RIGHTS OF INVESTORS IN THE CONTEXT OF ALGORITHMIC ARTIFICIAL INTELLIGENCE TECHNOLOGIES AND AUTOMATIZATION

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Abstract: This study explores the profound impact of digital technologies on economic processes, particularly in the realm of investments. Financial organizations are leveraging digital platforms and algorithmic artificial intelligence (AI) to provide enhanced services to consumers. AI-powered algorithms surpass humans in processing vast amounts of information, leading to improved price discovery and reduced transaction costs. Robo-advisors, empowered by AI, have become pivotal players in financial markets, offering personalized investment portfolios based on risk profiles and objectives. While algorithmic AI technologies eliminate human errors and streamline decision-making, they also introduce new risks. Flaws in algorithm construction, intentional errors, cybersecurity vulnerabilities, and the regulatory challenges of supervising self-learning algorithms are concerns. Additionally, the rise of blockchain platforms has transformed cryptocurrencies and digital tokens into new tradable assets with their own protection challenges. Researchers emphasize that the wealth of data and correlations facilitated by AI can have unintended consequences, and the development of proper supervision and control mechanisms is vital. As the financial landscape continues to evolve, it becomes crucial for investors and regulators to navigate the complexities of digital technologies and address the emerging Global Technology Risk (GTR).

Keywords: digital technologies; algorithmic artificial intelligence; robo-advisors; personalized investments; Global Technology RISK (GTR).

INTRODUCTION

Digital technologies have had a profound impact on economic processes within contemporary society. In a remarkably brief period, new methods of conducting business and contract formation have emerged, all of which have significantly influenced the sphere of investments. Financial organizations have embraced digital platforms and algorithmic artificial intelligence (AI) technologies to provide consumers with a higher quality of service. These algorithms possess the capacity to outperform humans in many respects due to their ability to swiftly process vast amounts of information[1]. Investment

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[1] Magnuson, William J., Financial Regulation in the Bitcoin Era (March 23, 2018).

firms, with the assistance of artificial intelligence (AI), have automated client interactions, engaged in high-frequency trading (HFT), analyzed markets, identified signals for enhanced and uncorrelated returns, optimized trading execution, formulated trading and investment strategies, and adjusted these strategies in response to changing environments, thus enhancing price discovery and reducing overall transaction costs in the system, among other functions[2].

Presently, AI technologies have paved the way for the prevalence of robo-advisors in financial markets. For instance, the Russian investment company, "Tinkoff JSC," utilizes an AI Research Engine that analyzes securities using various criteria[3], including growth potential, analyst forecasts, dividend yield, stock liquidity, and risk parameters. Furthermore, in some instances, AI not only conducts analytics but also executes transactions. As noted by William J Magnuson, "robo-advisors deploy sophisticated algorithms to assess an individual investor's risk profile, time horizon, and other characteristics to fashion investment portfolios. Potential investors simply visit the robo-advisor's website, complete a straightforward questionnaire, and can then entrust their investments to the robo-advisor's algorithm. The algorithm can issue buy and sell orders, rebalance portfolios, and even respond to changing legal incentives, such as engaging in 'tax harvesting' to reduce the investor's income taxes"[4]. The growth of blockchain platforms has also left its mark on financial markets through the advent of smart contracts and the transformation of cryptocurrencies and digital tokens into a new class of tradable assets[5]. Undoubtedly, the field of investments stands as one of the most digitized sectors[6].

From one perspective, algorithmic AI technologies aid in the elimination of human errors. These technologies enable the rapid reduction of decision-making time in investment markets by utilizing mechanisms that conduct in-

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Stanford Journal of Law, Business, and Finance, v. 23, n. 2, 2018

[2] Artificial intelligence and machine learning in financial services Market developments and financial stability implications. Available at https://www.fsb.org/wp-content/uploads/P011117.pdf

[3] See https://www.tinkoff.ru/about/news/08072019-tinkoff-investments-ai-research-engine/

[4] Magnuson, William J., Financial Regulation in the Bitcoin Era (March 23, 2018). *Stanford Journal of Law, Business, and Finance*, v. 23, n. 2, 2018

[5] Giudici, G., Milne, A.; Vinogradov, D. Cryptocurrencies: market analysis and perspectives. *J. Ind. Bus. Econ*., v. 47, p. 1-18, 2020.

[6] Buckley, Ross P.; Arner, Douglas W.; Zetzsche, Dirk Andreas; Selga, Eriks, The Dark Side of Digital Financial Transformation: The New Risks of FinTech and the Rise of TechRisk (November 18, 2019). *UNSW Law Research Paper No. 19-89*, *European Banking Institute Working Paper 2019/54*, *University of Luxembourg Law Working Paper 2019-009*, *University of Hong Kong Faculty of Law Research Paper No. 2019/112*, *Singapore Journal of Legal Studies (Forthcoming)*.

depth analysis of substantial data volumes, while automation ensures contract execution without room for alteration. Simultaneously, AI decision-making and automation introduce new risks for investors. It is no secret that even the most sophisticated algorithms are crafted by humans, potentially containing flaws stemming from a flawed understanding of investment principles. Of course, certain system errors may be intentionally introduced by dishonest programmers. Investors and traders must also remain vigilant regarding cybersecurity and the resilience of AI to computer viruses. Moreover, numerous challenges are associated with safeguarding digital token holders, particularly in jurisdictions where digital assets lack regulation or are outright illegal. Therefore, new technologies usher in new risks, as aptly articulated by researchers:

"The sheer volume of data promotes correlation-based analyses rather than causation, and correlations can lead to unintended, socially regressive consequences. Yet, methods for adequately supervising and controlling self-learning algorithms have yet to be developed. Cybersecurity risks and the technological complexity pose challenges for supervisors and regulators traditionally trained to oversee conventional financial services. The juxtaposition of traditional bankers communicating with computer scientists gives rise to the risk of miscommunication, design flaws, and compliance failures. As an ever-increasing number of high-profile cyberattacks and IT glitches have demonstrated, these new risks could result in an overall negative impact of FinTech on some investors and clients of financial intermediaries. FinTech has not eliminated risks but has transformed existing ones and introduced new risks, including what we term 'Global Technology Risk (GTR)'"[7].

I. NEW TECHNOLOGIES AND INVESTMENTS

A. New technologies, new risks

This paper aims to identify principles that allow for the development of a regulatory approach to protect investors' rights when investment companies employ algorithmic technologies, including AI technologies. It is undeniable that in the near future, AI will have a significant impact on investment technologies, raising questions about the legal regulation of decision-making delegation from humans to preprogrammed algorithms. The automation and

[7] Zetzsche, Dirk Andreas; Arner, Douglas W.; Buckley, Ross P.; Weber, Rolf H., The Future of Data-Driven Finance and RegTech: Lessons from EU Big Bang II (March 27, 2019). *European Banking Institute Working Paper Series 2019/35*, *UNSW Law Research Paper No. 19-22*, *University of Luxembourg Law Working Paper No. 005-2019*, *University of Hong Kong Faculty of Law Research Paper No. 2019/004.*

"blockchainization" of investment processes make it imperative to establish a regulatory framework that reduces potential risks while safeguarding and guaranteeing the legitimate rights of investors. Due to the global nature of many investment platforms and cryptocurrency exchanges, there is a need to establish international common principles for the application of algorithmic artificial intelligence technologies in the field of investments. Ultimately, it is crucial to determine who bears liability when AI makes decisions that harm investors and national markets. Therefore, national regulators must be prepared to adapt the legal framework and existing rules to this new reality.

B. Meaning of robo-advisors, HFT and smart contracts

As previously mentioned, there are three primary algorithmic technologies currently applied in the field of investments: Robo-advisors, HFT (High-Frequency Trading), and smart contracts. Despite the international nature of these technologies, there is, unfortunately, a lack of internationally recognized definitions that national regulators can use for cross-border financial interactions. However, in some countries, national regulators and legal scholars have proposed their own interpretations.

1. Robo-advisors

Some national regulators have attempted to officially define Robo-advisors. For instance, the Australian Securities and Investment Commission defines them in Regulatory Guide 255, which pertains to providing digital financial product advice to retail clients, as algorithms and technology that offer automated financial advice without direct involvement from a human adviser[8]. Meanwhile, there are at least four types of robo-advisors[9], differing in the degree of human participation in investment decision-making. However, all of them share a common feature: automated services for collecting information and providing tailored investment recommendations to clients based on their input[10]. In essence, a robo-advisor is software (a computer program or application) containing an algorithm that ranks or matches consumers to financial products on a personalized basis[11] or assists

[8] Regulatory Guide 255 Providing digital financial product advice to retail clients

[9] The expansion of Robo-advisory in wealth management Available at https://www2.deloitte.com/content/dam/Deloitte/de/Documents/financial-services/Deloitte-Robo-safe.pdf

[10] Maume, Philipp. Regulating Robo-Advisory (April 20, 2018). *Texas International Law Journal*, v. 55, n. 1, Fall 2019, pp. 49-87.

[11] Baker, Tom; Dellaert, Benedict G. C., Regulating Robo Advice Across the Financial Services Industry (2018). *Iowa Law Review*, v. 103, P. 713, 2018, *U. of Penn, Inst for Law*

investors in some way[12].

2. High Frequency Trading (HFT)

Similar to the situation with Robo-advisors, there is no widely accepted definition of High-Frequency Trading (HFT)[13]. Researchers define HFT as a trading technique characterized by short holding periods for trading positions, high trading volumes, frequent order updates, and proprietary trading[14]. This perspective aligns closely with the stance of the European Parliament. In 2018, the EU Parliament enacted MiFID II[15], which defines HFT as an algorithmic trading method characterized by:

a) Infrastructure designed to minimize network and other types of delays, with at least one of the following features for algorithmic opening of positions: co-location (hardware hosting), approximate hosting, or high-speed direct electronic access to the marketplace.

b) A system for determining the procedure for filing, creating, transmitting, or executing an application without human intervention.

c) High-speed execution of actions during the trading day, including the filing of orders, quotations, or cancellations of orders.

d) Order initiation, generation, routing, and execution determined by the system without human intervention for each individual trade or order, with a short time-frame for establishing and liquidating positions.

3. Smart contracts

The definition of a smart contract is not firmly established, even among IT professionals. However, it is indisputable that the key features of smart contracts are their execution without human involvement and the impossibility of overturning transactions[16]. The International Financial Corporation describes smart contracts as self-executing software code that

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& Econ Research Paper No. 17-11.

[12] Sanz Bayón, Pablo; Vega, Luis Garvía, Automated Investment Advice: Legal Challenges and Regulatory Questions (2018). *Banking & Financial Services Policy Report*, v. 37, n. 3, March 2018, pp. 1-11.

[13] Gomber, Peter; Arndt, Björn; Lutat, Marco; Uhle, Tim Elko. *High-Frequency Trading*, 2011.

[14] Gomber, P.; Haferkorn, M. High-Frequency-Trading. *Bus Inf Syst Eng*, v. 5, 97–99, 2013.

[15] Directive 2014/65/EU of the European Parliament and of the Council of 15 May 2014 on markets in financial instruments and amending Directive 2002/92/EC and Directive 2011/61/EU. Text with EEA relevance.

[16] World Bank Group. 2020. Smart Contract Technology and Financial Inclusion. Fintech Note; No. 6. World Bank, Washington, DC. Available at https://openknowledge.worldbank.org/handle/10986/33723

runs on a blockchain. The code in the smart contract defines the terms of an agreement on an "if" and "else" basis and automatically enforces those terms when the specific criteria programmed into the code are met[17]. It's worth noting that smart contracts are closely intertwined with digital assets circulating within the blockchain, and their potential is realized in the sphere of cryptocurrencies.

II. ROBO-ADVISORS AS THE NEW INTERMEDIARIES IN THE WORLD OF INVESTMENTS

A. Impact of Robo-advisors on the Sphere of Investments

The development of the FinTech industry has stimulated the application of new technologies for automating various financial services[18]. Since 2008, Robo-advisors have gained widespread use in the realm of personal financial consulting[19], with assets under management in the Robo-advisors segment projected to reach US$987,494m in 2020[20]. Thanks to this technology, private investors can receive rapid analysis of financial markets and investment strategy recommendations from computer programs. Investors can even entrust AI to select and purchase securities for them. Deloitte notes that sophisticated risk management and profiling questionnaires have led to direct investments via self-learning AI investment algorithms. These algorithms shift between different asset classes based on changing market conditions and individual investment needs, such as profit, risk appetite, and liquidity requirements. They also monitor and adjust single client portfolios in real-time to adhere to the selected investment strategy[21].

In Russia, Robo-advisors are taking their first steps. Robo-advisors offered by banks such as VTB, Alfa-Capital, AK-BARS, and Sberbank provide financial consulting, portfolio formation, and management services. For instance, Russia's largest bank, Sberbank, in collaboration with FinEx,

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[17] International Financial Corporation (IFC) (2019), Blockchain: Opportunities for Private Enterprises in Emerging Markets. Available at: https://www.ifc.org/wps/wcm/connect/2106d1c6-5361-41cd-86c2-f7d16c510e9f/201901-IFC-EMCompass-Blockchain-Report.pdf?MOD=AJPERES&CVID=mxYj-sA

[18] Arner, Douglas W.; Barberis, Janos Nathan; Buckley, Ross P., The Evolution of Fintech: A New Post-Crisis Paradigm? (October 1, 2015). *University of Hong Kong Faculty of Law Research Paper No. 2015/047*, *UNSW Law Research Paper No. 2016-62*.

[19] Top robo-advisors in 2020: Performance reviews, returns, and comparisons. Available at: https://www.businessinsider.com/best-robo-advisors

[20] Statista. Robo-Advisors. Fintech Worldwide Outlook Report. Available at: https://www.statista.com/outlook/337/100/robo-advisors/worldwide

[21] The expansion of Robo-advisory in wealth management. Available at https://www2.deloitte.com/content/dam/Deloitte/de/Documents/financial-services/Deloitte-Robo-safe.pdf

launched a robotic financial advisor in 2016. This advisor can assess a client's needs, risk tolerance, select investment assets, manage portfolios, and perform regular rebalancing. However, certain critical operations, like purchasing securities on the exchange, still require manual verification by a specialist[22]. This robotic financial advisor exclusively invests in exchange-traded funds listed on the Moscow Exchange, with a minimum investment of 100 thousand rubles (approximately $1,285.29 USD), and charges a commission of only 1.5% per year on the value of assets. In 2018, the Russian IT company Yandex introduced the Yammi robotic financial advisor, allowing individuals to start investing with as little as 5 thousand rubles[23]. Clearly, Robo-advisors enable banks to attract investors who previously might have been deterred by the high expenses associated with financial advisors. The application of AI for robo-advice has the potential to facilitate people's engagement in various asset markets for their investments[24].

As Georgiy Luntovsky, the head of the Association of Banks of Russia, pointed out, "The traditional process of forming an investment portfolio through interactions with a financial consultant in robo-advising is being replaced by a software algorithm. Existing platforms can already discern the client's needs and risk appetite to construct an investment portfolio based on this data. Such a service helps individuals save for significant purchases, preserve savings, and plan for retirement"[25].

However, despite these advantages, "there are numerous mixed features in Robo-advisors that could generate new challenges for existing legal rules, principles, institutions, and entities, whether they only advise, manage portfolios, or also make investments on behalf of their clients"[26]. The limited nature of communication between an investor and a Robo-advisor raises concerns about the robot's ability to replace a human when it comes to fulfilling fiduciary duties. Robo-advisors formulate investment strategies based on client responses, which can be flawed because clients may lack a clear understanding of their financial circumstances, something only a human advisor can ascertain. Additionally, Robo-advisors may introduce instability into the financial market by providing similar recommendations and

[22] Available at: https://www.rbc.ru/newspaper/2017/05/17/591af0c49a79477853b309cf

[23] Cf. https://yammi.io/

[24] Artificial intelligence and machine learning in financial services Market developments and financial stability implications https://www.fsb.org/wp-content/uploads/P011117.pdf

[25] Luntovsky, G. Marketplace as a means of increasing the availability of financial services. 2018, *Banking Review*, n. 9, at 26. <Лунтовский Г. Маркетплейс как средство повышения доступности финансовых услуг // Банковское обозрение>.

[26] Schweighofer Kummer Saarenpää Schafer (dirs.), Datenschutz LegalTech: *Tagungband des 21 Internationalen Rechtsinformatik Symposions IRIS 2018*, Editions Weblaw, Bern (Switzerland), 2018, pp. 311-318.

following identical investment strategies[27].

Another concern is related to the software's ability to manage investments as announced by its operators. In December 2018, the US Securities and Exchange Commission (SEC) charged two Robo-advisers with making false disclosures. Wealthfront, a Robo-adviser with over $US 11 billion in client assets under management, was fined $US 250,000, while Hedgeable Inc. faced an $US 80,000 penalty. The SEC found that Wealthfront had made false statements about a tax-loss harvesting strategy it offered to clients, while Hedgeable Inc. had made misleading statements about its investment performance by posting purported comparisons of the investment performance of its clients with those of two Robo-adviser competitors, comparing this with rates of return that were not based on competitors' actual trading models[28].

B. Brief overview of the existing legal framework for robo-advisors

The emergence of Robo-advisors has raised questions about the applicability of the existing regulatory framework to them, prompting governments worldwide to determine how to regulate these automated financial advisors. National financial market regulators have adopted various approaches to the inclusion of Robo-advisors in investment activities. For example, Australia[29] has actively promoted Robo-advisors and published Regulatory Guide 255, titled "Providing digital financial product advice to retail clients." Notably, this document does not introduce new regulatory approaches to the financial market. As the Australian Securities and Investment Commission states, "this is because the law is technology-neutral, and the obligations applying to the provision of traditional (i.e., nondigital) financial product advice and digital advice are the same"[30]. However, Regulatory Guide 255 does establish certain rules for industry participants. For instance, paragraph RG 255.61 mandates that holders of digital advice

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[27] Maume, Philipp. Regulating Robo-Advisory (April 20, 2018). *Texas International Law Journal*, v. 55, n. 1, Fall 2019, pp. 49-87.

[28] SEC Charges Two Robo-Advisers With False Disclosures. Available at: https://www.sec.gov/news/press-release/2018-300

[29] Regulatory Guide 255 Providing digital financial product advice to retail clients was issued on 30 of August 2016. It brings together some of the issues that persons providing digital advice to retail clients need to consider when operating in Australia—from the licensing stage through to the actual provision of advice. This guidance builds on Regulatory Guide 36 Licensing: Financial product advice and dealing and should be read in conjunction with other Australian Securities and Investment Commission regulatory guides concerning financial product advices.

[30] Digital advice providers. Available at https://asic.gov.au/regulatory-resources/find-a-document/regulatory-guides/rg-255-providing-digital-financial-product-advice-to-retail-clients/

licenses ensure they have personnel within their business who understand the technology and algorithms used to provide digital advice and can review the digital advice generated by algorithms. Consequently, Australia has not introduced new legislation for Robo-advisors but has issued regulatory guidelines on how to comply with existing laws in this specific domain.

In contrast to the Australian approach, Germany does not advocate for the development of a specific regulatory regime and treats Robo-advisors the same way as traditional financial advisors. The German Federal Financial Supervisory Authority (BaFin) provides information[31-32] on its website, categorizing robo-advice under Section 1 (1a) sentence 2 no. 1a of the German Banking Act as investment advice when customers, based on the information they provide, receive investment suggestions related to specific financial instruments. Consequently, providers of robo-advice in Germany must obtain authorization from BaFin in accordance with section 32 of the German Banking Act.

In the United States, Robo-advisors are subject to registration with the Securities and Exchange Commission (SEC) and are regulated by the same laws as human financial consultants[33]. It's worth noting that certain U.S. states have taken a less friendly stance towards Robo-advisors. Professor Maume pointed out that "the Massachusetts Securities Division even announced that it would refuse to authorize applications submitted by Robo-advisors. As a result, the operating conditions in various financial markets with significant growth potential vary widely, posing significant uncertainties for market participants"[34].

In Russia, the relationship between a Robo-advisor and an investor is regulated solely by the fiduciary management agreement. There are no specific rules for Robo-advisors that differentiate them from other financial consultants. Moreover, the Central Bank of Russia is cautious about robo-advising, citing concerns about vulnerability to cyberattacks and their overall effectiveness[35]. Nonetheless, despite this skepticism, the Central Bank of

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[31] Robo-advice and auto-trading – platforms for automated investment advice and automatic trading. Available at https://www.bafin.de/EN/Aufsicht/FinTech/Anlageberatung/anlageberatung_node_en.html

[32] Robo-advice - Automated investment advice in supervisory practice. Available at https://www.bafin.de/SharedDocs/Veroeffentlichungen/EN/Fachartikel/2017/fa_bj_1708_RoboAdvice_en.html

[33] Investor Bulletin: Robo-Advisers Feb. 23, 2017. Available at https://www.investor.gov/introduction-investing/general-resources/news-alerts/alerts-bulletins/investor-bulletins-45

[34] Maume, Philipp. Regulating Robo-Advisory (April 20, 2018). *Texas International Law Journal*, cit.

[35] Tarasenko, Olga. Digital transformation of banking and payment systems in Russia. *Entrepreneur Law*, n. 3, p. 3-10, 2019. <Тарасенко О.А. Цифровое преобразование банковской и платежной систем России // Предпринимательское право>

Russia has approved the Action Plan (roadmap) for the Implementation of the Main Directions of Development of the Financial Market of the Russian Federation for the Period 2019 – 2021. The plan aims to establish a regulatory framework for the operation of robot advisors and enhance the approaches for admitting robot advisors to the financial market. In 2021, the Central Bank of Russia will release a report detailing the legal status of robot advisors and measures to protect the rights of investors. The core principle underlying the development of the Russian framework for digitalizing the financial market is the protection of financial institutions and their clients from cyber threats. Consequently, the Bank of Russia is developing national information security standards that will bolster confidence in financial technologies. All these measures are set to expand the possibilities for the use of Robo-advisors in making investment decisions and remove barriers associated with the low financial literacy of private investors[36].

In summary, a brief overview of legal approaches to regulating Robo-advisors reveals that they are treated similarly to humans in many jurisdictions. Some states, such as Australia, emphasize the similarities between Robo-advisors and human consultants and have elaborated guidelines explaining how regulatory bodies interpret the law and what Robo-advisors must do to apply for a license. Nevertheless, despite the fact that Robo-advisors perform similar functions to traditional financial market brokers, they significantly differ from traditional services in the field of investments. As a result, it is "naïve to simply assume that intermediaries will always choose the algorithms and choice architecture that are best for consumers, rather than those that are best for intermediaries"[37]. The development and implementation of AI in the industry will necessitate a reevaluation of the legal approach in this sphere.

III. INVESTMENTS AND HIGH FREQUENCY TRADING

A. HFT and investors risks

Algorithmic technologies offer numerous opportunities for sophisticated financial market traders, enabling them to work more quickly. Additionally, these technologies open new horizons for investors involved in High-

[36] Antonova, N.V.; Balkhaeva, S.B.; Gaunova, J.A. *et al. In:* Tikhomirov, Yu. A.; Nanba, S. B. (Eds.). *Legal concept of robotization*: monograph. Moscow: Prospect, 2019. 240 p. <Юридическая концепция роботизации: монография / Н.В. Антонова, С.Б. Бальхаева, Ж.А. Гаунова и др.; отв. ред. Ю.А. Тихомиров, С.Б. Нанба. М.: Проспект, 2019. 240 с.>

[37] Baker, Tom; Dellaert, Benedict G. C. Regulating Robo Advice Across the Financial Services Industry (2018). *Iowa Law Review*, v. 103, p. 713, 2018, *U of Penn, Inst for Law & Econ Research Paper No. 17-11*.

Frequency Trading (HFT). HFT involves programs that automatically execute trades based on market information. These trading strategies rely on speed and automation to gain an advantage over their competitors. They can process information and make investment decisions much faster than any human could ever hope to do so. In some cases, these algorithms allow trading firms to purchase or sell securities in a matter of microseconds[38].

However, along with significant opportunities, the use of HFT also presents substantial challenges. In 2010, the flash crash wiped out over $800 billion from the value of U.S. stocks in a matter of minutes due to a trader's manipulation. In 2015, the New York Stock Exchange blamed a 3 ½ hour closure on a computer malfunction[39]. The main cause of such incidents is systematic risk, which can "result from malfunctioning rogue algorithms that inundate a marketplace with orders until the marketplace's infrastructure can no longer cope with the volume of orders"[40]. Scholars have noted that trading algorithms rely on simplified assumptions about the nature of markets and individuals. When these assumptions prove incorrect or errors occur in the programs, the speed and automation of algorithmic decision-making can lead to potentially more harmful consequences[41]. Today, automation is becoming increasingly prevalent in financial markets and will continue to grow in importance in the sphere of investments. Consequently, HFT introduces new types of risks that are closely linked to an algorithm's model and can spread easily[42].

B. HFT and MiFID II

Regrettably, only a few countries have established a legislative framework capable of effectively controlling the rapidly developing automation. Existing legal instruments are still insufficient for the direct and efficient regulation of advanced algorithms[43], with supranational regulation being enforced primarily in the European Union (EU). The EU has taken the lead in establishing general rules for the regulation of High-Frequency

[38] Magnuson, William J., Financial Regulation in the Bitcoin Era (March 23, 2018). *Stanford Journal of Law, Business, and Finance*, v. 23, n. 2, 2018

[39] QuickTake. Trading on Speed by Annie Massa and Sam Mamudi. Available at https://www.bloomberg.com/quicktake/automated-stock-trading

[40] Gomber, Peter; Arndt, Björn; Lutat, Marco; Uhle, Tim Elko, *High-Frequency Trading*, 2011.

[41] Magnuson, William J., Financial Regulation in the Bitcoin Era (March 23, 2018). *Stanford Journal of Law, Business, and Finance*, v. 23, n. 2, 2018.

[42] Panisi, Federico. Blockchain and 'Smart Contracts': FinTech Innovations to Reduce the Costs of Trust (November 1, 2017).

[43] Fitsilis, Fotios. Imposing Regulation on Advanced Algorithms (September 1, 2019). Fitsilis, F. (2019) *Imposing Regulation on Advanced Algorithms*. Cham: Springer.

Trading (HFT) through the implementation of MiFID II. Thanks to MiFID II[44], the EU has demonstrated that innovative financial technologies can be regulated at a supranational level. MiFID II encompasses rules governing the trading of financial instruments using algorithmic trading methods. Its core principles aim to reduce systematic and cybersecurity risks associated with the use of algorithmic technologies, ensure sufficient liquidity in the financial market, and eliminate the risks of erroneous and illegal actions by clients and investment companies.

The flash crash of 2010 highlighted the importance of preventing potential negative consequences arising from the reluctance of high-frequency traders to maintain current liquidity in the market. To avoid market disruption, MiFID II establishes the rule that an investment company engaged in algorithmic trading pursuing a market-making strategy should, considering liquidity, the scale and nature of a specific market, and the characteristics of financial instruments, take the following actions, as outlined in Article 17(3) of MiFID II:

(a) Continuously engage in market making during a specified proportion of the trading venue's trading hours, except under exceptional circumstances, to provide liquidity regularly and predictably to the trading venue.

(b) Enter into a binding written agreement with the trading venue specifying, at a minimum, the obligations of the investment firm in accordance with point (a).

(c) Maintain effective systems and controls to ensure compliance with the obligations outlined in the agreement referred to in point (b) at all times.

MiFID II enables the EU to enhance transparency in the financial market, bolster consumer confidence, and strengthen investor protection. However, all these measures also increase the operating costs of HFT businesses and may lead to industry consolidation, reduced competition, and increased margins (and market share) for significant players[45].

In conclusion, the future of High-Frequency Trading (HFT) does not appear uncertain. Despite its shortcomings, HFT remains attractive to traders, especially in emerging markets where they trade over-the-counter derivatives and bonds[46]. Furthermore, there are no barriers to applying HFT in the blockchain industry or integrating it with artificial intelligence in the future. These developments will create new opportunities and threats for investors.

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[44] Fitsilis, Fotios. Imposing Regulation on Advanced Algorithms (September 1, 2019). Fitsilis, F. (2019) *Imposing Regulation on Advanced Algorithms*. Cham: Springer.

[45] Armour, John; Bengtzen, Martin; Enriques, Luca. Investor Choice in Global Securities Markets (July 1, 2017). *European Corporate Governance Institute (ECGI) - Law Working Paper No. 371/2017*, *Oxford Legal Studies Research Paper No. 60/2017*.

[46] Brown, Aaron. High-Frequency Trading Is Changing for the Better. *Bloomberg*, Feb. 10, 2020. Available at https://www.bloomberg.com/opinion/articles/2020-02-10/high-frequency-trading-is-changing-for-the-better

Although MiFID II does not include provisions related to artificial intelligence, technologies continue to advance. Therefore, legislators should be prepared to adapt existing rules to a new reality where HFT is operated by Robo-traders.

IV. SMART CONTRACTS AND RISKS OF THEIR IMPLEMENTATION IN THE SPHERE OF INVESTMENTS

A. Risks of automatization and "blockchainization"

Over the last decade, blockchain technologies have made significant inroads into the realm of alternative financing. Consequently, virtual currencies, digital tokens, and smart contracts have become integral parts of the investment sphere. Smart contracts have had a profound impact on transaction processes, altering the conventional contract execution model by transforming computer code into the driving force behind transactions. Smart contracts, based on blockchain technologies and distributed validation systems, are characterized by their inability to be modified or halted, thereby drastically reducing settlement risk[47]. These features make smart contracts appealing to investors who favor digital financial assets.

However, engaging in activities such as purchasing digital tokens in an initial coin offering or investing in cryptocurrencies entails high risks[48]. Despite the high level of trust associated with blockchain transactions, a notable event occurred in 2014 when Mt. Gox, a Bitcoin exchange, lost 744,000 bitcoins due to a hacker attack[49]. As Magnuson notes, while transactions in Bitcoin and Ethereum are sometimes initiated by individuals, they are increasingly facilitated by automated "bots" that support the network's smooth operation. Given the absence of a central administrator for the blockchain, this ecosystem may struggle to address unintended or even illegal uses of the technology[50]. Furthermore, the most significant new threats to financial stability originate from the unregulated sector[51]. The use of

[47] Panisi, Federico. *Blockchain and 'Smart Contracts':* FinTech Innovations to Reduce the Costs of Trust (November 1, 2017).

[48] Bacon, Jean; Michels, Johan David; Millard, Christopher; Singh, Jatinder. Blockchain Demystified (December 20, 2017). *Queen Mary School of Law Legal Studies Research Paper No. 268/2017.*

[49] Bitcoin exchange Mt Gox files for bankruptcy protection. *Financial Times*. Available at: https://www.ft.com/content/6636e0e8-a06e-11e3-a72c-00144feab7de#axzz2v8w0y2mI

[50] Magnuson, William J. Financial Regulation in the Bitcoin Era (March 23, 2018). *Stanford Journal of Law, Business, and Finance*, v. 23, n. 2, 2018

[51] Avgouleas, Emilios. Regulating Financial Innovation: A Multifaceted Challenge to Financial Stability, Consumer Protection, and Growth (June 24, 2014). Forthcoming, *Oxford Handbook of Financial Regulation* (Oxford University Press, 2015). Available at

blockchain in financial transactions is not adequately regulated by states or, in some cases, is even considered illegal. Consequently, investors have limited avenues to protect their rights. For instance, the People's Court of Hangzhou, China, rejected a claim by an investor, arguing that cryptocurrency is illegal in China and therefore illegal interests are not protected by the law[52].

The fundamental idea behind blockchain is automation, which enables the creation of smart contracts that execute automatically. While this guarantees contract execution and fosters trust between parties, it is not always beneficial for investors. It is essential to remember that smart contracts leave no room for investors to annul or alter a contract, even in cases involving unlawful activities, errors, or computer or software bugs.

Scholars noted that:

> "The computer code will not contain human concepts such as largesse or opportunism. It will not be guilty of holding onto funds that should be handed over, nor will it waive rights of recovery because it cannot be bothered to enforce them, or (more consciously) because it will be too expensive to enforce, or because it wants to conserve the relationship between the parties. The computer will simply do what it has been programmed to do at the outset—funds will be transferred from one party to another on the Distributed Ledger, and other remedies will be triggered".[53]

Consequently, any actions the program code allows, with all its errors and vulnerabilities, are considered legitimate. Notably, no program code can be entirely free from vulnerabilities, and the program code used in smart contracts is no exception. In June 2016, a hacker exploited a vulnerability in the code of the distributed autonomous organization (DAO) and stole over $60 million[54] in cryptocurrency. The development of quantum computers also underscores the importance of data and investment protection.

Smart contracts also face limitations related to the technological aspects

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SSRN: https://ssrn.com/abstract=2458335

[52] Lingya and Cao Xingxian's second-instance civil judgment for disputes over entrusted financial management contracts <李玲亚、曹杏贤委托理财合同纠纷二审民事判决书> Available at https://wenshu.court.gov.cn

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[54] Castillo, M. del The DAO Attacked: Code Issue Leads to $60 Million Ether Theft// *CoinDesk*. 2016. 17 June. Available at http://coindesk.com/dao-attacked-code-issue-leads-60-million-ether-theft/

of blockchain architecture. To establish cryptographic protection, a blockchain system requires a substantial amount of energy, time[55], and computational power. These factors increase the risks associated with industry-level investment projects based on smart contracts. Another issue arises from the intersection of smart contracts and artificial intelligence (AI). Since smart contracts operate within digital ecosystems, systems with AI may make decisions about their material conditions and/or fulfillment. However, AI systems can be "black boxes," even to their creators and users[56], and their decisions are not always optimal or predictable.

Hence, it is necessary to determine how investors can be protected when a smart contract affected by a hacker or mistake is executed and who should be held liable for errors in the program code or software that enable successful hacker attacks.

B. Smart contracts and legislation

Understanding the required legal framework to mitigate the adverse consequences of blockchain and smart contracts is crucial. While technical problems can be resolved through comprehensive testing, this approach is not always feasible when addressing legal issues. Despite smart contracts' ability to reflect the fundamental elements of contract formation, the question remains whether judicial systems are prepared to admit smart contracts in court. The answer to this question is complex and varies across jurisdictions[57].

In Russia, for example, smart contracts have been recognized as a form of contract formation since October 2019. According to Article 309 of the Civil Code of the Russian Federation, when specific circumstances occur, a transaction can be executed using information technologies specified in the transaction terms without the separate expression of will by its parties aimed at fulfilling the obligation.

This rule introduces a new method of ensuring the fulfilment of obligations, using information technology. Therefore, based on Part 2 of Article 309 of the Civil Code of the Russian Federation, a smart contract is a standard (special) contractual structure—an agreement concluded using electronic or other technical means—whose terms provide for the fulfillment

[55] About 10 minutes are required to add information about the newly created block to all nodes of the distributed ledger.

[56] Bathaee, Yavar. The artificial intelligence black box and the failure of intent and causation. *Harvard Journal of Law & Technology*, v. 31, n. 2, 2018.

[57] World Bank Group. 2020. Smart Contract Technology and Financial Inclusion. Fintech Note; No. 6. World Bank, Washington, DC. Available at https://openknowledge.worldbank.org/handle/10986/33723

of obligations arising from it under specific circumstances without the separate additional expression of the parties' will aimed at fulfilling the obligation through the use of information technology specified in the contract terms[58].

Russian experience has demonstrated that the legalization of smart contracts is possible. However, the challenge lies in regulating the entire smart contract ecosystem, including blockchain and cryptocurrencies. In Russia, questions related to these aspects remain unanswered. Therefore, a legal framework for smart contracts should not only include rules allowing their use but also address the legal status of crypto assets and blockchain platforms.

V. QUESTION TO ANSWER

In today's globalized society, digital technologies transcend physical boundaries, surmount limitations, and hold the potential to enhance efficiency in the financial sector[59] or, conversely, trigger a new crisis. The COVID-19 pandemic underscored the significance of IT technologies for humanity, emphasizing that the digital transformation of the economy is both inevitable and critical. Consequently, challenges related to the implementation of new technologies in the realm of investments will become increasingly significant in the near future, necessitating changes in investment law to align with contemporary needs.

The introduction of Robo-advisors, High-Frequency Trading (HFT), and smart contracts in the financial market raises crucial questions that lawmakers must address. Firstly, are these new technologies potentially harmful to the market, and if so, how should the activities of companies and investors employing these technologies be regulated? Secondly, how can investors be safeguarded against hacker attacks, program code errors, and software bugs? Lastly, what if artificial intelligence (AI) assumes a dominant role in executing transactions in the investment market?

CONCLUSIONS

This paper demonstrates that while the traditional regulatory framework may be applicable to new technologies, its effectiveness can be limited or even rendered ineffective without addressing technological risks. Today,

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[58] Grin, O.S.; Grin, E.S.; Solovyov, A.V. The Legal Design of the Smart Contract: The Legal Nature and Scope of Application. *Lex Russica*, v. 8, p. 51-62, 2019. (In Russ.) Available at: https://doi.org/10.17803/1729-5920.2019.153.8.051-062

[59] Magnuson, William J. Financial Regulation in the Bitcoin Era (March 23, 2018). *Stanford Journal of Law, Business, and Finance*, v. 23, n. 2, 2018.

technology-related risks are as vital as financial risks[60], as illustrated in this paper by their potential to disrupt the financial market rapidly. Therefore, investment law should establish technical standards for those utilizing digital technologies in the investment sphere. A pivotal approach could be regulatory compliance, combining self-regulation with state regulation aimed at assessing and testing the capacity of digital service providers to mitigate technical risks stemming from hacker attacks, software bugs, and unlawful investor activities. Transparent pre and post-trade reporting concerning transaction stability should also be implemented. Ultimately, developers and providers of digital services, including smart contracts, HFT, and Robo-advisors, should be held liable for losses resulting from vulnerable program code or inadequate software security.

While artificial intelligence may not replace traders entirely, its influence is already pervasive within the sector, facilitating tasks such as faster order execution and bot and scam detection. The rise of AI technologies underscores the need for their regulation through the adoption of internationally recognized engineering standards for their development and use, as well as rules delineating what AI can and cannot do. Regulators should unequivocally specify who is responsible for AI's actions and when liability is incurred.

Given the transnational nature of IT technologies and the interconnectedness of financial markets, cooperation and information exchange among national regulators are imperative, as is the standardization of requirements for digital service providers. Standardizing national regulatory approaches through the implementation of a supranational model legal framework empowers national regulators[61] to formulate rules that mitigate various risks associated with investor rights protection. Scholars have rightly noted that Europe's experience with its HFT regulatory framework has had "a very important determinative impact on the structure of data-driven finance not only in Europe but also in global financial markets, particularly as other jurisdictions consider how best to balance the objectives of data protection and financial regulation while supporting innovation,

[60] Buckley, Ross P.; Arner, Douglas W.; Zetzsche, Dirk Andreas; Selga, Eriks. The Dark Side of Digital Financial Transformation: The New Risks of FinTech and the Rise of TechRisk (November 18, 2019). *UNSW Law Research Paper No. 19-89, European Banking Institute Working Paper 2019/54*, *University of Luxembourg Law Working Paper 2019-009*, *University of Hong Kong Faculty of Law Research Paper No. 2019/112*, *Singapore Journal of Legal Studies* (Forthcoming).

[61] Busch, Danny. MiFID II: Regulating High Frequency Trading, Other Forms of Algorithmic Trading and Direct Electronic Market Access (November 9, 2017). D. Busch, MiFID II: regulating high frequency trading, other forms of algorithmic trading and direct electronic market access, *Law and Financial Markets Review 2016/2*.

efficiency, and financial stability, and many of them look for role models"[62]. A similar form of cooperation could be initiated to standardize smart contracts and Robo-advisors. Therefore, to craft a model legal framework, it is essential to convene an international summit of regulatory bodies.

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