁶⁸ For thousands of years, they have been utilized for various purposes by ancient civilizations such as Babylon and ancient Egypt.⁶⁹ In today’s world, algorithms

⁶³ Robert McGarvey, “Robo-Advisors Are on the Rise” *TheStreet* (1 April 2016, updated on: 3 April 2016), online: <<https://www.thestreet.com/story/13515631/1/robo-advisors-are-on-the-rise.html>> [perma.cc/BH38-FU62]. In addition to start-up firms, some traditional financial institutions, too, provide robo-advisory services. See Blackrock, *supra* note 45 at 3, 6.

⁶⁴ See Magnuson, *supra* note 5 at 1215.

⁶⁵ See Ji, *supra* note 24 at 1545; Carrick, *supra* note 24.

⁶⁶ See Ringe & Ruof, *supra* note 25 at 7; See also Magnuson, *supra* note 5 at 1215 (discussing that FinTech regulation should find a balance between encouraging innovators to innovate and protecting the markets from the systemic risk).

⁶⁷ Jeff Erickson, *Algorithms*, University of Illinois Urbana-Champaign (2019), online: <<http://jeffe.cs.illinois.edu/teaching/algorithms/book/Algorithms-JeffE.pdf>> [perma.cc/2449-ZELH] at 1.

⁶⁸ See *ibid* at 3; Jean-Luc Chabert et al, *A History of Algorithms: From the Pebble to the Microchip* (Berlin: Springer, 1999) at 1.

⁶⁹ Chabert et al, *supra* note 68 at 11-20.

run on specifically described computational procedures⁷⁰ and are used to solve problems that can be as complicated as detecting the sequences of the billions of chemical base pairs in human DNA.⁷¹

An algorithm must have five fundamental features: input, output, definiteness, finiteness, and effectiveness.⁷² First, an algorithm, in order to solve a problem, must be fed with inputs.⁷³ Second, upon the receipt of an input, the algorithm must process it through specifically designated computational steps and generate an output.⁷⁴ Third, the instructions in an algorithm must be precise and definite; these instructions should not have any vagueness.⁷⁵ Fourth, the computational steps determined in an algorithm must be finite; accordingly, whenever the algorithm is run, it must terminate after implementing a specific number of instructions.⁷⁶ This feature is considered to be a significant difference between a computer program and an algorithm, as a computer program is not subject to such a principle, hence, it may or may not cease at a certain point.⁷⁷ Another significant difference between an algorithm and a computer program is that while an algorithm is a mechanism or a sequence of instructions used for solving a problem by using inputs, a computer program is the utilization of an algorithm by using a programming language.⁷⁸ As there is a variety of programming languages,⁷⁹ the same

⁷⁰ Thomas H. Cormen et al, *Introduction to Algorithms*, 3rd ed (Cambridge: MIT Press, 2009) at 6.

⁷¹ *Ibid.*

⁷² Ajay Mittal, *Programming in C: A Practical Approach* (New Delhi: Pearson, 2010) at 684.

⁷³ Cormen et al, *supra* note 70 at 5.

⁷⁴ *Ibid.*

⁷⁵ Mittal, *supra* note 72 at 684.

⁷⁶ *Ibid.*

⁷⁷ See *ibid.*

⁷⁸ Brad Miller & David Ranum, *Problem Solving with Algorithms and Data Structures*, Release 3.0 (The University of Auckland), online: <<https://www.cs.auckland.ac.nz/compsci105s1c/resources/ProblemSolvingwithAlgorithmsandDataStructures.pdf>> [perma.cc/2BMW-42NS] at 41.

⁷⁹ See Pavneet Singh Kochhar, Dinusha Wijedasa & David Lo, "A Large Scale Study of Multiple Programming Languages and Code Quality" (2016) Software Analytics Research, online: <https://soarsmu.github.io/papers/A_Large_Scale_Study_of_Multiple_Programming_Languages_and_Code_Quality.pdf> [perma.cc/N8TM-JL58].

algorithms may be implemented by a variety of programs.⁸⁰ The last feature, effectiveness, refers to the principle that the instructions of an algorithm must be practicable; they cannot be impossible tasks.⁸¹

While an algorithm functions as a mechanism that solves a certain problem, AI is the set of algorithms that can adjust and create new algorithms by virtue of its capability to learn from the inputs and data it processes.⁸² AI does not have a single definition. Computer scientists and authors approach AI from different perspectives based on different understandings of its capabilities.⁸³ For example, John McCarthy, the creator of the term “Artificial Intelligence”, defines AI as: “the science and engineering of making intelligent machines, especially intelligent computer programs.”⁸⁴ From a different perspective, Ray Kurzweil, an American inventor, defines AI as: “[t]he art of creating machines that perform functions that require intelligence when performed by people.”⁸⁵ In short, we can say that AI is the research field or simply the activities that aim to create intelligent machines.⁸⁶

In recent years, AI has been attracting a worldwide attention more than ever. With the increasing infrastructure speed, developing cloud technologies and the development of the hardware necessary to utilize AI algorithms facilitated the achievement of significant advancements in AI research in the past few years.⁸⁷ Nevertheless, we have not achieved strong AI yet and still have

⁸⁰ Miller & Ranum, *supra* note 78 at 41.

⁸¹ Mittal, *supra* note 72 at 864.

⁸² Kaya Ismail, “AI vs. Algorithms: What’s the Difference?” *CMS Wire* (26 October 2018), online: <<https://www.cmswire.com/information-management/ai-vs-algorithms-whats-the-difference/>> [perma.cc/H96B-S9JK].

⁸³ See Stuart Russel & Peter Norvig, *Artificial Intelligence: A Modern Approach*, 3rd ed (New Jersey: Pearson, 2010) at 1-2.

⁸⁴ John McCarthy, “What is Artificial Intelligence?” *Stanford University* (12 November 2007), online: <<http://www-formal.stanford.edu/jmc/whatisai.pdf>> [perma.cc/52HF-N2PH] at 2.

⁸⁵ Raymond Kurzweil, *The Age of Intelligent Machines* (Cambridge: MIT Press, 1990) cited in Russel & Norvig, *supra* note 83 at 2.

⁸⁶ Nils J. Nilsson, *The Quest for Artificial Intelligence: A History of Ideas and Achievements* (Web Version), online: <<https://ai.stanford.edu/~nilsson/QAI/qai.pdf>> [perma.cc/KE9J-7AV3] at 13 [Nilsson, *Artificial Intelligence*].

⁸⁷ Babak Hodjat, “The AI Resurgence: Why Now?” *Wired*, online: <<https://www.wired.com/insights/2015/03/ai-resurgence-now/>> [perma.cc/SBH2-7FZB].

a long way to go.⁸⁸ Strong AI is the term used to refer to the machines that have minds and can understand like humans.⁸⁹ On the contrary, weak AI is the type of AI that can solve specifically designated problems⁹⁰ but without human-like cognitive capabilities.⁹¹ The AI algorithms we use today are weak AI.⁹²

Today, ML is constituting the most essential component of the AI research.⁹³ ML is a sub-category of AI and it focuses on the development of the learning capability of machines.⁹⁴ The aim of the ML research is to enable machines to learn from the data fed into the ML algorithm.⁹⁵ In an ML model, the task of the algorithm is to find a function by modifying its own internal structure for a specific purpose such as solving problems or conducting data mining.⁹⁶ In recent years, the increasing computational power and the development of mathematical formulas enabled scientists to enhance and elaborate virtual neural networks to a greater extent; and with these developments, ML research has taken significant steps towards a better AI with the availability of Deep Learning algorithms.⁹⁷

⁸⁸ Skymind, “Strong AI, Weak AI & Superintelligence” *Skymind*, online: <<https://skymind.ai/wiki/strong-ai-general-ai>> [perma.cc/73F9-KWTE].

⁸⁹ See Richard E. Neapolitan & Xia Jiang, *Artificial Intelligence: With an Introduction to Machine Learning*, 2nd ed (Boca Raton: CRC Press, 2018) at 3.

⁹⁰ Skymind, *supra* note 88.

⁹¹ Neapolitan & Jiang, *supra* note 89 at 3.

⁹² Skymind, *supra* note 88.

⁹³ Tie-Yan Liu et al., “Machine Learning: Research hotspots in the next ten years” *Microsoft* (14 November 2018), online: <<https://www.microsoft.com/en-us/research/lab/microsoft-research-asia/articles/machine-learning-research-hotspots/>> [perma.cc/NT5N-K4VE].

⁹⁴ Terence Mills, “Machine Learning vs. Artificial Intelligence: How Are They Different?” *Forbes* (11 July 2018), online: <<https://www.forbes.com/sites/forbestechcouncil/2018/07/11/machine-learning-vs-artificial-intelligence-how-are-they-different/#52ba790b3521>> [perma.cc/ZT7G-JD7M].

⁹⁵ See generally, Will Knight, “The Dark Secret at the Heart of AI” *MIT Tech Rev* (11 April 2017), online: <<https://www.technologyreview.com/s/604087/the-dark-secret-at-the-heart-of-ai/>> [perma.cc/BA9Z-9JUC].

⁹⁶ Nils Nilsson, *Introduction to Machine Learning: An Early Draft of a Proposed Textbook*, online: <<https://ai.stanford.edu/~nilsson/MLBOOK.pdf>> [perma.cc/AN7N-C9EG] at 2, 5 [Nilsson, *Machine Learning*].

⁹⁷ See Robert D. Hof, “Deep Learning” *MIT Tech Rev* (23 April 2013), online: <<https://www.technologyreview.com/s/513696/deep-learning/>> [perma.cc/969F-5YEC].

Strong AI cannot be achieved without ML research.⁹⁸ Indeed, ML is of fundamental importance for making AI algorithms “truly intelligent.”⁹⁹ While ML is used as a means to improve AI, it is also used in many different contexts for facilitating data-related works such as processing large amount of data¹⁰⁰ and detecting hidden correlations and relationships within the given data.¹⁰¹ Nevertheless, this innovation comes with a dark side. As algorithms learn from data and experience, and improve their problem-solving methods as a result of this learning,¹⁰² even the programmer of the algorithm may not be able to monitor and analyze how the algorithm reached a certain result.¹⁰³ That is why many of ML models are called “black boxes.”¹⁰⁴ Will Knight, the senior editor for AI at the MIT Technology Review, describes this issue very clearly:

You can't just look inside a deep neural network to see how it works. A network's reasoning is embedded in the behavior of thousands of simulated neurons, arranged into dozens or even hundreds of intricately interconnected layers. The neurons in the first layer each receive an input, like the intensity of a pixel in an image, and then perform a calculation before outputting a new signal. These outputs are fed, in a complex web, to the neurons in the next layer, and so on, until an overall output is produced. Plus, there is a process known as back-propagation that tweaks the calculations of individual neurons in a way that lets the network learn to produce a desired output.¹⁰⁵

⁹⁸ Lee Bell, “Machine learning versus AI: what’s the difference?” *Wired* (1 July 2016), online: <<https://www.wired.co.uk/article/machine-learning-ai-explained>> [perma.cc/GNS7-GWVN].

⁹⁹ *Ibid.*

¹⁰⁰ See Maryam M. Najafabadi et al., “Deep learning applications and challenges in big data analytics” (2015) 2:1 *J Big Data* at 2.

¹⁰¹ Nilsson, *Machine Learning*, *supra* note 96 at 2.

¹⁰² *Ibid* at 1-2.

¹⁰³ See Andrew D. Selbst & Solon Barocas, “The Intuitive Appeal of Explainable Machines” (2018) 87:3 *Fordham L Rev* 1085 at 1094-1096 (“[t]he power of machine learning lies not only in its ability to relieve programmers of the difficult task of producing explicit instructions for computers, but in its capacity to learn subtle relationships in data that humans might overlook or cannot recognize. This power can render the models developed with machine learning exceedingly complex and, therefore, impossible for a human to parse.”).

¹⁰⁴ See Davide Castelvecchi, “Can we open the black box of AI?” *Nature* (5 October 2016), online: <<https://www.nature.com/news/can-we-open-the-black-box-of-ai-1.20731>> [perma.cc/3PRE-SGFJ].

¹⁰⁵ Knight, *supra* note 95.

The fact that the decision-making process of an AI or an ML algorithm may be inscrutable from outside poses significant threats especially when these algorithms are employed in areas which are heavily regulated.¹⁰⁶ When an algorithm is carrying out a task which is conventionally performed by humans under detailed regulations, it goes without saying that regulators and the consumers receiving a service in which these algorithms play important roles want to be sure that the algorithms are complying with the standards and performing the duties they are subject to under relevant regulations.¹⁰⁷ However, where even the programmer of the algorithm cannot fully comprehend the reasoning applied by an algorithm in reaching a conclusion, how can regulators or consumers fully understand whether the algorithm reaches a certain result in a legally compliant manner?¹⁰⁸ This issue will certainly attract greater attention as AI keeps developing in the future.

B. Robo-Advisers and Algorithms

Robo-advisers made their first appearance in the markets following the 2008 financial crisis.¹⁰⁹ Early versions of robo-advisers were not as sophisticated as today's state-of-the-art robo-adviser models; investors who were using the early versions of robo-advisers had to execute the securities transactions on their own based on the recommendations of robo-advisers.¹¹⁰ Today's robo-

¹⁰⁶ See e.g. US Department of Treasury, *Opportunities and Challenges in Online Marketplace Lending* (2016), [online: <https://www.treasury.gov/connect/blog/Documents/Opportunities_and_Challenges_in_Online_Marketplace_Lending_white_paper.pdf>](https://www.treasury.gov/connect/blog/Documents/Opportunities_and_Challenges_in_Online_Marketplace_Lending_white_paper.pdf) [perma.cc/2W4S-UT2N] at 20 (mentioning the concerns related to the inscrutableness of the algorithms used by FinTech lenders).

¹⁰⁷ See e.g. Andrew Burt, "Is there a 'right to explanation' for machine learning in the GDPR?" *laap* (1 June 2017), [online: <https://iapp.org/news/a/is-there-a-right-to-explanation-for-machine-learning-in-the-gdpr/>](https://iapp.org/news/a/is-there-a-right-to-explanation-for-machine-learning-in-the-gdpr/) [perma.cc/F9HA-MLQ3] (discussing the level of transparency required from machine learning algorithms under the GDPR).

¹⁰⁸ For a discussion of the inscrutableness of AI and the ineffectiveness of applying causation and intent tests to an inscrutable AI see generally Yavar Bathaee, "The Artificial Intelligence Black Box and the Failure of Intent and Causation" (2018) 31:2 *Harv JL & Tech* 889.

¹⁰⁹ Aparna Narayanan, "As Robo Advisors Go Viral, Where Do Traditional Money Managers Go?" *Investor's Business Daily* (27 June 2016), [online: <https://www.investors.com/etfs-and-funds/etfs/fund-industry-wakens-from-slumber-to-take-on-digital-advice-upstarts/>](https://www.investors.com/etfs-and-funds/etfs/fund-industry-wakens-from-slumber-to-take-on-digital-advice-upstarts/) [perma.cc/Y7HZ-X3FC].

¹¹⁰ Deloitte, *Robo-Advisory*, *supra* note 45 at 2.

advisers are using sophisticated algorithms to provide wealth management services¹¹¹ including tax loss harvesting and portfolio rebalancing,¹¹² and letting investors make and manage their investments with little effort.¹¹³ Nevertheless, it should also be noted that the services provided by robo-advisers vary; in other words, there is not a single business approach adopted and applied by all robo-advisers.¹¹⁴

The main investment product preferred by robo-advisers is Exchange Traded Funds (“ETF”),¹¹⁵ which provide flexibility in trading,¹¹⁶ and generally have low costs.¹¹⁷ According to the *CSA Staff Notice 31-342: Guidance for Portfolio Managers Regarding Online Advice*, robo-advisers are also investing in cash, cash equivalents, and mutual funds.¹¹⁸ In the USA, the SEC states that emerging market funds, too, may be preferred by some robo-advisers.¹¹⁹ Robo-adviser fees and account minimums are generally considerably low.¹²⁰ For example, FidelityGo, a robo-adviser in the USA, does not require a minimum

¹¹¹ Lightbourne, *supra* note 17 at 652.

¹¹² See Elisabeth Kashner, “Inside Robo Advisor Tax Loss Harvesting” *ETF* (9 September 2014), online: <<https://www.etf.com/sections/blog/23212-inside-robo-advisor-tax-loss-harvesting.html?nopaging=1>> [perma.cc/7L37-95M8]; See also Aston, *supra* note 57.

¹¹³ Jansen, *supra* note 16.

¹¹⁴ Lightbourne, *supra* note 17 at 663-664; Ji, *supra* note 24 at 1560.

¹¹⁵ Orçun Kaya, “Robo-advice – a true innovation in asset management” (2017) Deutsche Bank Research EU Monitor, online: <https://www.dbresearch.com/PROD/RPS_EN-PROD/PROD000000000449125/Robo-advice_%E2%80%93_a_true_innovation_in_asset_managemen.PDF> [https://perma.cc/3ZBM-3KZN] at 13; Roger Wohlner, “How to Evaluate a Robo-Advisor” *Investopedia* (3 May 2019), online: <<https://www.investopedia.com/articles/financial-advisors/032415/how-evaluate-roboadvisor-schw.asp>> [perma.cc/NPM7-YUH9]; Andrew Goldman & Lisa MacColl, “Best Robo-Advisors in Canada – 2019 Guide” *Wealthsimple* (last updated: 6 August 2019), online: <https://www.wealthsimple.com/en-ca/learn/best-robo-advisor#about_canadian_robo_advisors> [perma.cc/47GK-HU26].

¹¹⁶ Brian Beers, “Introduction to Exchange Traded Funds – ETF” *Investopedia* (updated: 19 May 2019), online: <<https://www.investopedia.com/articles/01/082901.asp>> [perma.cc/T44M-CWRE].

¹¹⁷ Mitch Tuchman, “What is an ETF? Three Simple Answers” *Forbes* (28 June 2018), online: <<https://www.forbes.com/sites/mitchelltuchman/2013/06/28/what-is-an-etf-three-simple-answers/#31c6de1a2404>> [perma.cc/7CLQ-K8U7].

¹¹⁸ *CSA Staff Notice 31-342*, *supra* note 15 at 8197.

¹¹⁹ SEC, “Investor Bulletin: Robo-Advisers”, *supra* note 15.

¹²⁰ See Seidt, Zaharis & Jarrett, *supra* note 23 at 506-508.

amount for opening an account and its annual advisory fee is 0.35%.¹²¹ As another example, Wealthbar, a Canadian robo-adviser, charges 0.6% for the first CAD 150,000.¹²² For the next CAD 350,000 it charges 0.4%, and for the amounts above CAD 500,000, the fee is 0.35%.¹²³ Some robo-advisers, such as SoFi, another robo-adviser in the USA, do not request management fee for their service.¹²⁴

As mentioned before, robo-advisers generally provide their clients with online questionnaires; and clients should fill out these questionnaires in order to provide information necessary for generating an investment advice.¹²⁵ These questionnaires ask for information regarding clients' financial conditions and investment targets, such as the client's age, net income, savings rate, value of the current investments, and risk appetite.¹²⁶ After the client completes the questionnaire and submits the answers, the algorithm employed by the robo-adviser analyzes the data provided by the client, determines the proper portfolio for the client, generates the investment advice, and makes the investment.¹²⁷ The algorithm bases its recommendation on the information provided by the client through the questionnaire; accordingly, its information source for the client is limited to what the client makes available to it.¹²⁸ On the other hand, the algorithm processes massive amount of market data to find the suitable investment products for the client.¹²⁹ As algorithms can analyze massive amounts of data much faster than humans can,¹³⁰ this ability can be considered as an advantage of robo-advisers over human investment advisers.

¹²¹ "Overview" *FidelityGo*, online: <<https://www.fidelity.com/managed-accounts/fidelity-go/overview>> [perma.cc/6C6J-S2KW].

¹²² Goldman & MacColl, *supra* note 115.

¹²³ *Ibid.*

¹²⁴ Backend Benchmarking, *supra* note 55 at 17.

¹²⁵ SEC, *IM Guidance Update*, *supra* note 15 at 6.

¹²⁶ Faloon & Scherer, *supra* note 49 at 31.

¹²⁷ Jansen, *supra* note 16.

¹²⁸ SEC, "Investor Bulletin: Robo-Advisers", *supra* note 15.

¹²⁹ Sean Allocca, "Why regulators are taking aim at robo-advisors" *Financial Planning* (13 March 2019), online: <<https://www.financial-planning.com/news/robo-advisors-face-increased-scrutiny-from-sec-finra>> [perma.cc/D5FL-WT57].

¹³⁰ See e.g. Duke University, "Artificial Intelligence singles out neurons faster than a human can: Deep-learning algorithm maps active neurons as accurately as humans in a fraction of the time" *Science Daily* (12 April 2019), online: <<https://www.sciencedaily.com/releases/2019/04/190412150628.htm>>

Aforementioned in Section I, there are two types of robo-advisers: fully-automated robo-advisers and hybrid robo-advisers. While fully-automated robo-advisers use only algorithms to process client and market data and generate investment advices, hybrid robo-advisers combine human investment advisers' services with the algorithms¹³¹ to provide a more personalized investment advice.¹³² Robo-advisers that use the hybrid models usually enable investors to get in contact with human investment advisers to provide their clients with the opportunity to discuss their investments further.¹³³ It should also be noted that some companies operating fully-automated robo-advisers are also providing the hybrid model as a more sophisticated service option.¹³⁴ As hybrid models include human investment advisers in the provision of advisory services, the account minimum and advisory fee of these hybrid models generally differ from that of fully-automated robo-advisers.¹³⁵

As there is no single way to code AI or ML algorithms, there is no single set of algorithms or technology utilized by all robo-advisers.¹³⁶ Additionally, as these algorithms are companies' know-how, they are not made available to public, and accordingly, we cannot review the particular mechanisms employed by robo-adviser algorithms herein. Furthermore, it should also be noted that the complexity of these algorithms and accordingly the method used for providing investment advisory varies among robo-adviser companies;¹³⁷ for example, while some robo-advisers are using advanced forms

[perma.cc/RZ27-EJ9H].

¹³¹ Nizan Geslevich Packin, "Why We Still Want Humans, And Not (Just) Robots, To Invest Our Money" *Forbes* (18 December 2018), online: <<https://www.forbes.com/sites/nizangpackin/2018/12/18/why-we-still-want-humans-and-not-just-robots-to-invest-our-money/#70675da7c72a>> [perma.cc/GLX8-SCSW].

¹³² Verhage, *supra* note 27.

¹³³ SEC, "Investor Bulletin: Robo-Advisers", *supra* note 15.

¹³⁴ See Seidt, Zaharis & Jarrett, *supra* note 23 at 507.

¹³⁵ See Verhage, *supra* note 27; See e.g. Backend Benchmarking, *supra* note 55 at 16-17.

¹³⁶ See Blackrock, *supra* note 45 at 3 ("[a]lgorithms can range from a simple or pre-packaged algorithm that builds a single portfolio to a complex multi-strategy algorithm that reviews thousands of instruments and scenarios in order to construct an aggregate portfolio based on an individual's current holdings, investment horizon, and risk tolerance.").

¹³⁷ *Ibid* at 3-4; See also Deloitte, *Robo-Advisory*, *supra* note 45 at 2-3 (categorizing robo-advisers as Robo-Adviser 1.0, Robo-Adviser 2.0, Robo-Adviser 3.0, and Robo-Adviser 4.0 based on their business models and technology infrastructures).

of ML such as Deep Learning,¹³⁸ some of them may be using more basic forms of AI.¹³⁹ Determining the type of algorithms to be used for investment advisory is up to the robo-adviser company and its own business strategy. In other words, we should not interpret the robo-adviser technology as a single and homogeneous innovation; robo-adviser algorithms, it is worth reiterating, include various possibilities of AI and ML technology.

III. REGULATIONS GOVERNING ROBO-ADVISERS

In the USA, investment advisory is heavily regulated under state and federal laws.¹⁴⁰ Additionally, the Securities and Exchange Commission (“SEC”) is authorized to regulate and supervise investment advisers.¹⁴¹ The main federal regulation pertaining to robo-advisers is the *Investment Advisers Act of 1940* (“IAA”). The Supreme Court with a decision given in 1963,¹⁴² indicated that investment advisers, under the IAA, are required to act in accordance with the fiduciary duty while providing service to their clients.¹⁴³ Further, the IAA stipulates that these advisers must be registered either with state securities regulators or the SEC to provide investment advice.¹⁴⁴ The amount of the assets under management (“AUM”) of an investment adviser indicates whether it should register with the SEC or not.¹⁴⁵ Whether an

¹³⁸ For example, Qplum, which is currently an inactive robo-adviser, was using deep learning technology to provide services to its clients. See, Wolinsky, *supra* note 46.

¹³⁹ See Lightbourne, *supra* note 17 at 663 (“[i]t should be noted that while robo-advisers have become more complex, they are not as complex as intricate deep learning networks like Watson.”).

¹⁴⁰ SEC, *Regulation of Investment Advisers* (March 2013), online: <https://www.sec.gov/about/offices/oia/oia_investman/rplaze-042012.pdf> [perma.cc/N3YA-JYP7] at 1 [SEC, *Investment Advisers*].

¹⁴¹ SEC, *The Inspector General’s Statement on the SEC’s Management and Performance Challenges* (October 2018), online: <<https://www.sec.gov/Inspector-Generals-Statement-on-the-SECs-Mgt-and-Performance-Challenges-Oct-2018.pdf>> [perma.cc/SLK8-KZHD] at 1.

¹⁴² *SEC v Capital Gains Research Bureau, Inc.*, 375 US 180 at 194 (US 1963) [*Capital Gains*].

¹⁴³ For a further explanation See J. Tyler Kirk, “A Federal Fiduciary Standard under the Investment Advisers Act of 1940: A Refinement for the Protection of Private Funds” (2016) 7 Harv Bus L Rev Online 19 at 25.

¹⁴⁴ *Investment Advisers Act of 1940*, 15 USC § 80b-3, 80b-3a (1940).

¹⁴⁵ In terms of registration requirements, investment advisers are divided into three categories based on the amounts they manage: (i) investment advisers have less than USD 25 million of AUM (small-sized investment advisers), (ii) investment advisers that have between USD

investment adviser is registered with a state securities regulator or the SEC shows which regulator has the primary regulatory authority over the investment adviser.¹⁴⁶ Securities regulations also indicate certain cases where investment advisers are exempted from the registration requirement,¹⁴⁷ however, these exemptions will not be discussed herein as they are not relevant to the subject of this Article.

In recent years both the SEC and the Financial Industry Regulatory Authority (“FINRA”) released bulletins and reports to provide guidance regarding robo-advisers. These are the SEC’s *Investor Bulletin: Robo-Advisers*,¹⁴⁸ and *IM Guidance Update*¹⁴⁹ that were released in February 2017, and the FINRA’s *Report on Digital Investment Advice*¹⁵⁰ that was released in March 2016, and an investor alert, *Automated Investment Tools*,¹⁵¹ dated 8 May 2015, issued jointly by the SEC and the FINRA. The *Automated Investment Tools* provides investors with some tips regarding the use of robo-advisers,¹⁵² and the *Report on Digital Investment Advice* demonstrates FINRA’s observations regarding various aspects of robo-advisers.¹⁵³ The SEC’s *Investor Bulletin: Robo Advisers* and *IM Guidance Update* are of great importance regarding the regulation of robo-advisers. In the *Investor Bulletin: Robo Advisers*, the SEC, in addition to providing some insight into the particulars of robo-advisers, states that robo-

25 million and USD 100 million of AUM (mid-sized investment advisers), (iii) and larger investment advisers that have over USD 100 million of AUM. The first two categories, small-sized and mid-sized investment advisers are not allowed to register with the SEC. Nevertheless, there are exceptions to this rule. For example, a mid-sized investment adviser is required to register with the SEC if the securities regulator in the state where the investment adviser’s business place and principal office is located does not examine investment advisers. See SEC, *Investment Advisers*, *supra* note 140 at 8,9.

¹⁴⁶ See SEC, “Investor Bulletin: Transition of Mid-Sized Investment Advisers from Federal to State Registration” SEC (December 2011), online: <<https://www.sec.gov/files/transition-of-mid-sized-investment-advisers.pdf>> [perma.cc/5WPN-3EJY].

¹⁴⁷ See e.g. 15 USC § 80b-3(b), (l), (m).

¹⁴⁸ SEC, “Investor Bulletin: Robo-Advisers”, *supra* note 15.

¹⁴⁹ SEC, *IM Guidance Update*, *supra* note 15.

¹⁵⁰ FINRA, *Digital Investment Advice*, *supra* note 15.

¹⁵¹ FINRA, “Automated Investment Tools”, *supra* note 15; SEC, “Investor Alert: Automated Investment Tools”, *supra* note 15.

¹⁵² See FINRA, “Automated Investment Tools”, *supra* note 15; SEC, “Investor Alert: Automated Investment Tools”, *supra* note 15.

¹⁵³ See generally FINRA, *Digital Investment Advice*, *supra* note 15.

advisers are subject to the securities laws governing investment advisers, including those which are applicable to state-registered advisers.¹⁵⁴ In the *IM Guidance Update*, the SEC emphasizes that robo-advisers are required to comply with the IAA and that they are subject to the fiduciary duty¹⁵⁵ and the registration requirements as investment advisers.¹⁵⁶

In Canada, there is no uniform national securities act like the USA's IAA or the *Securities Exchange Act of 1934* and no national securities regulator like the USA's SEC.¹⁵⁷ Each province and territory has its own *Securities Act*; and accordingly investment advisers are regulated by provincial and territorial securities regulators on a provincial basis under these Acts.¹⁵⁸ Nevertheless, Canadian securities law is not totally disconnected. The Canadian Securities Administrators ("CSA"), which is an "umbrella organization" over the territorial and provincial securities regulators, is targeting to integrate and improve the capital markets regulation across the country.¹⁵⁹ For this purpose, the CSA issues national and multilateral instruments regarding various aspects of the securities law.¹⁶⁰ In addition to the national and multilateral instruments, the CSA also provides direction in numerous aspects of securities through different staff notices it issues.¹⁶¹

In Canada, investment advisers are required to register with the securities regulators in the provinces and territories they are providing service in.¹⁶² Registration exemptions apply to some investment advisers; for example, as per section 8.26(3) of the *National Instrument 31-103: Registration Requirements, Exemptions and Ongoing Registrant Obligations* ("National Instrument 31-103"), a company or a person that is advising a permitted client, which is not a

¹⁵⁴ SEC, "Investor Bulletin: Robo-Advisers", *supra* note 15.

¹⁵⁵ SEC, *IM Guidance Update*, *supra* note 15 at 2, 8.

¹⁵⁶ *Ibid* at 8.

¹⁵⁷ Christopher C. Nicholls, *Securities Law*, 2nd ed (Toronto: Irwin Law, 2018) at 77.

¹⁵⁸ See *ibid* at 75, 84, 94-95.

¹⁵⁹ CSA, "Overview" CSA (2009), online: <<https://www.securities-administrators.ca/aboutcsa.aspx?id=45>> [perma.cc/Y7CN-ASHN].

¹⁶⁰ See Nicholls, *supra* note 157 at 100-101.

¹⁶¹ See *ibid* at 103.

¹⁶² See e.g. *Securities Act*, RSBC 1996, c 418, s 34 ("[a] person must not (a) trade in a security or exchange contract, (b) act as an adviser, (c) act as an investment fund manager, or (d) act as an underwriter, unless the person is registered in accordance with the regulations and in the category prescribed for the purpose of the activity.").

registered dealer or an investment adviser in Canada, regarding a security which was issued by a foreign government or an issuer established according to the laws of a foreign jurisdiction is not required to register as an investment adviser in Canada.¹⁶³

In the Canadian regulatory framework, in addition to the provincial and territorial securities regulations, the main regulation regarding robo-advisers is the *National Instrument 31-103* and the *Companion Policy 31-103CP Registration Requirements and Exemptions* (“*Companion Policy 31-103*”). The CSA has also published *CSA Staff Notice 31-342: Guidance for Portfolio Managers Regarding Online Advice* (“*Guidance for Portfolio Managers Regarding Online Advice*”) to provide guidance on the legal status of robo-advisers.¹⁶⁴ In the *Guidance for Portfolio Managers Regarding Online Advice*, it is stated that portfolio managers wishing to provide online service are not legally different from those following traditional methods, therefore, they are subject to the registration requirements and other obligations stipulated in the *National Instrument 31-103*.¹⁶⁵

In the *Guidance for Portfolio Managers Regarding Online Advice*, the CSA stated: “the registration and conduct requirements set out in the *National Instrument 31-103* are ‘technology neutral’” and declared that robo-advisers must be registered as they are subject to the requirements specified in the *National Instrument 31-103*.¹⁶⁶ However, unlike the USA, fully automated robo-advisers are not allowed by the CSA in Canada.¹⁶⁷ In the Canadian model, each investment strategy generated by robo-advisers must be reassessed by human advisers,¹⁶⁸ which is similar to what has been defined as hybrid robo-adviser above. Therefore, a fully automated robo-adviser cannot be registered as an investment adviser, and accordingly cannot provide investment advisory services in Canada.

In the *Guidance for Portfolio Managers Regarding Online Advice*, the CSA states:

¹⁶³ *National Instrument 31-103*, supra note 19 s 8.26(3).

¹⁶⁴ See generally *CSA Staff Notice 31-342*, supra note 15.

¹⁶⁵ *Ibid* at 8197.

¹⁶⁶ *Ibid*.

¹⁶⁷ *Ibid* at 8198.

¹⁶⁸ Payette, supra note 42 at 424.

The online advisers that have been approved to carry on business in Canada are not 'robo-advisers' of the kind that are operating in the United States, which may provide their services to clients with little or no involvement of an AR [advising representative]. By comparison, Canadian online advisers can be seen as providing hybrid services, in that they use an online platform for the efficiencies it offers, while ARs remain actively involved in (and responsible for) decision-making.¹⁶⁹

Further, it is set forth in the *Guidance for Portfolio Managers Regarding Online Advice* that in case a portfolio manager wishes to employ an online platform which is substantially different from the hybrid model in order to provide investment advisory services, the CSA staff should carefully assess if the desired online platform complies with the requirements stipulated in the *National Instrument 31-103*.¹⁷⁰ It may be inferred from this provision that the CSA leaves an open door for fully automated robo-advisers, but still, given that the CSA explicitly disallows them as mentioned above, this provision does not look very promising for fully-automated models.

IV. REGTECH AND SUPTECH

RegTech, in simple terms, is the use of technology as a tool for facilitating the compliance with the regulatory requirements.¹⁷¹ In the past few years, in parallel with the advancement of technology, implementation and innovation of RegTech tools have seen a considerable development.¹⁷² As of today, many financial institutions are using different RegTech tools to ensure their compliance with various regulatory requirements.¹⁷³

¹⁶⁹ CSA Staff Notice 31-342, *supra* note 15 at 8198.

¹⁷⁰ *Ibid* at 8197.

¹⁷¹ Yueh-Ping Yang & Cheng-Yun Tsang, "RegTech and the New Era of Financial Regulators: Envisaging More Public- Private-Partnership Models of Financial Regulators" (2018) 21:2 U Pa J Lab & Employment L 354 at 357; Institute of International Finance, *Regtech in Financial Services: Technology Solutions for Compliance and Reporting* (March 2016), online: <https://www.iif.com/Portals/0/Files/private/iif-regtech_in_financial_services_-_solutions_for_compliance_and_reporting.pdf?ver=2019-01-04-142943-690> [perma.cc/CVB5-B59X] at 3; FINRA, *Technology Based Innovations for Regulatory Compliance ("RegTech") in the Securities Industry* (September 2018), online: <http://www.finra.org/sites/default/files/2018_RegTech_Report.pdf> [perma.cc/99B7-RBSE] at 2.

¹⁷² See Yang & Tsang, *supra* note 171 at 360-363.

¹⁷³ See Susannah Hammond, "FinTech, RegTech and the role of compliance" *Thomson Reuters* (5 December 2016), online: <<https://blogs.thomsonreuters.com/answeron/fintech->

The rise of RegTech is strongly correlated with the recent advancements in data science and the changing regulatory framework after the 2008 financial crisis as well as financial institutions' desire to decrease their compliance costs.¹⁷⁴ In addition to these factors, regulators, too, contributed to the burgeoning of RegTech as they have been trying to increase the effectiveness of their supervision in the financial markets.¹⁷⁵ After the 2008 financial crisis, regulators moved to impose stricter requirements on financial institutions,¹⁷⁶ and this led to an increasing use of technology-driven alternative methods for providing financial services¹⁷⁷ as well as utilizing technology for ensuring compliance with the heightened standards of the new regulations in a more convenient fashion.¹⁷⁸ The first trend is now called FinTech, and the latter one is RegTech.

Since the 2008 financial crisis, FinTech companies, by employing state-of-the-art tools of technology in financial markets, have been disrupting the market balances,¹⁷⁹ on the other side, especially banks, by utilizing software programs that have been made available by the recent breakthroughs in technology, have been finding new and more convenient ways to respond to the heightened regulatory requirements and compliance costs in the post-crisis era.¹⁸⁰ In addition to the needs to implement effective solutions to meet the new regulatory requirements, the advancements in data science, too, expedited the expansion and development of RegTech tools.¹⁸¹ Especially, as the

regtech-compliance/> [perma.cc/YSC9-GSYX].

¹⁷⁴ Douglas W. Arner, Janos Barberis & Ross P. Buckley, "FinTech, RegTech, and the Reconceptualization of Financial Regulation" (2017) 37:3 Nw J Int L Bus 371 at 383 [Arner, Barberis & Buckley, "RegTech"].

¹⁷⁵ *Ibid.*

¹⁷⁶ See generally Randall D. Gynn, Davis Polk & Wardwell LLP, "United States" in International Bar Association, *A survey of current regulatory trends* (October 2015), online: <https://www.davispolk.com/files/uploads/FIG/Financial_Crisis_Report_IBA.pdf> [perma.cc/G7RJ-CKXV].

¹⁷⁷ Douglas W. Arner, Janos Barberis & Ross P. Buckley, "The Evolution of FinTech: A New Post-Crisis Paradigm" (2016) 47:4 Geo J Intl L 1271 at 1287-1289.

¹⁷⁸ Arner, Barberis & Buckley, "RegTech", *supra* note 174 at 388-389.

¹⁷⁹ Magnuson, *supra* note 5 at 1214.

¹⁸⁰ See Arner, Barberis & Buckley, "RegTech", *supra* note 174 at 374; See also Gregory Roberts, "Fintech spawns regtech to automate compliance with regulations" *Bloomberg* (28 June 2016), online: <<https://www.bloomberg.com/professional/blog/fintech-spawns-regtech-automate-compliance-regulations/>> [perma.cc/E6GN-M3AS].

¹⁸¹ For a detailed analysis of the current and potential effects of technological advancements,

developments in AI and ML have turned the analysis of massive amounts of data into an easier task, traditional financial institutions have moved to utilize this technology to facilitate their supervisory activities.¹⁸² Lastly, the increasing use of innovative products in the financial markets urged regulators to strengthen their supervision of the markets, and this led to an increasing attention on technology-driven tools to facilitate regulatory activities.¹⁸³

Today, a great number of companies are developing RegTech products that address various needs of market players.¹⁸⁴ Here, some examples of the RegTech tools would help us gain a deeper insight into the subject. Ayasdi, a California based company, is offering AI-driven tools that can help institutions monitor their compliance with a range of regulatory requirements.¹⁸⁵ Ayasdi's platform, for example, functions by utilizing different implementations of ML technology and topological data analysis, helps financial institutions to carry out their obligations regarding Anti-Money-Laundering and detect and prevent fraud.¹⁸⁶ Ayasdi's Model Accelerator facilitates financial institutions' risk modeling through the use of supervised and unsupervised learning.¹⁸⁷

such as cloud computing, artificial intelligence, machine learning, and distributed ledger technology, on the RegTech tools, See Yang & Tsang, *supra* note 171 at 366-371.

¹⁸² See Financial Stability Board, *Artificial intelligence and machine learning in financial services: Market developments and financial stability implications* (1 November 2017), online: <<https://www.fsb.org/wp-content/uploads/P011117.pdf>> [perma.cc/RAE4-YQZ9] at 16-17.

¹⁸³ See Dirk Broeders & Jermy Prenio, *Innovative technology in financial supervision (suptech) – the experience of early users*, FSI Insights on policy implementation No 9 (Financial Stability Institute – Bank for International Settlements, 2018), online: <<https://www.bis.org/fsi/publ/insights9.pdf>> [perma.cc/MV65-KSCD] at 1-2; Arner, Barberis & Buckley, “RegTech”, *supra* note 174 at 374.

¹⁸⁴ See Abigail Beall, “What is regtech? The latest wave of startups hitting the fintech industry” *Wired* (18 May 2017), online: <<https://www.wired.co.uk/article/regtech-next-fintech>> [perma.cc/W3YV-XVGN].

¹⁸⁵ Ayasdi, *Understanding Ayasdi: What we do, how we do it, why we do it* (2017), online: <https://s3.amazonaws.com/cdn.ayasdi.com/wp-content/uploads/2018/04/04142230/UnderstandingAyasdi_WP_061617v011.pdf> [perma.cc/Q9H6-CS57]; Raghav Bharadwaj, “Artificial Intelligence in Regulatory Technology (RegTech) – 5 Current Applications” *Emerj* (17 May 2019), online: <<https://emerj.com/ai-sector-overviews/artificial-intelligence-in-regulatory-technology-regtech/>> [perma.cc/C5S2-AKUB].

¹⁸⁶ Bharadwaj, *supra* note 185.

¹⁸⁷ Ayasdi, “Regulatory Risk” Ayasdi, online: <<https://www.ayasdi.com/applications/regulatory-risk/>> [perma.cc/FV2Z-5C9Y].

Chainalysis, another innovator in RegTech, offers an investigation software to financial institutions and governments for detecting and preventing illegal activities, such as money laundering and extortion, in the cryptocurrencies sector.¹⁸⁸ Algoreg, a Luxembourg based company, is offering identity verification, watchlist screening and Anti-Money-Laundering risk scoring tools to a variety of industries, ranging from online gambling platforms to e-commerce.¹⁸⁹ One of its products, “go!vid”, provides a video-bot that facilitates client onboarding process and facial recognition technology to verify customers’ identity.¹⁹⁰

As can be seen from above examples, RegTech tools promise efficiency, effectiveness, and convenience in meeting regulatory requirements. RegTech can provide this convenience to regulators as well; furthermore, the use of RegTech may even be a requisite for regulators rather than an arbitrary choice.¹⁹¹ Indeed, the increasing amount of data and reports provided by the market players to the regulators necessitates the use of RegTech tools for regulators as well, since the traditional methods are likely to be inconvenient to analyze massive amounts of data.¹⁹² Furthermore, the expansion of innovation in financial markets requires a deeper understanding and utilization of the new technology for developing optimal regulatory solutions.¹⁹³ A specific word has already been coined for the use of technology for supervisory purposes: SupTech.¹⁹⁴ According to the Basel Committee of Banking Supervision (“BCBS”), SupTech and RegTech refer to two different

¹⁸⁸ Sam Daley, “Regulatory Reinvention: 12 Regtech Companies Helping the Fintech Sector Play By The Rules” *Built In* (8 April 2019, updated: 1 May 2019), online: <<https://builtin.com/fintech/regtech-companies>> [perma.cc/VD7X-DLV6].

¹⁸⁹ Algoreg, “our global KYC solutions” *Algoreg*, online: <<https://www.algoreg.com/our-global-kyc-solutions/>> [perma.cc/7VHR-TDZF].

¹⁹⁰ Algoreg, “go!vid - Customer Identification & ID Authentication” *Algoreg*, online: <<https://www.algoreg.com/verification-id-authentication/>> [perma.cc/FW27-37SD].

¹⁹¹ See Arner, Barberis & Buckley, “RegTech”, *supra* note 174 at 403-411.

¹⁹² *Ibid* at 398-399.

¹⁹³ See *Ibid* at 402-414 (discussing the different possibilities of the use of technology for regulatory purposes).

¹⁹⁴ See generally Broeders & Prenio, *supra* note 183; See also Basel Committee on Banking Supervision, *Implications of fintech developments for banks and bank supervisors*, Sound Practices (Bank for International Settlements, 2018), online: <<https://www.bis.org/bcbs/publ/d431.pdf>> [perma.cc/WTM2-42AS] at 35.

mechanisms.¹⁹⁵ In the words of the BCBS, “Suptech lets supervisors conduct supervisory work and oversight more effectively and efficiently. This differs from regtech, as suptech is not focused on assisting with compliance with laws and regulations, but on supporting supervisory agencies in their assessment of that compliance.”¹⁹⁶

In fact, the use of technology for supervisory purposes is not a new phenomenon.¹⁹⁷ Nevertheless, changing conditions witnessed in the post-crisis era, such as the increasing reporting requirements imposed on market players in the aftermath of the 2008 financial crisis,¹⁹⁸ new issues supervisory agencies have been encountering such as the need to analyze and process massive amounts of data that is collected from a myriad of different sources,¹⁹⁹ and the increasing intricacy of the market supervision due to the increasing number of innovative financial services and new business models necessitate a greater utilization of technology-based systems and tools.²⁰⁰ At this point, SupTech can provide market supervisors and regulators with an extensive convenience in conducting their supervisory and regulatory activities.²⁰¹ Some agencies are already focusing on the possible implementations of SupTech. For example, in

¹⁹⁵ Basel Committee on Banking Supervision, *supra* note 194 at 35.

¹⁹⁶ *Ibid.*

¹⁹⁷ World Bank, *From Spreadsheets to Suptech: Technology Solutions for Market Conduct Supervision*, Discussion Note (2018), online: <<http://documents.worldbank.org/curated/en/612021529953613035/pdf/127577-REVISED-Suptech-Technology-Solutions-for-Market-Conduct-Supervision.pdf>> [perma.cc/3MXU-U8LN] at 3; Patrick Armstrong & Alexander Harris, “RegTech and SupTech – change for markets and authorities” (2019) 1 *European Securities and Markets Authority Report on Trends, Risks and Vulnerabilities* 42 at 42; Arner, Barberis & Buckley, “RegTech”, *supra* note 174 at 399-400.

¹⁹⁸ Bart van Liebergen, “Machine Learning: A Revolution in Risk Management and Compliance?” (2017) 45 *The Capco Institute Journal of Financial Transformation* 60 at 64.

¹⁹⁹ World Bank, *supra* note 197 at 3-4; See Anne Leslie-Bini, “Suptech: More than just a new name for solving an old problem” *Central Banking* (31 July 2018), online: <<https://www.centralbanking.com/central-banks/economics/data/3650941/suptech-more-than-just-a-new-name-for-solving-an-old-problem>> [perma.cc/8BJM-UAWF].

²⁰⁰ World Bank, *supra* note 197 at 4-5.

²⁰¹ *Ibid.* at 4-6; Toronto Centre, *FinTech, RegTech and SupTech: What They Mean for Financial Supervision* (August 2017), online: <<https://res.torontocentre.org/guidedocs/FinTech%20RegTech%20and%20SupTech%20-%20What%20They%20Mean%20for%20Financial%20Supervision.pdf>> [perma.cc/Z7A4-5AZU] at 11-12.

the UK, the Financial Conduct Authority (“FCA”) has been engaging in the development of ML-based methods for detecting financial crimes, especially money laundering.²⁰² Another regulator, the Australian Securities and Investments Commission (“ASIC”) has been using a SupTech tool named Market Analysis Intelligence that uses algorithmic trading technology to detect suspicious activities in the markets.²⁰³ The ASIC is also exploring other possible implementations of SupTech, such as the use of Natural Language Processing for facilitating regulatory activities²⁰⁴ and detecting deceptive promotions of financial products on the Internet.²⁰⁵ Despite these developments, SupTech is still in an early stage, and limited data is available to review the performance of SupTech tools.²⁰⁶

Technology will keep developing, and especially with the developments in AI and ML, financial services are likely to run on much more complicated algorithms and infrastructures in the future.²⁰⁷ If not today, eventually one day, regulators will have to use these technologies to a greater extent in order to reinforce regulations and address the challenges arising from the use of financial technologies.²⁰⁸ This Article will not discuss further the potentials of

²⁰² Risk Screen, “FCA Turning to Machine Learning Techniques to Identify Misconduct” *Risk Screen* (9 May 2019), online: <<https://www.riskscreen.com/kyc360/news/fca-turning-to-machine-learning-techniques-to-identify-misconduct/>> [perma.cc/7V2L-NU8N]; “FCA evolving fight against financial crime by employing machine learning” *Financial Accountant* (10 May 2019), online: <<https://www.financialaccountant.co.uk/news/fca-evolving-fight-against-financial-crime-by-employing-machine-learning/>> [perma.cc/3AXW-DRZQ].

²⁰³ ASIC, “13-316MR ASIC’s next generation market surveillance system commences” ASIC (25 November 2013), online: <<https://asic.gov.au/about-asic/news-centre/find-a-media-release/2013-releases/13-316mr-asic-next-generation-market-surveillance-system-commences/>> [perma.cc/J8EH-WWYN].

²⁰⁴ ASIC, “Natural language processing trials” ASIC, online: <<https://asic.gov.au/for-business/innovation-hub/asic-and-regtech/natural-language-processing-trials/>> [perma.cc/3G59-393A]; Asha Barbaschow, “ASIC to conduct natural language processing trials” *ZD Net* (21 February 2018), online: <<https://www.zdnet.com/article/asic-to-conduct-natural-language-processing-trials/>> [perma.cc/PAV7-SUG8].

²⁰⁵ James Eyers, “ASIC to use AI to target misleading advertising” *Financial Review* (3 March 2019), online: <<https://www.afr.com/business/banking-and-finance/asic-to-use-ai-to-target-misleading-advertising-20190303-h1bx8f>> [perma.cc/NPP7-BWRK].

²⁰⁶ Basel Committee on Banking Supervision, *supra* note 194 at 35.

²⁰⁷ See, Lighthourne, *supra* note 17 at 671-672 (discussing the possible future developments in robo-advisory).

²⁰⁸ See, Arner, Barberis & Buckley, “RegTech”, *supra* note 174 at 384.

using RegTech and SupTech as regulatory tools in a wide context. Instead, below, it will focus on the analysis of the possibilities of using online surveys, user testing and algorithms as an implementation of RegTech and SupTech for ensuring and enhancing robo-advisers' compliance with particular regulatory requirements.

V. USE OF REGTECH AND SUPTECH FOR ROBO-ADVISERS

Aforementioned in Section II, strict regulations and heavy administrative burdens on FinTech companies may impede innovation in financial markets, and therefore, any regulatory attempt on robo-advisers, should find a balance between controlling the risks and encouraging innovation.²⁰⁹ Nevertheless, traditional methods of regulation-making may not be fully effective for addressing the issues arising from the use of FinTech.²¹⁰ These methods may not be fast enough to respond to the ever-changing dynamics of the markets and the intervention of innovative products into the financial services industry.²¹¹ Furthermore, recent issues arising from the use of technology such as digital privacy and security as well as algorithmic bias and the inscrutableness of algorithms add to the challenges traditional methods of regulation are struggling with.²¹² In the case of robo-advisers, securities regulators are facing even more complicated issues such as the algorithms' capability of complying with fiduciary standards, the efficiency of robo-adviser questionnaires in collecting sufficient KYC information and the suitability of the investment advices generated by algorithms.²¹³ Under these circumstances, securities regulators should consider using and benefiting from RegTech and SupTech tools as a mechanism for regulating robo-advisers.

The following section of this Article will discuss the use of RegTech and SupTech, in particular online surveys, user testing, and AI algorithms for addressing KYC and suitability issues regarding robo-adviser algorithms. Yet,

²⁰⁹ See, Ringe & Ruof, *supra* note 25 at 7; See also Magnuson, *supra* note 5 at 1215.

²¹⁰ William D. Eggers, Mike Turley & Pankaj Kishnani, "The future of regulation: Principles for regulating emerging technologies" *Deloitte Insights* (19 June 2018), online: <<https://www2.deloitte.com/insights/us/en/industry/public-sector/future-of-regulation/regulating-emerging-technology.html>> [perma.cc/5XQE-328P].

²¹¹ *Ibid.*

²¹² *Ibid.*

²¹³ See SEC, *IM Guidance Update*, *supra* note 15 at 6-7; CSA *Staff Notice 31-342*, *supra* note 15 at 8198.

before this discussion, an analysis of the applicability of the regulatory sandboxes for developing robo-adviser regulations will be conducted.

A. Regulatory Sandboxes

It is customary to analyze the possible benefits of using regulatory sandboxes in discussing the regulation of FinTech products. A regulatory sandbox is a regulatory approach with which a securities regulator allows FinTech companies to operate their innovative financial services on a trial basis under the supervision of the securities regulator.²¹⁴ In 2015, the first regulatory sandbox was created by the FCA in the United Kingdom,²¹⁵ and today, more than 20 countries are using regulatory sandboxes to encourage innovation in the financial markets.²¹⁶ In the USA, at the time of writing, only three states are using regulatory sandboxes; Arizona,²¹⁷ Utah,²¹⁸ and Wyoming.²¹⁹ Additionally, at the time of writing, the Illinois General Assembly is reviewing a bill for establishing a regulatory sandbox.²²⁰

In Canada, the CSA has been operating a regulatory sandbox since 2017.²²¹ In the Canadian regulatory sandbox model, a firm that wants to operate its FinTech product in the financial markets applies to the local

²¹⁴ United Nations Secretary-General's Special Advocate for Inclusive Finance for Development, *Briefing on Regulatory Sandboxes* (2017), online: <<https://www.unsgsa.org/files/1915/3141/8033/Sandbox.pdf>> [perma.cc/JQ5G-PVA8] at 1 [UN Briefing].

²¹⁵ Ernst & Young, *As FinTech evolves, can financial services innovation be compliant?: The emergence and impact of regulatory sandboxes – in the UK and across Asia-Pacific* (2017), online: <[https://www.ey.com/Publication/vwLUAssets/ey-the-emergence-and-impact-of-regulatory-sandboxes-in-uk-and-across-apac/\\$FILE/ey-the-emergence-and-impact-of-regulatory-sandboxes-in-uk-and-across-apac.pdf](https://www.ey.com/Publication/vwLUAssets/ey-the-emergence-and-impact-of-regulatory-sandboxes-in-uk-and-across-apac/$FILE/ey-the-emergence-and-impact-of-regulatory-sandboxes-in-uk-and-across-apac.pdf)> [perma.cc/LM2R-Z2XM] at 4.

²¹⁶ UN Briefing, *supra* note 214 at 1.

²¹⁷ US, HB 2434, *An Act Amending Section 41-1491.10, Arizona Revised Statutes; Amending Title 41, Arizona Revised Statutes, by Adding Chapter 55; Amending Section 44-1531.01, Arizona Revised Statutes; Relating to Financial Products and Services*, 53rd Legislature, 2nd Reg Sess, Ari, 2018 (enacted).

²¹⁸ US, HB 378, *Regulatory Sandbox*, 2019 Gen Sess, Uta, 2019 (enacted).

²¹⁹ US, HB 0057, *Financial Technology Sandbox*, 65th Legislature, 2019 Gen Sess, Wyo, 2019 (enacted).

²²⁰ US, HB 5139, *Regulatory Sandbox Act*, 100th Gen Assem, Ill, 2019.

²²¹ CSA, "The Canadian Securities Administrators Launches a Regulatory Sandbox Initiative" CSA (23 February 2017), online: <<https://www.securities-administrators.ca/aboutcsa.aspx?id=1555>> [perma.cc/X4C5-Q2VB].

securities regulator with its proposed business model.²²² The staff of the relevant securities regulator works with the applicant firm to detect which regulations will be applicable to the proposed business model.²²³ Afterwards, the firm completes its application with the local securities regulator; and the CSA starts examining the application.²²⁴ Once the examination is over, the CSA designates the conditions for the proposed business model; and if the firm agrees to the framework created by the CSA, it will be authorized to operate its product for a certain period of time.²²⁵

The creator of the first regulatory sandbox, the FCA, when it initiated this modern regulatory tool, indicated that it aimed to create a “safe space” where innovators can put their FinTech products to test and that a regulatory sandbox would facilitate the innovation in the financial markets.²²⁶ The FCA’s regulatory sandbox has already achieved this purpose to a great extent. Indeed, since its creation, it has been playing a significant role in creating a bridge between innovators and the FCA and providing businesses with the opportunity to prove their innovations.²²⁷ The FCA has opened five cohorts so far, received 375 applications, and accepted 118 applications to test in the regulatory sandbox.²²⁸ Given that these applications were received only in 4 years, we can easily say that innovators have been enthusiastic for sharing their ideas with the securities regulator and test their products in this safe space.²²⁹

²²² CSA, “CSA Regulatory Sandbox” CSA, online: <https://www.securities-administrators.ca/industry_resources.aspx?id=1588> [perma.cc/AD8H-96UN].

²²³ *Ibid.*

²²⁴ *Ibid.*

²²⁵ *Ibid.*

²²⁶ FCA, *Regulatory Sandbox* (November 2015), online: <<https://www.fca.org.uk/publication/research/regulatory-sandbox.pdf>> [perma.cc/66YS-LJ9Z] at 2-3.

²²⁷ See generally Deloitte, *A journey through the FCA regulatory sandbox (2018)*, online: <<https://www2.deloitte.com/uk/en/pages/financial-services/articles/journey-through-financial-conduct-authority-regulatory-sandbox.html?id=gb:2wb:3dn:4ECRSSandboxJourney:5eng:6fs:InnFin>> [perma.cc/E4ST-VFZV] [Deloitte, *Regulatory Sandbox*].

²²⁸ FCA lists the name of the accepted applicants on its website. See e.g. FCA, “Regulatory sandbox - cohort 1” (15 June 2017), online: <<https://www.fca.org.uk/firms/regulatory-sandbox/cohort-1>> [perma.cc/6345-MJAV].

²²⁹ See Deloitte, *Regulatory Sandbox*, *supra* note 227 at 1.

Regulatory sandboxes, when efficiently implemented, can bring advantages both to robo-advisers and regulators.²³⁰ FinTech companies that want to develop and use robo-adviser technology can utilize these regulatory sandboxes to test their products in the capital markets and to exchange ideas with the regulators.²³¹ The FCA reports that already some robo-advisers have participated in the regulatory sandbox and tested their products.²³² Participating in the regulatory sandbox can help robo-advisers understand the points they need to improve in their algorithmic models.²³³ Indeed, according to the Deloitte's interview with the FinTech companies that participated in the FCA regulatory sandbox, many participants reported that they found the opportunity to detect the problems in their products during their tests in the regulatory sandbox.²³⁴ Another finding of Deloitte shows that FinTech companies testing their products in the FCA regulatory sandbox gain an in-depth insight into the regulations they are subject to.²³⁵ Robo-advisers, too, by testing their products under the supervision of a securities regulator, can have a better understanding of the investment adviser regulations,²³⁶ and adjust and improve their business models efficiently in accordance with the feedback they receive from the regulator.²³⁷

On the other side, regulators, by supervising robo-advising activities in the regulatory sandbox, can gain a better insight of the technical aspects of robo-advisers.²³⁸ However, compared to other FinTech products that utilize relatively more basic forms of technology, robo-advisers run on intricate algorithms and it may be difficult for regulators to fully comprehend without the guidance of an expert of the technology underlying robo-advisory, such as

²³⁰ Carney, *supra* note 42 at 611-613; See Bradley, *supra* note 1 at 85 (discussing the benefits of regulatory sandboxes in FinTech).

²³¹ See Carney, *supra* note 42 at 609; Ringe & Ruof, *supra* note 25 at 47-48.

²³² FCA, *Regulatory sandbox lessons learned report* (October 2017), online: <<https://www.fca.org.uk/publication/research-and-data/regulatory-sandbox-lessons-learned-report.pdf>> [perma.cc/XC2B-5WP5] at 4.39-4.42.

²³³ See *ibid* at 4.41

²³⁴ Deloitte, *Regulatory Sandbox*, *supra* note 227 at 7.

²³⁵ *Ibid*.

²³⁶ Carney, *supra* note 42 at 609; See Ringe & Ruof, *supra* note 25 at 47 (arguing that robo-advisers may gain insight into the relevant EU laws by participating in regulatory sandboxes).

²³⁷ See FCA, *Regulator sandbox lessons learned report*, *supra* note 232 at 4.39-4.41.

²³⁸ *Ibid* at 49-50; Carney, *supra* note 42 at 613.

AI, ML, and algorithmic decision-making. It goes without saying that, for an ideal implementation of a regulatory sandbox for robo-advisers, regulators must be able to understand and effectively assess the implementation of AI and ML.²³⁹ This will certainly require regulators to employ computer and data scientists to help them evaluate different aspects of robo-advisers.²⁴⁰ Hence, an optimally implemented regulatory sandbox, while helping regulators to understand and evaluate robo-advisers, is likely to increase the public expenses.²⁴¹ Nevertheless, an increase in public expenses is an inevitable result of employing technology experts as a part of regulatory sandboxes.²⁴² Given that establishing a single robo-adviser platform can approximately require as high as USD 1 million,²⁴³ constructing a system that will help regulators understand and regulate robo-adviser technology is likely to cost millions of dollars. However, these costs are worth to bear.²⁴⁴ Given the increasing popularity of robo-advisers among investors, and the systemic risks augmenting as a consequence of the use of models running on same or similar technology, regulators should invest in obtaining the sufficient technology and tools to respond to these challenges even if it costs a great amount.²⁴⁵ Yet, the increasing costs are not only to be encountered in the context of regulatory sandboxes. Using SupTech tools for robo-advisers and imposing new regulatory requirements on robo-advisers for the implementation of RegTech tools are also likely to add to the costs incurred by the regulators and public.

Regulatory sandboxes can in particular help Canadian robo-advisers discuss with the securities regulators the potential benefits and drawbacks of operating fully-automated robo-advisers in Canada.²⁴⁶ As mentioned above,

²³⁹ See Ringe & Ruof, *supra* note 25 at 50 (arguing that developing a good understanding of a new technology is a necessity for regulating it).

²⁴⁰ See Baker & Dellaert, “Regulating Robo Advice”, *supra* note 32 at 716.

²⁴¹ See Ringe & Ruof, *supra* note 25 at 53.

²⁴² See *ibid.*

²⁴³ Seidt, Zaharis & Jarrett, *supra* note 23 at 510.

²⁴⁴ See Benedict & Dellaert, “Regulating Robo Advice”, *supra* note 32 at 716 (“[t]he benefits to developing these capacities almost certainly exceed the costs because the same returns to scale that make an automated advisor cost-effective lead to similar returns to scale in assessing the quality of automated advisors. An expert administrative agency is well situated to realize those returns to scale.”).

²⁴⁵ See *ibid.*

²⁴⁶ See Payette, *supra* note 42 at 474 (arguing that the regulatory sandbox of the CSA is a beneficial tool for developing an understanding of the technology underlying the new

the CSA does not allow fully-automated robo-advisers but allows only hybrid models in Canada.²⁴⁷ Existing robo-advisers or new enterprises may develop exemplary fully-automated robo-advisers and share the details thereof with the CSA and the securities regulators, and in turn, the CSA can observe the performance of fully-automated robo-advisers in the closed environment of the regulatory sandbox and this can help both innovators and the CSA see the potential outcomes of using fully-automated robo-advisers in the Canadian markets.²⁴⁸

B. Use of Online Surveys and User Testing for Enhancing Compliance with KYC Requirements

Both the US and Canadian securities regulations require investment advisers to provide their clients with suitable investment advices.²⁴⁹ Furthermore, in the USA, as a fiduciary duty is imposed on investment advisers, the investment advice provided by the advisers must be in the best interests of their clients.²⁵⁰ Before discussing the suitability requirements, we must first address the issues regarding the Know-Your-Client obligations. Because, in order to provide a suitable investment advice, an adviser must first have sufficient amount of customer data and analyze this data to understand its client's financial conditions and investment targets.²⁵¹

Know-Your-Client ("KYC") is imposed as an ethical obligation on investment advisers both in the USA and Canada. Regardless of whether the investment advice is given through traditional mediums or automated platforms, all investment advisers must ensure that they collect necessary information to sufficiently assess their clients' financial conditions.²⁵²

In the USA, the SEC, in its recent release, *Commission Interpretation Regarding Standard of Conduct for Investment Advisers*, provides a detailed

business models and for making necessary changes in the regulations accordingly.)

²⁴⁷ CSA Staff Notice 31-342, *supra* note 15 at 8197.

²⁴⁸ For a discussion of the possible benefits of allowing fully-automated robo-advisers in Canada See Payette, *supra* note 42 at 458.

²⁴⁹ SEC, *Commission Interpretation*, *supra* note 20 at 12; *National Instrument 31-103*, *supra* note 19 s 13.3.

²⁵⁰ SEC, *Commission Interpretation*, *supra* note 20 at 12.

²⁵¹ *Ibid* at 13-18; *Companion Policy 31-103CP – Registration Requirements and Exemptions*, (4 December 2017) ss 13.2, 13.3 [*Companion Policy 31-103CP*].

²⁵² Payette, *supra* note 42 at 439; See SEC, *IM Guidance Update*, *supra* note 15 at 6-7.

explanation of the extent of the KYC obligations. In the *Commission Interpretation Regarding Standard of Conduct for Investment Advisers*, the SEC sets forth that an investment adviser, before providing any advice to its client, should “make a reasonable inquiry into the client’s financial situation, level of financial sophistication, investment experience, and financial goals.”²⁵³ The KYC information collected from the client should include the client’s “current income, investments, assets and debts, marital status, tax status, insurance policies, and financial goals.”²⁵⁴

In Canada, the *National Instrument 31-103* imposes the KYC rule as a strict obligation on investment advisers. According to the *National Instrument 31-103*, an investment adviser, in order to provide suitable advice to its clients must collect sufficient information regarding “(a) the client’s investment needs and objectives; (b) the client’s financial circumstances; (c) the client’s risk tolerance.”²⁵⁵ Furthermore, according to the *Companion Policy 31-103CP*, certain facts such as the type of security, the relationship between the client and the adviser, adviser’s business model, and the client’s circumstances will affect the extent of the information that should be collected from the client.²⁵⁶

Robo-advisers, as investment advisers, must comply with the above-mentioned KYC requirements.²⁵⁷ As mentioned before, robo-advisers collect investor information with online questionnaires.²⁵⁸ In this respect, these questionnaires must be able to gather sufficient information so as to provide the most suitable advice to the clients.²⁵⁹ Therefore, as the CSA emphasizes, a “tick the box exercise” in these questionnaires will not suffice to meet the KYC requirements.²⁶⁰ In this regard, the CSA sets forth standards that must be followed by robo-advisers regarding online questionnaires. First of all, these questionnaires must “use a series of behavioural questions to establish risk

²⁵³ SEC, *Commission Interpretation*, *supra* note 20 at 13.

²⁵⁴ *Ibid* at 13-14.

²⁵⁵ *National Instrument 31-103*, *supra* note 19 s 13.2.

²⁵⁶ *Companion Policy 31-103CP*, *supra* note 251 s 13.3.

²⁵⁷ See SEC, *IM Guidance Update*, *supra* note 15 at 6-7; CSA *Staff Notice 31-342*, *supra* note 15 at 8198.

²⁵⁸ Faloon & Scherer, *supra* note 49 at 31.

²⁵⁹ See SEC, *IM Guidance Update*, *supra* note 15 at 6-7; CSA *Staff Notice 31-342*, *supra* note 15 at 8198.

²⁶⁰ CSA *Staff Notice 31-342*, *supra* note 15 at 8199.

tolerance and elicit other KYC information.”²⁶¹ Further, the questionnaires must prevent a client from proceeding to the next questions if he/she did not answer all questions,²⁶² as the unanswered questions may result in the generation of an improper investment advice.²⁶³ Additionally, the questionnaires must assess the answers to spot inconsistencies, and detect and flag the circumstances where clients’ answers are inconsistent and prompt advising representatives to get in contact with clients regarding such inconsistencies.²⁶⁴ Most importantly, the CSA requires advising representatives to be involved in the KYC process and check and ensure that sufficient client information has been collected for providing a suitable investment advice.²⁶⁵ In parallel with the CSA’s recommendations, the SEC, too, states that robo-advisers should consider whether the online questionnaires they provide to clients are efficient to obtain sufficient information to conclude an investment advice and whether the questionnaires are able to inform a client as to any inconsistency in the answers.²⁶⁶ FINRA, too, in the *Report on Digital Investment Advice*, discusses the features robo-adviser questionnaires should have in order to provide a sound advice.²⁶⁷ In the said report, FINRA draws attention to the questionnaires’ capability of collecting sufficient information and providing an alert in case of an inconsistency in the answers given by the client.²⁶⁸

Regarding KYC obligations, the main issue, as emphasized by the CSA, the SEC, and FINRA, is whether robo-advisers can obtain sufficient and correct information from their clients through the use of online questionnaires. In this regard, FINRA’s observations on robo-advisers provide

²⁶¹ *Ibid.*

²⁶² *Ibid.*

²⁶³ Payette, *supra* note 42 at 441.

²⁶⁴ CSA Staff Notice 31-342, *supra* note 15 at 8199.

²⁶⁵ *Ibid.* at 8198 (“[t]he AR is responsible for determining that sufficient KYC information has been gathered to support investment suitability determinations for the client or prospective client. In most cases, the firm’s policy is that an AR will always communicate directly with a client or prospective client before its KYC information gathering is completed. Less often, a firm will only require an AR to have direct communications with a client or prospective client if the AR has questions or concerns about the information gathered through the online platform.”).

²⁶⁶ SEC, *IM Guidance Update*, *supra* note 15 at 6-7.

²⁶⁷ See FINRA, *Digital Investment Advice*, *supra* note 15 at 8-11.

²⁶⁸ *Ibid.* at 9.

a great insight into this issue. FINRA, in the *Report on Digital Investment Advice*, lays out the principles that must be followed in obtaining client information and constructing the customer profile.²⁶⁹ According to FINRA, an ideal method for constructing customer profiles should be based on the following principles:

[I]dentifying the key elements of information necessary to profile a customer accurately; assessing both a customer's risk capacity and risk willingness; resolving contradictory or inconsistent responses in a customer profiling questionnaire; assessing whether investing (as opposed to saving or paying off debt) is appropriate for an individual; contacting customers periodically to determine if their profile has changed; and establishing appropriate governance and supervisory mechanisms for the customer profiling tool [...]²⁷⁰

In the light of the above principles, an effective robo-advisor questionnaire should be able to obtain essential client information for generating a suitable advice, sufficiently analyze a client's risk appetite and risk tolerance, and resolve inconsistencies in the answers given by clients.²⁷¹ Of course, above principles also indicate that an effective robo-advisor should also provide suitable investment advice and update client information periodically; the suitability requirement will be discussed in the following section of this Article.

There are a number of aspects of robo-advisor questionnaires that must be taken into consideration to analyze whether these questionnaires are indeed complying with the regulations. First of all, the extent of the questionnaires changes from a robo-advisor to another.²⁷² These questionnaires vary in length and method applied.²⁷³ While some robo-advisors are focusing on the analysis of the risk appetite, some others are focusing on the risk tolerance of the clients.²⁷⁴ Another important aspect is the presentation of these questionnaires. Baker & Dellaert argue that the way of presentation of the investment products such as the number and order of options which are provided to the clients as well as the complexity of the presentation of the investment products may affect clients' decisions while investing through a

²⁶⁹ *Ibid* at 8.

²⁷⁰ *Ibid*.

²⁷¹ *Ibid* at 9.

²⁷² *Ibid*; Carney, *supra* note 42 at 600.

²⁷³ Carney, *supra* note 42 at 600-601.

²⁷⁴ *Ibid* at 601-602; FINRA, *Digital Investment Advice*, *supra* note 15 at 9-10.

robo-adviser platform.²⁷⁵ Although this argument was not directed to the questionnaires by Baker & Dellaert, it provides some insight into how the presentation style chosen for a questionnaire can affect investors' answers. Ideally, robo-adviser questionnaires should be designed well enough to enable investors to understand the questions and give correct answers.²⁷⁶ In this regard, in parallel with Baker & Dellaert's argument that the presentation style of the investment products may influence investors' decisions, we can argue that the presentation of the questionnaire may affect investors' answers to the questions. Indeed, studies in psychology and design prove that the presentation of a website to a user has a great influence on users' reactions to and interactions with the website.²⁷⁷ For example, a study conducted by Pamela W. Anderson, Joan L. Giese & Joseph A. Cote shows that different font types are leaving different impressions on people; for example, while some font types seem pleasing to people, some others may seem reassuring, engaging, or prominent.²⁷⁸ In another study, Dianne Cyr, Milena Head & Hector Larios argue that colours can influence users' interaction with the websites.²⁷⁹ The said study also shows that people from different cultures may react to website colours differently.²⁸⁰ Accordingly, in the case of robo-adviser questionnaires as well, the size and type of the font used for the text, the color used in the background of the website, or the method of completing the questionnaire (such as answering to hypothetical questions²⁸¹ or filling out the blank spaces) may have substantial effect on clients, and accordingly, on questionnaires' ability to obtain sufficient information. FINRA, in the *Report on Digital Investment Advice*, lays emphasis on the different questionnaire styles used by robo-advisers. Therein, it mentions that some robo-advisers are gauging investors' risk appetite by requiring them to choose the level of risk they are

²⁷⁵ Baker & Dellaert, "Regulating Robo Advice", *supra* note 32 at 739.

²⁷⁶ See FINRA, *Digital Investment Advice*, *supra* note 15 at 8-10.

²⁷⁷ See e.g. Nathalie Bonnardel, Annie Piolat & Ludovic Le Bigot, "The impact of colour on Website appeal and users' cognitive processes" (2011) 32 *Displays* 69 (demonstrating that colours used in a website affects users' interaction with the website).

²⁷⁸ See generally Pamela W. Anderson, Joan L. Giese & Joseph A. Cote, "Impression Management Using Typeface Design" (2004) 68:4 *Journal of Marketing* 60.

²⁷⁹ See generally Dianne Cyr, Milena Head & Hector Larios, "Colour appeal in website design within and across cultures: A multi-method evaluation" (2010) 68 *Int J Human-Computer Studies* 1.

²⁸⁰ *Ibid* at 16.

²⁸¹ See FINRA, *Digital Investment Advice*, *supra* note 15 at 10.

willing to take from different pre-set options, and some other robo-advisers are using scenario-based questions or slide bars to assess their clients' risk appetite.²⁸² Different questionnaire methods may indeed affect investors' interaction with the questionnaires.

How can we know or assess whether a robo-adviser questionnaire can obtain accurate and sufficient information from clients and accordingly comply with the KYC requirements stated above? As mentioned above, the presentation style of the questionnaires is changing from a robo-adviser to another; and some presentation styles among these may be providing a better client-questionnaire interaction, and accordingly, they may be able to help investors understand questions better and provide their answers more accurately. Nevertheless, detecting the optimal presentation style and imposing this style as a requirement on robo-advisers would be an overregulation. Furthermore, imposing standards regarding the presentation style of the questionnaires would constitute an excessive intervention into robo-advisers' business and design preferences. A regulation targeting to create certain presentation standards for robo-advisers may open a discussion as to whether human investment advisers' presentation to the clients should be regulated. Because, as the font type used in a robo-adviser questionnaire may affect a client's interaction with the questionnaire, a human investment adviser's suit or voice tone may also be influencing an investor's responses to the adviser. It goes without saying that regulating these details would be beyond the logical limits. Yet, at minimum, it must be ensured that robo-adviser questionnaires are collecting sufficient information from their clients before generating an investment advice. This may be achieved by improving robo-adviser questionnaires to compensate the absence of a human interaction during the collection of KYC information.

When an investor is discussing her financial targets and needs with a human investment adviser, the adviser can gain a good understanding of the investor by asking detailed questions.²⁸³ The investor, too, by providing extensive information about her financial background and expectations, can

²⁸² *Ibid* at 10.

²⁸³ See Carney, *supra* note 42 at 602 (“[...] these questionnaires have no way of taking into account a client’s hesitation or confidence in asserting certain risk preferences: with mostly multiple choice questions, the adviser cannot see whether the client really vacillated between two options before selecting one or the other. A human adviser collecting this information from a potential client in person might more readily be able to read hesitation on the potential client’s face and come to a more holistic risk assessment.”).

let the adviser construct her investor profile accurately.²⁸⁴ For example, the investor, while providing information about her risk tolerance, may say “I can risk X amount of money, however, if I have a promotion this year, this amount may be Y as well. However, I am worried about my debts, because...” Nevertheless, an investor may not be able to have this extensive interaction with an online questionnaire as the interaction with the questionnaire may be more limited than the interaction with a human investment adviser.²⁸⁵ At this point, it should be noted that some robo-advisers enable their clients to contact with human advisers during the gathering of KYC information²⁸⁶ and that, in Canada, as mentioned before, the CSA requires advising representatives to be involved in robo-advisers’ KYC processes.²⁸⁷ The online questionnaires that are discussed herein with regard to the absence or limitedness of human interaction are the questionnaires that do not allow consultation with a human adviser and those that provide this opportunity to a very limited extent.

An online questionnaire asks certain questions, and expects certain answers. For example, a questionnaire, as mentioned by FINRA in the *Report on Digital Investment Advice*, asks the following question: “Have you ever lost 20% or more of your investments in one year?”²⁸⁸ If the investor chooses “yes”, the next question she needs to answer is: “In the year I lost 20% of my investments, I: a) sold everything; b) sold some; c) did nothing; d) reallocated my investments; or e) bought more.”²⁸⁹ A human investment adviser, too, may ask the same question; but while talking with a human, the investor may be able to say “I sold some, but in fact, I was thinking of reallocating my investments. Because...” In short, the interaction with a human may let the investor give more information about herself;²⁹⁰ however, robo-adviser questionnaires may be improved to a level where they can compensate the

²⁸⁴ See *ibid.*

²⁸⁵ See Tara Siegel Bernard, “The Pros and Cons of Using a Robot as an Investment Adviser” *New York Times* (29 April 2016), online: <<https://www.nytimes.com/2016/04/30/your-money/the-pros-and-cons-of-using-a-robot-as-an-investment-adviser.html>> [perma.cc/J5BA-P7ZP] (citing William F. Galvin’s and Arthur Laby’s comments); See also FINRA, “Automated Investment Tools”, *supra* note 15; Carney, *supra* note 42 at 601-602.

²⁸⁶ SEC, “Investor Bulletin: Robo-Advisers”, *supra* note 15.

²⁸⁷ CSA *Staff Notice* 31-342, *supra* note 15 at 8198.

²⁸⁸ FINRA, *Digital Investment Advice*, *supra* note 15 at 10.

²⁸⁹ *Ibid.*

²⁹⁰ See Bernard, *supra* note 285 (citing William F. Galvin’s and Arthur Laby’s comments).

absence of a human interaction, or even to a level where they can collect KYC information even better than human investment advisers.

At this point, the use of RegTech and SupTech tools may help improving robo-adviser questionnaires' capability of obtaining sufficient client information. It should be noted that this Article does not argue that the current robo-adviser questionnaires need improvement or are deficient. Nevertheless, as these questionnaires are provided to investors through online platforms, we must contemplate how these questionnaires can provide optimal interaction opportunities to investors so that they can efficiently collect sufficient KYC information.

Above in Section IV, different uses of AI and ML algorithms for various regulatory and supervisory purposes have been noted; and the examples that have been mentioned were generally referring to tangible tools or software programs. Here, the use of RegTech and SupTech for robo-advisers will be discussed in terms of their applicability as a method rather than specific software programs. The first option, in this regard, is the use of online surveys for assessing users' reviews and recommendations about robo-adviser questionnaires. The online survey model proposed herein may be implemented as follows:

1. The regulator will create a project that is based on the collaboration of computer scientists, website developers, psychologists, and investor advocates. These experts, together with the regulator, will assess the questionnaires used by robo-advisers that are currently active in the markets. The assessment will target to find possible deficiencies in these questionnaires. At the end of this assessment, a survey will be created. This survey will ask current clients of robo-advisers a set of questions regarding their experience and recommendations pertaining to the robo-adviser questionnaires.
2. The regulator will provide this survey to all robo-advisers and require robo-advisers to provide this survey to their clients on their websites.
3. Investors will complete these surveys and their answers will be kept by robo-advisers. After a certain period of time which will be determined by the regulator (e.g. 3 months or 6 months), robo-advisers will submit the answers obtained through the surveys to the regulator.

4. The regulator, together with the experts who created the survey, will analyze the answers and detect which aspects of robo-adviser questionnaires need improvement for collecting sufficient and accurate KYC information better. The results will be shared with each robo-adviser, and the regulator will provide guidance to robo-advisers as to what improvements they should make and why these improvements are required.
5. Robo-advisers will consider adjusting their questionnaires in accordance with the guidance provided by the regulator.

The improvements stated in the guidance provided by the regulator at the end of this project may be non-obligatory. Indeed, one may argue that if such improvements are imposed on robo-advisers as mandatory guidelines, then same project may be conducted to test human investment advisers' interactions with their clients. As mentioned before, the regulations, by creating higher standards for robo-advisers, should not disrupt robo-advisers' capability to compete with the traditional investment advisers.²⁹¹ Accordingly, conducting online surveys and guiding robo-advisers, based on the answers received from the investors, regarding the possible adjustments and improvements in their questionnaires in a non-obligatory framework has the potential of enhancing robo-advisers' compliance with the KYC requirements without imposing heavy burdens on robo-advisers.

Another possible use of RegTech and SupTech for robo-adviser questionnaires would be user testing. User testing is a method implemented in the area of design to find out what features of a product, website, or an application work or do not work as planned.²⁹² User testing allows designers "to identify if users are able to complete specific tasks successfully; establish how efficiently users can undertake predetermined tasks; and pinpoint changes to the design that might need to be made to address any shortcomings to improve performance."²⁹³

²⁹¹ See Baker & Dellaert, "Regulating Robo Advice", *supra* note 32 at 716 ("[...] it is important not to overreact by setting a higher bar for automated advisors than for human advisors. For now, the standard against which automated advisors should be compared is that of humans, whom we know are much less than perfect.")

²⁹² Cristopher Murphy, "A Comprehensive Guide to User Testing" *Smashing Magazine* (7 March 2018), online: <<https://www.smashingmagazine.com/2018/03/guide-user-testing/>> [perma.cc/LD5U-7H8X].

²⁹³ *Ibid.*

User testing can be conducted at different stages; it can be conducted for an already existing product, or for a competitor's product, or for a product which is being developed.²⁹⁴ Additionally, user testing can be conducted in person²⁹⁵ as well as through an online platform.²⁹⁶ In user testing, several factors are used to assess users' interactions with the product; such as tracking users' eye movements during the interaction with the product²⁹⁷ and tracking the methods preferred by users while carrying out the tasks.²⁹⁸ The user testing proposed herein for robo-adviser questionnaires would be implemented as follows:

1. The regulator will create a project that includes web and user experience designers as well as computer scientists and website developers, psychologists, and investor advocates. These experts, under the guidance of the regulator, will prepare different questionnaires. Each questionnaire will provide a different interaction for an investor.
2. These questionnaires will be made available to the users online. The target users for these questionnaires may be determined by the regulator and/or the experts.
3. During the user testing, users' interactions with the different types of questionnaires will be monitored. The assessment may include monitoring different factors such as how much time users spend for certain questions or whether users can easily and efficiently complete the questionnaires.
4. Results of the user testing will be shared with robo-advisers as a guidance. Robo-advisers will consider adjusting their questionnaires in accordance with the guidance provided by the regulator.

²⁹⁴ *Ibid.*

²⁹⁵ *Ibid.*

²⁹⁶ Anna Iurchenko, "Remote User Research & Usability Methods" *UX Magazine* (4 January 2016), online: <<https://uxmag.com/articles/remote-user-research-usability-methods>> [perma.cc/W6Z4-ETKE].

²⁹⁷ James Breeze, "Eye Tracking: Best Way to Test Rick App Usability" *UX Magazine* (8 December 2011), online: <<https://uxmag.com/articles/eye-tracking-the-best-way-to-test-rich-app-usability>> [perma.cc/P5CA-TCSN].

²⁹⁸ "Usability Testing" *Usability*, online: <<https://www.usability.gov/how-to-and-tools/methods/usability-testing.html>> [perma.cc/396W-HMPG].

User testing, as explained above, may show some patters between certain presentation types of the questionnaires and clients' interactions with the questionnaires and accordingly help regulators and robo-advisers gain a deeper insight into how robo-adviser questionnaires can be improved. As is the case with the online surveys, the results of the user testing, too, may be provided to robo-advisers as a non-obligatory guidance. In fact, some robo-advisers may be already conducting user testing for their own products and trying to improve their questionnaires based on their tests. However, a user testing implemented by a regulator on a large scale with numerous different questionnaire types has the potential of helping robo-advisers better understand the correlations between different presentations of questionnaires and user interactions.

C. Use of Algorithms for Enhancing Compliance with Suitability Obligations

Securities regulations, both in Canada and the USA, require investment advisers to provide suitable advices to their clients.²⁹⁹ In the USA, as a fiduciary duty is imposed on investment advisers, the advice provided by investment advisers must be in the best interest of the clients.³⁰⁰ At this point, we should first review the investment adviser fiduciary duty to understand the suitability requirements better.

Fiduciary duty is the core element of investment advisory in the USA. In the decision given by the Court of Appeals of New York in the case of *Meinhard v Salmon*, the fiduciary duty is defined as “the duty of the finest loyalty,” and further, it is stated therein that fiduciaries are “held to something stricter than the morals of the market place.”³⁰¹ In a similar vein, the Supreme Court, in *SEC v Capital Gains Research Bureau, Inc.*, defined the duty of a fiduciary as “an affirmative duty of ‘utmost good faith, and full and fair disclosure of all material facts’ as well as an affirmative obligation ‘to employ reasonable care to avoid misleading’ his clients.”³⁰²

²⁹⁹ SEC, *Commission Interpretation*, *supra* note 20 at 12; *National Instrument 31-103*, *supra* note 19 s 13.3.

³⁰⁰ SEC, *Commission Interpretation*, *supra* note 20 at 12.

³⁰¹ *Meinhard v Salmon*, 249 NY 458 at 463-464 (NY 1928).

³⁰² *Capital Gains*, *supra* note 142 at 194.

As mentioned before, in the USA, a fiduciary duty is imposed on investment advisers.³⁰³ In a study conducted by the SEC, it is stated that investment advisers, as fiduciaries, must provide services under the duty of loyalty and care.³⁰⁴ Furthermore, most recently, in the *Commission Interpretation Regarding Standard of Conduct for Investment Advisers* released on 5 June 2019, the SEC has once again emphasized on investment advisers' duty of care and duty of loyalty.³⁰⁵ Under the duty of care, an investment adviser must ensure that the investment advice it provides is in the best interest of its clients.³⁰⁶ An investment adviser's duty of loyalty puts it under the obligation to look after its clients' best interests; accordingly, it is obliged "not to subordinate the clients' interests to its own."³⁰⁷ Further, the duty of care that investment advisers must adhere to necessitates that an investment adviser must provide service to its clients in the light of complete and accurate information obtained from its clients.³⁰⁸ These duties are applicable to robo-advisers as well.³⁰⁹ As mentioned above, in the *IM Guidance Update*, the SEC stated that robo-advisers are required to adhere to the fiduciary obligations.³¹⁰

On the contrary to the US regulations, in Canada, there is no nation-wide statutory fiduciary duty imposed on investment advisers.³¹¹ The CSA, since 2012, has been assessing the applicability of a statutory best interest standard on advisers and dealers.³¹² While some regulators supported the said

³⁰³ Kirk, *supra* note 143 at 25.

³⁰⁴ SEC, *Study on Investment Advisers and Broker-Dealers* (January 2011), online: <<https://www.sec.gov/news/studies/2011/913studyfinal.pdf>> [<https://perma.cc/TZX2-6NVC>] at 22 [SEC, *Investment Advisers and Broker-Dealers*].

³⁰⁵ See generally SEC, *Commission Interpretation*, *supra* note 20.

³⁰⁶ *Ibid* at 14.

³⁰⁷ SEC, *Investment Advisers and Broker-Dealers*, *supra* note 304 at 22.

³⁰⁸ *Ibid*.

³⁰⁹ SEC, *IM Guidance Update*, *supra* note 15 at 2.

³¹⁰ *Ibid*.

³¹¹ CSA Consultation Paper 33-403: *The Standard of Conduct for Advisers and Dealers: Exploring the Appropriateness of Introducing a Statutory Best Interest Duty When Advice is Provided to Retail Clients* (25 October 2012) 35 OSCB 9558 at 9564 [CSA Consultation Paper 33-403].

³¹² See *Ibid*; CSA Staff Notice 33-316 – *Status Report on Consultation under CSA Consultation Paper 33-403: The Standard of Conduct for Advisers and Dealers: Exploring the Appropriateness of Introducing a Statutory Best Interest Duty When Advice is Provided to Retail Clients* (17 December 2013) 36 OSCB 11998; CSA Consultations Paper 33-404: *Proposals to Enhance the Obligations of Advisers, Dealers, and Representatives toward their Clients* (28 April 2016) 39 OSCB 3947;

proposal,³¹³ some others had strong concerns about it;³¹⁴ and in the end, a statutory best interest standard was not adopted by securities regulators;³¹⁵ and in 2017, the CSA has moved to propose amendments in the *National Instrument 31-103* for “better aligning the interests of registrants with the interests of their clients, improving outcomes for clients, and making clearer to clients the nature and the terms of their relationships with registrants.”³¹⁶

Four provinces, namely, Alberta, Manitoba, Newfoundland and Labrador, and New Brunswick impose acting in clients’ best interests as a requirement on investment advisers when they are managing their clients’ assets in discretionary accounts.³¹⁷ Accordingly, investment advisers may be subject to the fiduciary duty in these provinces on the condition that discretionary accounts are used.³¹⁸ In Quebec, as per section 160 of the *Securities Act*, “[a]ll persons registered as dealers, advisers or representatives are required to deal fairly, honestly, loyally and in good faith with their clients.”³¹⁹ Furthermore, general civil law in Quebec requires investment advisers and dealers to seek the best interests of their clients.³²⁰ According to some scholars, the level of standard of care imposed on investment advisers and dealers in Quebec is analogous to the fiduciary duty under the common law.³²¹

The fact that securities regulations do not explicitly impose a fiduciary duty on investment advisers does not purport that investment advisers are exempt from the fiduciary duty. In the Canadian common law, whether or not an

CSA Staff Notice 33-319 – *Status Report on CSA Consultation Paper 33-404: Proposals to Enhance the Obligations of Advisers, Dealers, and Representatives toward their Clients* (11 May 2017) 40 OSCB 4778 [CSA Staff Notice 33-319].

³¹³ CSA Staff Notice 33-319, *supra* note 312 at 4782.

³¹⁴ *Ibid.*

³¹⁵ CSA Notice and Request for Comment – *Proposed Amendments to National Instrument 31-103 Registration Requirements, Exemptions and Ongoing Registrant Obligations and to Companion Policy 31-103CP Registration Requirements, Exemptions and Ongoing Registrant Obligations – Reforms to Enhance the Client-Registrant Relationship (Client Focused Reforms)* (21 June 2018) 41 OSCB (Supp-1) at 2.

³¹⁶ *Ibid.*; See also CSA Staff Notice 33-319, *supra* note 312 at 4781-4782.

³¹⁷ *The Securities Act*, CCSM c S50, s 154.2(2); *Securities Act*, RSA 2000, c S-4, s 75.2(2); *Securities Act*, SNB 2004, c S-5.5, s 54(2); *Securities Act*, RSNL 1990, c S-13, s 26.2(2).

³¹⁸ CSA Consultation Paper 33-403, *supra* note 311 at 9564.

³¹⁹ *Securities Act*, CQLR c V-1.1 s 160.

³²⁰ CSA Consultation Paper 33-403, *supra* note 311 at 9564.

³²¹ *Ibid.* (citing R. Crête, G. Brisson, M. Naccarato & A. Létourneau).

investment adviser has fiduciary duty depends on the specific facts and circumstances of the case.³²² In order to determine whether or not the fiduciary duty is existent in a particular case, Canadian courts have developed an approach which is based on five different aspects of investment advisory. These are; the vulnerability of the client, the client's trust in the adviser, the client's reliance on the adviser, the degree of discretion granted to the adviser, and the professional rules or codes of conduct.³²³ Accordingly, despite there is no statutory investment adviser fiduciary duty in Canada, courts may determine that an investment adviser is actually subject to the fiduciary standards.³²⁴ Among these factors, the discretion granted to the adviser is of great importance, as the CSA states that an investment adviser that has discretion over performing transactions and investment decisions on its clients' assets is subject to the fiduciary duty.³²⁵ This is a critical factor for robo-advisers, as they mostly manage their clients' assets through discretionary accounts.³²⁶

These five factors are not exhaustive, therefore, courts may consider more factors to determine the existence of the fiduciary duty.³²⁷ Nevertheless, even if an investment adviser is found to have no fiduciary duty in a specific case, it is still obliged to provide a suitable investment advice to its clients.³²⁸ The *National Instrument 31-103* sets forth, "A registrant must take reasonable steps to ensure that, before it makes a recommendation to or accepts an instruction from a client to buy or sell a security, or makes a purchase or sale of a security for a client's managed account, the purchase or sale is suitable for the client."³²⁹

Are robo-advisers subject to the fiduciary standards in Canada? Answering this question is not easy and it requires an analysis on a case-by-case basis. In a market study published in December 2017, the Competition Bureau Canada stated that even though robo-advisers are employing algorithms to provide a service to their clients, they must adhere to the "same rigorous oversight" as human investment advisers.³³⁰ The CSA, in the *Guidance for Portfolio Managers*

³²² *Ibid* at 9561-9562.

³²³ *Hunt v TD Securities Inc.*, 2003 OJ No 3245 at para 40.

³²⁴ *CSA Consultation Paper 33-403*, *supra* note 311 at 9561.

³²⁵ *Ibid* at 9564.

³²⁶ Payette, *supra* note 42 at 429.

³²⁷ *Hunt v TD Securities Inc.*, *supra* note 323 at para 41.

³²⁸ *National Instrument 31-103*, *supra* note 19 s 13.3.

³²⁹ *Ibid*.

³³⁰ Competition Bureau Canada, *Technology-Led Innovation in the Canadian Financial Services*

Regarding Online Advice, states that regardless of the mediums used to deliver an investment advice, investment advisers are subject to the same regulatory requirements.³³¹ Accordingly, the fiduciary duty seems applicable to robo-advisers.³³² Above all, as investment advisers who manage their clients' assets through discretionary accounts are generally deemed to be fiduciaries,³³³ robo-advisers may be deemed to be subject to fiduciary standards in view of the fact that they use discretionary accounts for managing the assets of their clients. However, as Canadian courts may develop new factors, in addition to the five factors mentioned above, to determine the existence of the fiduciary duty in a particular case, they may consider additional issues to assess whether robo-advisers can be subject to the fiduciary duty. This Article will not discuss further whether robo-advisers may be subject to the fiduciary duty in Canada; indeed, such discussion would require a more comprehensive analysis of the fiduciary duty and the user profiles of the robo-advisers in Canada.

Aforementioned in Section II, as these robo-adviser algorithms are companies' know-how, they are not made available to public, and accordingly, we cannot review the particular mechanisms employed by robo-adviser algorithms; accordingly, we cannot easily test whether a robo-adviser algorithm is indeed providing suitable advices to the clients. While robo-adviser algorithms, for now, may not be as complex as Deep Learning algorithms of which decision-making process may be inscrutable, with the developments in ML, robo-advisers, too, may employ more complex algorithms in the future and this would add to the transparency issue.³³⁴ In addition to this transparency issue, another concern regarding the suitability of the investment advices is that a robo-adviser may be directing investors to products that are more profitable for the robo-adviser itself.³³⁵ As Baker & Dellaert puts it, “[i]t would be naïve to simply assume that intermediaries will always choose the algorithms and choice architecture that are best for consumers, rather than

Sector – A Market Study (December 2017) Cat No Iu54-65/2017E-PDF at 62.

³³¹ CSA Staff Notice 31-342, *supra* note 15 at 8197.

³³² See also Payette, *supra* note 42 at 443.

³³³ CSA Consultation Paper 33-403, *supra* note 311 at 9564.

³³⁴ See Lightbourne, *supra* note 17 at 671-672.

³³⁵ See Tom Baker & Benedict Dellaert, “Behavioral Finance, Decumulation and the Regulatory Strategy for Robo-Advice” (2018) Wharton Pension Research Council Working Papers, online: <https://repository.upenn.edu/prc_papers/2/> [perma.cc/3]7P-WTPE]; See Ji, *supra* note 24 at 1573; Baker & Dellaert, “Regulating Robo Advice”, *supra* note 32 at 735-736.

those that are best for the intermediaries.”³³⁶ At this point, it should be noted that this Article does not argue that robo-advisers are actually implementing such practices; nevertheless, such practices are within the bounds of possibility, and these possibilities raise concerns.

Despite testing robo-adviser algorithms may not be practicable for securities regulators for now, regulators, by using algorithms may understand how robo-advisers match investment products with investors, and accordingly, provide guidance to robo-advisers as to any refinements necessary for enhancing compliance with the suitability requirements. The use of algorithms proposed herein would be implemented as follows:

1. The regulator will create a project where computer scientists and programmers will develop different robo-adviser algorithms.
2. Each algorithm will be provided with the data of imaginary investment products, and fed with imaginary client data.
3. As each algorithm will be provided with the same data, the regulator will be able to efficiently compare the outputs generated by these algorithms.

By developing algorithms and testing how they work and match customer data with products, regulators can gain a profound understanding of how algorithms may be providing investment advice. By comparing different algorithms’ decisions, regulators may also see certain patterns and correlations between specific data points regarding customers and the products and the particulars of the algorithm that makes the decision. This would enlighten regulators as to the possible issues underlying the robo-adviser technology as well as the potential benefits of robo-advisers. Developing these algorithms and testing them is likely to be very costly, and the idea of developing these systems may seem to be a far-fetched method; nevertheless, as mentioned before, in order to regulate robo-advisers and other FinTech products, regulators firstly must understand the particulars of the technology these products are using.³³⁷ Developing systems similar to those used by actual market players may indeed serve this purpose.

³³⁶ Baker & Dellaert, “Regulating Robo-Advice”, *supra* note 32 at 732.

³³⁷ Ringe & Ruof, *supra* note 25 at 50.

VI. CONCLUSION

This Article has discussed only a fraction of the possible uses of RegTech and SupTech tools for understanding and improving robo-adviser technology and enhancing compliance with regulatory requirements. Indeed, technology is offering great opportunities and tools to regulators for developing new perspectives on developing effective policies to respond to the changing dynamics of the markets.³³⁸ However, neither the use of technology for regulatory and supervisory purposes nor the traditional regulatory methods should hinder the development of robo-adviser products and services.³³⁹ Yet, regulators should be able to effectively monitor and assess the use of robo-adviser technology.³⁴⁰ Within this scope, regulators, instead of trying to fit robo-advisory into an inflexible framework, should help robo-advisers comply with the investment adviser regulations.³⁴¹ In this regard, RegTech and SupTech may be beneficial. Here we could only discuss the use of regulatory sandboxes as a general regulatory mechanism, and online surveys and user testing for KYC requirements, and lastly, algorithms for suitability requirements. Similar or different technology-based methods may be used in relation to other requirements that robo-advisers are subject to such as avoiding conflicts of interest or disclosing material facts. A more comprehensive study would cover these issues as well. Yet, the Author believes that the possible uses of regulatory sandboxes, online surveys, user testing and algorithms as discussed in this Article already show that a technology-based approach would be beneficial for the facilitation of the innovations as well as the protection of investors.

³³⁸ World Bank, *supra* note 197 at 4-6.

³³⁹ See Ji, *supra* note 24 at 1545 (arguing that the SEC should find a balance between encouraging innovation in robo-adviser technology and ensuring investor protection).

³⁴⁰ See Baker & Dellaert, "Regulating Robo-Advice", *supra* note 32 at 732.

³⁴¹ Ringe & Ruof, *supra* note 25 at 47.