NOTE FOR NATIONAL DEFENCE:
Artificial Intelligence: Economic System and Financial Market Security

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SUMMARY

- The arrival of the AI, autonomous systems, and algorithms has significantly influenced and altered the financial markets, particularly in developed countries. Current electronic markets heavily rely on algorithms that digest gigantic data volumes at very high speeds. AI has transformed how financial institutions generate and utilize insight from data, which in turn alters business models and reshapes financial environments and dynamics. An integral part of such circumstances is automation and rapid response to information that gradually eliminates slow humans from the decision-making loops and processes.

- The oncoming wave of AI technology has revolutionized the global financial services industry, among many other sectors. It is deployed by Fintech companies and Incumbents as a powerful tool to either develop new products and services or to foster innovations within existing product portfolios. Financial services are inclined towards the mass adoption of AI machines to generate new revenue potential, process automation, risk management, as well as enhancements to customer services and client acquisitions. These circumstances engender and bring about new risks and dynamics that pose novel challenges to firms and policy-makers.

- The use of AI, however, can have adverse impacts on financial markets as it has the potential to be utilized for market manipulation. In other words, autonomous financial agents are capable of committing financial fraud in various ways through interfering and meddling with regular and truthful market trends through artificial interventions.

- Moreover, as autonomous agents tend to have unanticipated and intricate behavior, the problem of accountability remains troublesome. While organizations that develop algorithmic trading seem to be responsible for the behavior of these agents, due to the unpredictable nature

of these autonomous applications in unusual circumstances the question of responsibility remains elusive and needs to be further addressed.

- Under the influence of AI, financial systems have changed dramatically. It allows banks and non-bank institutions to work more closely and to widen financial access using digital approaches. However, the issue of digital financial inclusion tends to be a concern as people at the bottom of the pyramid, such as women, the youth, minorities, and small businesses might be financially excluded and neglected.

- Despite the promise of profitable trading through the use of autonomous agents, its unwanted and unpredictable consequences remain an issue to be addressed. Autonomous trading agents could either accidently or intentionally be interfered with and as a result they might destabilise markets or harm innocent parties. The autonomy, adaptability, and the use of sophisticated machine learning techniques remain indefinite and might generate unforeseen and unexpected outcomes and consequences.

CONTEXT

- The rise of AI has had significant impacts on financial markets, as humans fail to compete with algorithmic trading which provides firms with substantial profits. Firms tend to invest in this novel technology to such large extents that it allows them to experience trading on a new level which offers profit at a speed and frequency that used to be impossible within the context of pre-AI financial markets.

- As with the emergence and growth of e-commerce market online fraud, such as credit fraud has also increased. In order to prevent fraud or illegal financing, US banks spend more than $70 billion each year on compliance, part of which is implementing AI to gain efficacy and accuracy. AI is employed to analyze millions of data points to detect malicious activity which would take an enormous amount of time for a human to go through. It also improves precision and reduces false rejections. The AI applications are also able to flag transactions and categorize them into various risk groups so that banks can keep control and dig deeper into some transactions.

- Currently, several financial companies such as Mastercard use the AI application called "Decision Intelligence" which uses existing data to analyze patterns from previous use of their cards to establish "standard Transaction". Mastercard then compares and scores every transaction from new customers up against their standard transaction in order to recognize possible anomalies.

- Approached with sufficient prudence and diligence AI could allow more informed and tailored products and services in the financial market. Fintech institutions are ever more inclined to the adoption of Big Data analytics, Artificial Intelligence, and Blockchain technologies. These technologies revolutionize the financial industry through offering more inclusive access to financial services. However, there are inherent challenges as well, such as the underestimation of

creditworthiness, market volatility, cyber-attacks, fraud and money laundering that require regulators and supervisory bodies to tackle them.

- Although the widespread use of AI such as in smart phones gives the formerly excluded individuals to become financially active and more included in the digital financial system at an affordable cost, there are also potential risks that need to be addressed. For instance, the existence of new contractual relationships between financial institutions and third parties involving the use of agent networks seems to be risky. Also, there is the risk of unknown and unpredictable costs to inexperienced and vulnerable customers, as well as security and privacy issues.

- Through simulation of markets comprising artificial trading agents, experts have demonstrated that AI has the capacity to develop the technique of order-book spoofing through reinforcement learning. This technique enables agents to place orders without any intention of executing them, to artificially affect market pricing and to manipulate sincere participants in the market place.

- Moreover, social bots are able to exploit and manipulate financial markets by artificially inflating stock through fraudulent promotion, which is then sold to unaware parties at an inflated price. An example would be a recent notorious case in which a social bot network's sphere of influence was used to spread misinformation about a barely traded public company. The company's value gained more than 36,000% when its penny stocks surged from less than $0.10 to above $20 a share within few weeks.

- Furthermore, AI can elevate the risk of price fixing which is a type of collusion that may be generated by autonomous trading agents. These algorithmic agents are capable of learning about pricing data on-the-spot which allows them to reduce a price by one agent which could be matched by another immediately. Although this skill seems beneficial and can enhance the efficacy of the market, it may also result in artificially and tactically agreed higher prices which is a form of conspiracy.

- Fintech or financial technologies being supplemented by AI technologies such as deep learning, machine learning, cognitive computing, natural language processing, etc. have brought the promise of a dramatic transformation in the financial services industry. However, many of the customers who are worth billions and are integral to the industry are not inclined to become digital. Moreover, millions of people who belong to the poor and disadvantaged populations remain excluded and undeserved.

- The use of AI has proved beneficial for the purpose of overcoming the issue of traditional financial inclusion in which those at the lower levels of the pyramid such as women or smaller businesses remain excluded and undeserved. AI, however, solves the problem of information asymmetry through offering information to customers who belong to marginal and rural and more vulnerable populations with limited access to such information. Also, it makes communication and transaction easier and more affordable and changes the ways in which individuals relate to technology.

- Despite its potential risks, AI plays a crucial role in the improvement of the security of online finance. Not only it offers populations at the bottom of the pyramid the opportunity to be included in the formal financial sector, it also improves consumer protection and user experience, while managing risks and detecting fraud. AI-enabled cybersecurity systems detect and prevent possible security breaches. Moreover, robot advisors are becoming able to provide automated financial planning services such as tax planning, insurance and investment advice.

- Cybercrime has constantly been a major threat to the development of financial services and the banking system. According to surveys, the cost of such cyber and infrastructure attacks in the global economy was $450 billion and $360 billion in global banking and financial industry in 2016. Information technology opens up global doors to cybercrimes such as fraud and theft. To solve these problems, experts attempt to use AI for identifying the behavioral pattern of all user accounts and devices.

- In order to monitor financial institutions more efficiently, financial regulators are exploring the use of AI. For instance, the UK Financial Conduct Authority (FCA) is attempting to make its handbook machine readable and fully machine-executable. In other words, they aim to design machines in ways that they interpret and implement the rules directly. Moreover, The Division of Economic and Risk Analysis (DERA) at the SEC is exploring ML to extract actionable insights from massive datasets, helping examiners find cases of potential fraud and misconduct.

- Furthermore, to tackle issues such as vulnerability patterns, scanning lengthy reports or analysing incoming data, international regulators are aiming to use AI-supported analytical methods. For instance, in 2017, the Bank of England (BoE) joined forces with MindBridge to use an AI auditor to help detect anomalies in transactions and reports. The BoE utilizes ML to achieve these goals.

CONSIDERATIONS

- Since autonomous trading agents are capable of manipulation and might intervene with the honest market in adverse ways, it is essential to provide regulations that prevent societal harm. However, such regulations and legislations may be impeded due to the fact that autonomous algorithms do not meet legal definition of market manipulation as they lack 'intent'. In this context, the problem of accountability remains elusive since the companies who develop such AI technology are unable to address its unanticipated behavior.

- Although AI could offer financial systems and services with plenty of benefits, there remain challenges that cast a shadow over these advantageous opportunities. Since the performance of AI within the financial context relies heavily on the data it is provided with, the accumulation of the right quantity and quality of data often seems to be an obstacle as its availability is limited. The data fed to the algorithm indicates its future impact and efficacy. Yet, in the financial sector such data lacks quality and might even have hidden biases.

↓ Moreover, the question of liability and accountability regarding the use of AI in finance remains unaddressed. The behavior of AI machines is not fully predictable and for this reason financial institutions are not inclined to give these applications and digital systems full autonomy. They require the presence of a human supervisor to monitor and validate integral decisions such as blocking or releasing payments. Consequently, the adoption of AI in financial services becomes limited under standards and regulations provided by firms.

↓ Although AI has inherent risks and challenges, it seems to be beneficial as with solving the problem of financial inclusion and availability for vulnerable groups in the mainstream financial market. Therefore, it is recommended that financial and non-financial institutions adopt AI to assist certain excluded individuals who are not able to formally participate in the financial market.

↓ Financial organizations which employ AI must practice prudence and be aware of the potential risks regarding the appropriateness of using big data in customer profiling and credit scoring. Using AI might cause bias in input data, process and outcome when profiling customers and scoring credit. This might affect the disadvantaged groups negatively. Institutions who rely on data analytics must have a thorough understanding of the data that has been used to train, test, retrain, upgrade and use their AI systems.

↓ As it is crucial for the financial services to protect financial data of their customers, AI can be employed in financial systems for the purposes of fraud detection and risk management. In other words, financial systems use AI to screen and prevent various occasions of misrepresentation and trade misconduct, illegal tax avoidance, negligence and the identification of potential hazards such as loan fraud, ATM hacks, and money laundering. Using AI financial institutions attempt to detect and recognize the regular behavioral patterns of users and in case of an anomaly these machines have the skill to detect irregular transactions.

↓ Since hackers are mastering the skill of breaching passwords and encrypted data it is becoming more crucial to implement stronger cyber security networks which can assist financial services to protect their customers against cyber threats.

↓ In 2018, Amazon security network was breached by hackers and both email addresses, personal and credit card information from thousands of customers were compromised. Therefore, it is necessary to deploy AI in this context for developing various kinds of biometric logins such as fingerprint scanners, retina and palm prints, and facial recognition for more secure access.

↓ In order to control financial crimes, ML can be employed to identify fraudulent patterns of data which reduces the risk of false positives in payments and transactions. Moreover, in case the credentials of users will be compromised in the course of cyber-attacks, firms can use AI behavioral biometrics techniques to authenticate customers and protect users. For instance, banks and other enterprise use BioCatch to protect users. Biocatch delivers behavioral biometrics analysing human-device interactions to reduce online fraud.

- Policy-makers seem to be failing to catch up with the rapid advancements in AI and ML. the credibility of policy evaluation needs to be improved. In the context of Fintech, the field known as Reg Tech aims to make compliance and regulatory activities easier, faster and more efficient.

- For this purpose, Reg Tech utilises Big Data and ML to reduce costs and elevate efficacy. ML can improve regulation of human behavior through fast, accurate and consistent judgements. Also, non-discrimination and equality must be implemented in machine learning systems used in banking, financial industry, and insurance.

- "An example of Reg Tech can be found at the Hong Kong Stock Exchange which is employing AI software used by NASDAQ to detect stock manipulation and market abuses. The software analyses historical trading activity to identify patterns and anomalies, including dramatic swings in stock prices and rises in trading volume".

REFERENCES

- EPRS, European Parliamentary Research Service, Scientific Foresight Unit (STOA), (2020), "The ethics of artificial intelligence: Issues and initiatives".

- https://analyticsindiamag.com/artificial-intelligence-and-its-impact-on-financial-services-landscape/

- Mhlanga David, (2020), "Industry 4.0 in Finance: The Impact of Artificial Intelligence (AI) on Digital Financial Inclusion", International Journal of Financial Studies, MDPI

- Soni Dineshkumar Vishal, (2019) "Role of Artificial Intelligence in Combating Cyber Threats in Banking", International Engineering Journal for Research & Development, Vol. 4 Issue 1

- Kunwar Manju, (2019) "Artificial Intelligence in Finance: Understanding How Automation and Machine Learning is Transforming the Financial Industry", Thesis, Central University of Applied Sciences, Centria

- Mardanghom Reza and Sandal Henrik, (2019) "Artificial Intelligence in Financial Services: An Analysis of the AI Technology and the Potential applications, Implications, and Risks it may Propagate in Financial Services" Thesis, Norwegian school of Economics

- UK Finance, (2019), "Artificial Intelligence in Financial Services", Microsoft

- Buchanan Bonnie G. (2019), "Artificial Intelligence in Finance" The Alan Turning Institute, EPSRC grant