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ALGORITHMIC TRADING AND MARKET MANIPULATION: A LEGAL PERSPECTIVE ON INSIDER TRADING REGULATIONS

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I. ABSTRACT

Algorithmic trading has revolutionized financial markets by increasing efficiency, reducing transaction costs, and enhancing liquidity. However, its rapid expansion has introduced significant concerns regarding market manipulation, insider trading, and regulatory oversight. The rise of High-Frequency Trading (HFT), which enables thousands of transactions per second, has made it increasingly difficult for regulators to detect and prevent fraudulent trading practices.

In jurisdictions like India, the SEBI (Prohibition of Insider Trading) Regulations, 2015 govern securities transactions and aim to prevent the misuse of Unpublished Price-Sensitive Information (UPSI) by insiders. However, these regulations were primarily designed for traditional trading environments and may not adequately address the complexities of AI-driven trading strategies. Algorithmic trading raises unique legal challenges, such as lack of transparency, difficulty in establishing intent, and regulatory enforcement gaps. This paper critically examines whether India's existing legal framework is sufficient to regulate algorithmic trading and prevent insider trading in automated transactions.

The study further explores global regulatory approaches in jurisdictions such as the United States (SEC), United Kingdom (FCA), and the European Union (MiFID II Regulations), which have implemented sophisticated AI-based market surveillance mechanisms and real-time monitoring to curb manipulation. Comparative analysis highlights regulatory best practices that could be adapted to India's financial markets. In light of these challenges, this paper proposes legal and policy reforms, including mandatory algorithmic audits, enhanced AI-driven surveillance mechanisms, cross-

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border regulatory cooperation, and clearer definitions of algorithmic insider trading. Strengthening SEBI's oversight capacity with RegTech solutions can enhance transparency, prevent market manipulation, and ensure fair trading practices. As algorithmic trading continues to evolve, regulatory frameworks must be dynamic and adaptive to safeguard market integrity while fostering innovation in India's financial ecosystem.

II. KEYWORDS

Algorithmic Trading, Insider Trading, SEBI Regulations, Market Manipulation, High-Frequency Trading, AI in Securities Law

III. INTRODUCTION

Algorithmic trading, also known as automated trading or algo trading, has revolutionized financial markets by leveraging sophisticated mathematical models and artificial intelligence (AI) to execute trades at speeds far beyond human capability. By eliminating emotional biases and enhancing market liquidity, algorithmic trading has become the dominant force in stock exchanges worldwide. However, alongside these advantages, it has introduced significant risks, particularly in the realm of insider trading and market manipulation.

Insider trading traditionally involves individuals with access to unpublished price-sensitive information (UPSI)[2] using that knowledge for unfair market gains. In the context of algorithmic trading, AI-driven systems can predict market movements with extreme accuracy, sometimes replicating the effects of insider trading without direct human intervention. This raises complex legal questions:

- Can an algorithm be considered an 'insider' under the law?
- How do we differentiate between legal market prediction and unlawful exploitation of confidential information?
- Do SEBI's current regulations effectively address AI-driven market manipulation?

[2] SEBI (Prohibition of Insider Trading) Regulations, 2015, Reg. 2(1)(n)

The SEBI (Prohibition of Insider Trading) Regulations, 2015[3] were designed to curb unfair trading practices based on UPSI. However, these regulations were drafted primarily with human actors in mind, leaving potential gaps in detecting and prosecuting algorithmic-based market abuses. Unlike traditional insider trading cases, where intent and personal knowledge are crucial factors, algorithmic trading operates on complex, opaque decision-making processes that may or may not involve human intervention.

This paper examines the legal challenges of regulating algorithmic trading under SEBI's current framework, compares India's approach with global best practices, and explores necessary legal reforms. In an era where AI is reshaping financial markets, strengthening regulatory oversight is critical to ensuring fairness, transparency, and investor protection.

IV. UNDERSTANDING ALGORITHMIC TRADING AND ITS RISKS

Algorithmic trading, also known as automated or AI-driven trading, has transformed financial markets by leveraging complex mathematical models to analyze vast datasets, identify profitable opportunities, and execute trades at lightning speeds. These models operate based on pre-defined criteria, including price movements, volume fluctuations, and even news sentiment analysis. The adoption of algorithmic trading has led to increased liquidity, reduced transaction costs, and enhanced market efficiency.

A. Types of Algorithmic Trading Strategies

Algorithmic trading relies on sophisticated mathematical models and high-speed data processing to execute trades with minimal human intervention. These strategies can be broadly classified into three main types, each designed to capitalize on different market inefficiencies and trading opportunities.

High-Frequency Trading (HFT)

[3] SEBI (Prohibition of Insider Trading) Regulations, 2015, SEBI | Securities and Exchange Board of India (Prohibition of Insider Trading) Regulations, 2015 [Last amended on August 05, 2021]

High-Frequency Trading[4] is a subset of algorithmic trading that involves executing a large number of trades in fractions of a second. These algorithms operate at incredibly high speeds, often leveraging advanced computing infrastructure and co-location services to minimize latency.

HFT strategies focus on exploiting minute price discrepancies that exist for only milliseconds. To achieve this, HFT firms deploy sophisticated algorithms that scan multiple exchanges simultaneously, identifying arbitrage opportunities and price inefficiencies before human traders can react. By leveraging microsecond advantages, HFT firms can generate substantial profits on razor-thin margins.

While HFT enhances market liquidity by increasing trading volumes, it also introduces significant risks, particularly in terms of market volatility. The rapid execution of thousands of trades can sometimes lead to market disruptions and unintended consequences, such as the infamous 2010 U.S. Flash Crash,[5] where the Dow Jones Industrial Average plummeted nearly 1,000 points within minutes before rebounding.

Market Making Algorithms

Market making algorithms play a crucial role in maintaining liquidity in financial markets by continuously placing buy and sell orders at various price levels. These algorithms act as intermediaries between buyers and sellers, ensuring that securities are always available for trade. By profiting from the bid-ask spread—the difference between the buying and selling price—market makers generate revenue while simultaneously stabilizing markets.

A key advantage of market-making algorithms is their ability to narrow spreads and enhance price efficiency, benefiting all market participants.However, they are not without risks. Some traders use market-making algorithms to create artificial trading volume, a practice known as "spoofing," where fake buy or sell orders are placed to

[4] *High-Frequency Trading,* INVESTOPEDIA (April 4, 2025, 3:03 PM), What Is High-Frequency Trading?
[5] *2010 Flash Crash,* CORPORATE FINANCE INSTITUTE (April 4, 2025, 3:10 PM), 2010 Flash Crash - Overview, Main Events, Investigation

mislead other investors about market trends. Such manipulative strategies can distort market prices and erode investor confidence, making regulatory oversight essential.

Arbitrage Algorithms

Arbitrage algorithms exploit price discrepancies across different exchanges or markets to generate risk-free profits.[6] These strategies are particularly effective in highly liquid markets, where even minor price differences can be capitalized upon instantaneously.

For example, if a stock is trading at ₹1,000 on the National Stock Exchange (NSE) and ₹995 on the Bombay Stock Exchange (BSE), an arbitrage algorithm will simultaneously buy the stock at the lower price on BSE and sell it at the higher price on NSE, pocketing the difference as profit. Since such price discrepancies are often short-lived, arbitrage algorithms must operate at ultra-high speeds to remain profitable.

While traditional arbitrage is widely regarded as a legitimate trading strategy, AI-powered arbitrage can sometimes raise ethical concerns. Advanced machine learning models may identify patterns that exploit market inefficiencies in ways that blur the line between fair trading and market manipulation. Regulators worldwide are increasingly scrutinizing AI-driven arbitrage strategies to ensure they do not undermine market integrity.

B. Risks of Algorithmic Trading

Despite its numerous advantages, algorithmic trading also introduces significant risks that can impact market stability, fairness, and transparency. Some of the most pressing concerns include flash crashes, market manipulation, and regulatory challenges.

Flash Crashes

One of the most serious risks associated with algorithmic trading is the potential for sudden and extreme market crashes, known as flash crashes. These events occur when trading algorithms react to market conditions in an automated and highly aggressive manner, leading to large-scale sell-offs and drastic price fluctuations.[7]

[6] *Arbitrage Trading in Algorithmic Trading,* ENRICH MONEY (April 4, 2025, 3:19 PM), Arbitrage Trading in Algorithmic Trading

[7] Will Kenton, *Flash Crash: Definition, Causes, History,* INVESTOPEDIA (April 4, 2025, 3:35 PM), Flash Crash: Definition, Causes, History

A notable example is the 2010 U.S. Flash Crash, where the Dow Jones Industrial Average plunged nearly 1,000 points in a matter of minutes, wiping out billions of dollars in market value before quickly recovering. Investigations revealed that algorithmic trading strategies, particularly those involving rapid-fire order placement and cancellation (also known as "quote stuffing"), played a key role in exacerbating the crash.[8]

Flash crashes undermine investor confidence and expose vulnerabilities in market infrastructure, prompting regulators to implement safeguards such as circuit breakers, which temporarily halt trading during extreme price movements. However, as algorithms become more complex, ensuring market stability remains a challenge.

Market Manipulation

AI-driven trading strategies have also been linked to various forms of market manipulation, where algorithms are designed to create artificial price movements that mislead investors. One common tactic is "momentum ignition," in which an algorithm initiates rapid buying or selling activity to generate the illusion of strong market momentum. This can entice retail investors to follow the trend, allowing the algorithm to profit by reversing its position at a favourable price.

Hedge funds and proprietary trading firms sometimes deploy sophisticated AI models to manipulate prices by executing a series of deceptive trades. Such practices not only distort fair price discovery but also expose smaller investors to significant financial losses. While regulators, including the Securities and Exchange Board of India (SEBI), have introduced measures to detect and penalize such activities, enforcement remains a constant challenge.

Lack of Transparency

Another major concern with algorithmic trading is the opacity surrounding AI-driven decision-making processes. Unlike traditional human traders, algorithms operate autonomously, making it difficult for regulators and market participants to trace

[8] Ali N. Akansu, *The Flash Crash: A Review*, 1 JCMS 89 (2017), The flash crash: a review | Emerald Insight

manipulative or unethical trading patterns. Many proprietary trading firms use "black-box" AI models, where even the developers themselves cannot fully explain how the algorithms arrive at certain trading decisions.

This lack of transparency raises concerns about accountability, particularly when algorithmic strategies lead to unintended market disruptions or unethical practices. Regulators worldwide are exploring ways to enhance oversight, including requiring firms to disclose algorithmic trading strategies, implement pre-trade risk controls, and conduct periodic audits of their AI models.

As SEBI and other global financial regulators grapple with the rapid evolution of algorithmic trading, the need for legal reform and enhanced regulatory oversight has never been more critical. Striking a balance between fostering innovation and ensuring fair, transparent markets will be a key challenge in the years ahead.

V. INSIDER TRADING IN THE ALGORITHMIC ERA

Algorithmic trading has redefined insider trading enforcement, challenging traditional laws that rely on human intent. AI-driven systems operate autonomously, raising accountability concerns and regulatory gaps. This section examines these challenges, including liability issues and cross-border enforcement, highlighting the need for urgent legal reforms.

A. Insider Trading Laws in India

Insider trading is a long-standing concern in financial markets, involving the misuse of UPSI for unfair trading advantages. In India, insider trading is governed by the SEBI (Prohibition of Insider Trading) Regulations, 2015 (PIT Regulations),[9] which define it as:

- Trading in securities by individuals who have access to UPSI in a manner that benefits them unfairly.
- Unlawful communication of UPSI by corporate insiders, such as executives, auditors, or consultants.

[9] *Supra* note 2

SEBI enforces these rules by analyzing trading patterns, identifying large trades executed before significant market announcements, and tracking information leaks. However, the rise of algorithmic trading presents significant regulatory challenges, making it difficult to detect intent and ensure accountability.

B. Challenges Posed by AI-Driven Trading

Traditional insider trading laws are based on the assumption that trades are executed by humans who knowingly act on material, non-public information (MNPI). However, with the rise of AI-driven trading systems, assigning liability becomes significantly more complex. Unlike human traders, AI systems operate autonomously, analyzing vast amounts of data to execute trades in milliseconds. This raises critical legal and ethical questions about whether an AI can be considered an "insider" and who should be held accountable when an AI-driven system engages in transactions based on market-moving information.

Automated Execution of Insider Information

AI trading systems, especially those trained on corporate data such as earnings reports, mergers, and acquisitions, have the capability to detect subtle patterns and execute trades before such information becomes publicly available. Even if an AI model is not explicitly programmed to use UPSI, it may independently develop strategies that resemble insider trading. This leads to a fundamental legal dilemma: Can an AI system itself be classified as an "insider" under existing securities laws?

The challenge is further compounded by the fact that AI models are designed to optimize trading outcomes without human intervention. If an AI system unintentionally engages in trades that regulators would typically consider insider trading, should its developers, financial institutions, or users be held responsible? The absence of direct human intent complicates enforcement efforts and creates a grey area in regulatory frameworks.

Pre-Programmed Decision-Making and Liability Gaps

One of the core principles of insider trading laws is the requirement of intent—individuals must knowingly use UPSI to gain an unfair advantage. However, AI-

driven trading operates on pre-set algorithms and machine learning models that continuously evolve based on data patterns. If an AI system processes sensitive market information and autonomously executes trades, the question arises: Who should be held accountable?

Financial firms and developers may argue that AI-driven trading decisions are an unintended byproduct of sophisticated market predictions rather than deliberate misuse of inside information. This creates significant accountability gaps, as regulatory bodies struggle to determine whether responsibility should fall on the financial institution, the algorithm's developer, or the end-user. The lack of clarity in current regulations allows firms to evade liability by attributing trading decisions to AI's autonomous nature, making enforcement particularly challenging.

Cross-Border Transactions and Regulatory Challenges

Another major challenge in regulating AI-driven insider trading is the issue of cross-border transactions. Algorithmic trading firms often operate in multiple jurisdictions, complicating enforcement efforts. For instance, an AI model based in Singapore could execute trades on Indian stock exchanges, exploiting information obtained from different regulatory environments. This makes it difficult for agencies like SEBI to track, investigate, and regulate offshore transactions effectively.

Given the global nature of financial markets, regulatory bodies must collaborate to develop standardized approaches for monitoring AI-driven trading. Without robust international cooperation, AI-powered trading firms can exploit regulatory loopholes across jurisdictions, undermining market integrity.

As AI continues to reshape financial markets, traditional insider trading laws must evolve to address these emerging complexities. Stricter disclosure norms, mandatory algorithmic audits, and enhanced AI accountability measures are essential to ensure fair and transparent trading practices. Regulators must proactively adapt to technological advancements, closing legal loopholes that allow AI systems to operate in ways that challenge existing frameworks of financial law.

VI. MARKET MANIPULATION TECHNIQUES ENABLED BY ALGORITHMIC TRADING

Algorithmic trading has revolutionized financial markets, increasing liquidity and efficiency. However, it has also enabled sophisticated market manipulation techniques that exploit high-speed execution and automated decision-making. These strategies distort price discovery, mislead investors, and create artificial market conditions, posing significant challenges for regulators.

A. Quote Sharing

Quote stuffing is a manipulative practice where traders flood the market with a large number of buy or sell orders, only to cancel them almost immediately. The sheer volume of these orders creates the illusion of heightened demand or supply, misleading other traders into making reactive investment decisions. By the time the market adjusts, the manipulator has already executed trades at artificially influenced prices.

One of the most infamous examples of quote stuffing was the 2010 U.S. Flash Crash, where rapid, HFT exacerbated market instability, causing the Dow Jones to plummet nearly 1,000 points in minutes.[10] Regulators, including SEBI, have introduced surveillance mechanisms to detect abnormal order placements. However, enforcing penalties remains a challenge due to the millisecond-level speed at which these orders are executed and cancelled.[11]

B. Spoofing and Layering

Spoofing and layering are deceptive strategies that manipulate market sentiment by creating false trading signals.

- Spoofing involves placing large orders with no intention of executing them, artificially influencing supply and demand. Once other traders react by

[10] *Findings Regarding the Market Events of May 6, 2010,* U.S. SECURITIES AND EXCHANGE COMMISSION (Sept. 29, 2010), SEC.gov | Findings Regarding the Market Events of May 6, 2010
[11] Measures for Strengthening Algorithmic Trading Framework, SECURITIES AND EXCHANGE BOARD OF INDIA (April 4, 2025, 4:23 PM), 1524113320566_1.pdf

adjusting their positions, the manipulator cancels the fake orders and executes trades in the opposite direction.[12]

- Layering is a more complex variation, where multiple fake orders are placed at different price levels, creating a misleading market depth to deceive traders into perceiving non-existent trends.[13]

AI-powered trading bots can execute thousands of these manipulative orders per second, making detection extremely difficult. A notable example occurred in 2015 when UK-based trader Navinder Sarao was arrested for using spoofing techniques to manipulate the S&P 500. His algorithm-driven trades contributed to significant market distortions, underscoring the risks posed by AI in financial markets.[14]

C. Momentum Ignition

Momentum ignition is another deceptive technique used to manipulate stock prices and trigger herd behaviour among investors. This strategy involves executing trades in a way that creates an illusion of strong momentum—either upward or downward—encouraging retail traders to follow the perceived trend. Once the stock price reaches a targeted level, the manipulator offloads their position at a profit, leaving uninformed investors with losses.[15]

Hedge funds and institutional traders have been known to use momentum ignition to manipulate penny stocks and low-liquidity securities. Since AI-powered systems can execute and analyze trades at an unparalleled scale, detecting and preventing such strategies requires robust regulatory intervention.

D. Regulatory Challenges & the Need for AI Oversight

The rapid pace of algorithmic trading makes real-time detection and enforcement of market manipulation practices highly challenging for regulators. Traditional regulatory frameworks were designed for human-driven trading, where intent and

[12] Merritt B. Fox et. al., *Spoofing and Its Regulation,* HARVARD LAW SCHOOL FORUM ON CORPORATE GOVERNANCE (April 4, 2025, 4:50 PM), Spoofing and its Regulation
[13] *Layering: The Deceptive Layers of Market Manipulation,* FASTERCAPITAL (April 4, 2025, 4:56 PM), Layering: The Deceptive Layers of Market Manipulation - FasterCapital
[14] United States v. Sarao, Criminal Complaint No. 15-MJ-03076 (N.D. Ill. 2015).
[15] *Momentum Ignition,* TRADING TECHNOLOGIES (April 4, 2025, 5:01 PM), Momentum Ignition | Market Abuse Models Help and Tutorials

accountability are more easily established. However, with AI-driven strategies, firms can exploit legal loopholes and attribute manipulative trades to automated decision-making.

In India, SEBI has implemented monitoring mechanisms to detect market abuses, but current regulations lack AI-specific provisions. Moving forward, regulators must:

- Enforce real-time AI monitoring to track suspicious trading patterns.
- Introduce strict penalties for algorithmic manipulation, ensuring accountability for firms deploying deceptive strategies.
- Mandate algorithmic audits, requiring trading firms to disclose their AI models and trading logic.

As algorithmic trading continues to dominate financial markets, striking a balance between efficiency and ethical trading practices is essential to protect investors and maintain market integrity.

VII. LEGAL FRAMEWORK FOR INSIDER TRADING IN INDIA

The regulation of insider trading in India is primarily governed by the Securities and Exchange Board of India (Prohibition of Insider Trading) Regulations, 2015. These regulations were introduced to prevent the misuse of UPSI by individuals or entities who have access to confidential market data.[16] With the increasing integration of AI in trading, however, these regulations face new challenges in enforcement and applicability.

A. Key Provisions of the SEBI (PIT) Regulations, 2015

Under the SEBI (PIT) Regulations, insider trading is broadly defined as dealing in securities while in possession of UPSI. The key provisions include:

Definition of Insider

An insider is any person who:

- is connected to the company and has access to UPSI, or

[16] *Supra* note 2

- possesses UPSI due to their association with the company.
- This includes directors, employees, auditors, external advisors, and even temporary consultants who gain access to confidential information.

Unpublished Price-Sensitive Information (UPSI)

UPSI refers to any non-public information that can materially affect a company's stock price. This includes details about mergers, acquisitions, financial results, regulatory approvals, or changes in key management.

Trading Restrictions

Insiders are prohibited from dealing in securities when in possession of UPSI. Violations of this rule can lead to both civil and criminal penalties, including hefty fines and imprisonment.

Disclosure Obligations

Companies must maintain a structured database of individuals having access to UPSI and ensure the fair disclosure of material information. This is intended to prevent selective leaks that could give certain investors an unfair advantage.

While these provisions have been effective in curbing traditional insider trading, AI-driven trading strategies present new regulatory challenges.

B. Regulatory Gaps in the Context of Algorithmic Trading

Despite its effectiveness in traditional markets, the SEBI (PIT) Regulations struggle to address the complexities introduced by AI-based algorithmic trading. Some key gaps include:

- **Lack of Algorithmic Transparency:** AI-driven trading models process vast amounts of data and execute trades in milliseconds, making it difficult to determine whether a trade is based on public information or UPSI. Unlike human traders, AI does not consciously "decide" to act on insider knowledge—it merely identifies patterns and acts accordingly.[17]

[17] *The use of artificial intelligence and machine learning by market intermediaries and asset managers, Final Report,* INTERNATIONAL ORGANIZATION OF SECURITIES COMMISSIONS (Sept. 2021), FR06/2021 The use of artificial intelligence and machine learning by market intermediaries and asset managers

- **Absence of AI-Specific Regulations:** The current insider trading framework does not explicitly regulate AI-driven traders who use predictive models to analyze market-sensitive information. This regulatory blind spot enables firms to exploit AI for trading strategies that may closely resemble insider trading, without violating the existing legal definitions.
- **Challenges in Proving Intent:** One of the core principles of insider trading law is the requirement of intent. However, AI-driven trading lacks human intent—it simply operates based on pre-programmed algorithms. This raises the question: If an AI model autonomously executes trades based on UPSI, who should be held liable? The financial institution, the developer, or the user? The absence of clear legal accountability makes enforcement difficult.
- **The Need for Evolving Regulations:** As AI continues to reshape trading, India must update its regulatory framework to address the evolving risks of algorithmic trading.

C. Enhanced Disclosure Requirements

Firms using AI for trading should be required to disclose their algorithmic strategies and risk management measures to regulators.

- **AI-Specific Insider Trading Rules:** SEBI must introduce AI-specific guidelines that clarify how AI-driven trades using UPSI should be regulated.
- **Algorithmic Audits & Oversight:** Regular audits of algorithmic trading models should be mandated to ensure compliance with insider trading laws.
- **International Regulatory Collaboration:** Given the cross-border nature of algorithmic trading, SEBI must work with global regulators to develop harmonized policies that prevent offshore firms from exploiting jurisdictional loopholes.

In the face of rapid technological advancements, regulatory adaptation is crucial to maintaining fair and transparent markets. Strengthening legal oversight of AI-driven trading will not only protect investors but also enhance market stability in the long run.

VIII. COMPARATIVE ANALYSIS: GLOBAL REGULATORY APPROACHES

As algorithmic trading continues to reshape global financial markets, different jurisdictions have adopted distinct regulatory frameworks to mitigate risks and ensure market integrity. A comparative analysis of regulatory approaches in the United States, European Union, and United Kingdom provides valuable insights that India can leverage to strengthen its own oversight mechanisms.

A. United States – SEC Regulations

The U.S. Securities and Exchange Commission (SEC)[18] has implemented stringent measures to regulate algorithmic trading and prevent market manipulation. The Market Access Rule (Rule 15c3-5)[19] requires firms engaging in algorithmic trading to implement pre-trade risk controls. Additionally, SEC Rule 10b-5 prohibits fraudulent and deceptive trading practices, including AI-driven manipulation.[20] The Commodity Futures Trading Commission (CFTC)[21] has also prosecuted cases involving spoofing and layering, as seen in the 2010 Flash Crash, where high-frequency trading contributed to extreme volatility. The SEC employs real-time trade surveillance systems to monitor and detect suspicious algorithmic activities.

B. European Union – MiFID II Regulations

The Markets in Financial Instruments Directive II (MiFID II),[22] introduced in 2018, established a robust framework for regulating algorithmic trading across the EU. It mandates algorithm registration, requiring firms to disclose details about their trading algorithms to regulators. Algorithmic trading risk controls ensure that firms implement pre-programmed circuit breakers to prevent market crashes. Additionally,

[18] SECURITIES AND EXCHANGE COMMISSION (SEC) SEC.gov | Home (last visited April 4, 2025)
[19] *Rule 15c3-5 — Risk Management Controls for Brokers or Dealers with Market Access,* U.S. SECURITIES AND EXCHANGE COMMISSION (April 4, 2025, 5:44 PM), Small Entity Compliance Guide: Rule 15c3-5 - Risk Management Controls for Brokers or Dealers with Market Access
[20] *Insider Trading Arrangements and Related Disclosures,* U.S. SECURITIES AND EXCHANGE COMMISSION (April 4, 2025, 5:44 PM), SEC.gov | Insider Trading Arrangements and Related Disclosures
[21] COMMODITY FUTURES TRADING COMMISSION, Commodity Futures Trading Commission | CFTC (last visited April 4, 2025)
[22] Markets in Financial Instruments Directive II (MiFID II), Directive 2014/65/EU of European Parliament, MiFID II | European Securities and Markets Authority

MiFID II enhances transparency by requiring order book disclosures, making it easier for regulators to track manipulative practices like spoofing.

C. United Kingdom – FCA Regulations

The Financial Conduct Authority (FCA) focuses on algorithmic accountability and market integrity.[23] It mandates firms to maintain detailed audit trails for all algorithmic trades, ensuring regulators can track and investigate suspicious activities. The Senior Managers and Certification Regime (SMCR)[24] holds individual executives accountable for algorithmic trading misconduct. FCA regulations also require trading firms to prove that their AI-driven trading models comply with market abuse laws, making it one of the most rigorous frameworks globally.

D. Lessons for India

India's regulatory framework can benefit from adopting real-time monitoring (SEC model), algorithm registration (MiFID II), and algorithmic audit trails (FCA). Strengthening SEBI's oversight mechanisms through AI-powered surveillance systems can enhance market transparency and reduce algorithmic manipulation risks.

IX. CASE STUDIES ON ALGORITHMIC TRADING MANIPULATION

The rise of algorithmic trading has led to several high-profile incidents of market manipulation, exposing regulatory gaps and the potential risks associated with automated financial systems. Examining past cases provides valuable insights into how algorithmic trading can disrupt markets and the regulatory responses needed to prevent future crises.

A. The 2010 Flash Crash (United States)

One of the most infamous incidents of algorithmic trading manipulation occurred on May 6, 2010, when the Dow Jones Industrial Average (DJIA) dropped nearly 1,000 points (about 9%) within minutes, only to recover by the end of the trading day. This

[23] FINANCIAL CONDUCT AUTHORITY, Financial Conduct Authority | FCA (last visited April 4, 2025)
[24] *Senior Managers and Certification Regime,* FINANCIAL CONDUCT AUTHORITY (July 5, 2015), Senior Managers and Certification Regime | FCA

event, later known as the Flash Crash, was largely attributed to high-frequency trading algorithms executing trades at extreme speeds, leading to a cascade of sell-offs.[25]

Investigations by the U.S. Securities and Exchange Commission and the Commodity Futures Trading Commission revealed that a London-based trader, Navinder Singh Sarao, manipulated the market using a technique known as "spoofing"—placing large sell orders without the intent to execute them, tricking other algorithms into reacting and causing artificial price movements. His fraudulent activities amplified market volatility, prompting the SEC to introduce new circuit breakers and impose stricter oversight on HFT firms.

This case highlighted the dangers of unregulated algorithmic trading and the need for real-time market surveillance tools.

B. The Adani-Hindenburg Report Controversy (India, 2023)

In January 2023, U.S.-based investment research firm Hindenburg Research released a report alleging fraudulent practices and stock manipulation by the Adani Group, an Indian multinational conglomerate.[26] The report accused Adani of artificially inflating stock prices through undisclosed offshore entities and high-frequency trading techniques, leading to a massive $100 billion drop in market capitalization of Adani Group companies.

SEBI launched an investigation into the claims, focusing on algorithmic trading patterns and the potential misuse of insider information.[27] The controversy raised concerns about India's regulatory capacity to monitor large-scale algorithmic manipulations, pushing for greater algorithmic transparency and regulatory reforms.

[25] Andrei Kirilenko et al., *The Flash Crash: High-Frequency Trading in an Electronic Market,* 72 JOF 967 (2017)
[26] *Adani Group: How the World's 3rd Richest Man is Pulling the Largest Con in Corporate History,* HINDENBURG RESEARCH (January 24, 2023), Adani Group: How The World's 3rd Richest Man Is Pulling The Largest Con In Corporate History – Hindenburg Research
[27] *Sebi submits Adani report to Supreme Court, says probe completed,* THE NEW INDIAN EXPRESS (Aug. 26, 2023), Sebi submits Adani report to Supreme Court, says probe completed

These cases illustrate the challenges regulators face in detecting and preventing AI-driven market manipulation. Strengthening oversight mechanisms is crucial to ensuring market integrity.

X. RECOMMENDATIONS FOR SEBI & LEGAL REFORMS

To address the risks posed by algorithmic trading and AI-driven market manipulation, SEBI must undertake comprehensive regulatory reforms. Implementing stricter oversight mechanisms can enhance transparency, mitigate insider trading risks, and improve overall market integrity. The following recommendations outline key areas for reform:

A. Strengthening Insider Trading Regulations

SEBI should expand the definition of an "insider" to include individuals who program AI trading models based on UPSI. This would ensure accountability for those developing manipulative trading algorithms and prevent the misuse of confidential market data. Additionally, SEBI must invest in advanced machine learning-based surveillance systems capable of detecting algorithmic manipulation patterns. Regulatory technologies (RegTech), already in use in jurisdictions such as the U.S. and the European Union, can serve as models for implementing AI-specific monitoring tools in India.

B. Implementing Pre-Trade Risk Controls

To prevent sudden market disruptions, algorithmic traders should be required to conduct pre-trade risk assessments before executing large-scale trades. These assessments would help identify potential market distortions and prevent excessive volatility. Furthermore, SEBI should mandate the implementation of automated kill switch mechanisms, which would immediately halt trading when abnormal market conditions arise. Such measures would minimize the impact of flash crashes and algorithmic errors on the financial markets.

C. Enhancing Cross-Border Regulatory Cooperation

Given the global nature of algorithmic trading, SEBI must strengthen its cooperation with international regulators. Establishing formal agreements with agencies such as the U.S. Securities and Exchange Commission (SEC), the U.K.'s Financial Conduct Authority (FCA), and the European Securities and Markets Authority (ESMA) would facilitate the exchange of intelligence on cross-border manipulative practices. In addition, SEBI should work toward the development of a global AI trading framework in collaboration with these regulators. A harmonized regulatory approach would ensure consistent enforcement across jurisdictions and prevent firms from exploiting regulatory loopholes.

D. Increasing Penalties for Algorithmic Market Manipulation

To deter firms from engaging in algorithmic market manipulation, SEBI should impose higher financial penalties and strict trading bans on violators. Increasing fines and banning firms from trading would serve as effective deterrents against unethical trading practices. Moreover, SEBI should introduce a mandatory disclosure requirement for algorithmic trading models, ensuring that firms submit their AI-driven strategies for regulatory review. This level of transparency would enable authorities to identify manipulative algorithms before they disrupt the market.

By integrating AI-driven monitoring tools, fostering international regulatory cooperation, and enforcing stricter penalties, SEBI can modernize its approach to regulating algorithmic trading. These reforms are essential to safeguarding market integrity and ensuring fair trading practices in an increasingly digital financial landscape.

XI. CONCLUSION

Algorithmic trading has fundamentally reshaped financial markets by enhancing efficiency, liquidity, and trading speed. However, it has also introduced unprecedented risks, particularly in the realm of insider trading and market manipulation. The current regulatory framework in India, primarily governed by the SEBI (Prohibition of Insider Trading) Regulations, 2015, was designed for traditional

trading environments and struggles to address the complexities of AI-driven trading systems. The lack of transparency, difficulty in proving intent, and enforcement challenges associated with algorithmic trading necessitate urgent regulatory reforms.

A comparative analysis of global regulatory frameworks, such as the SEC's Market Access Rule in the U.S. and the MiFID II regulations in the EU, highlights best practices that India can adopt. These include mandatory algorithmic audits, AI-driven real-time surveillance, and stringent disclosure requirements for trading algorithms. Strengthening SEBI's oversight through RegTech solutions, cross-border regulatory cooperation, and enhanced legal definitions of algorithmic insider trading is essential to maintaining market integrity.

Furthermore, as AI continues to evolve, regulatory frameworks must remain adaptive and proactive. Striking a balance between promoting financial innovation and safeguarding investors is critical. By incorporating AI-specific regulatory provisions, enforcing real-time monitoring mechanisms, and holding financial institutions accountable for algorithmic decisions, India can mitigate the risks of market manipulation while fostering a fair and transparent trading ecosystem. Ensuring that legal structures keep pace with technological advancements will be instrumental in sustaining trust and stability in financial markets.

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