

ARTIFICIAL INTELLIGENCE, BIG DATA AND INSIDER TRADING: RETHINKING SECURITIES REGULATION IN THE DIGITAL ERA

Ms. Mansi Chhaya, Dr. Akta Mehta

Research Scholar, School of Law, Gujarat University
Ahmedabad, Gujarat, India
mschhaya2013@gmail.com

Principal (I/C), I.M.Nanavati Law College, Gujarat University
Ahmedabad, Gujarat, India
mehtaakta@gmail.com

Abstract

Artificial intelligence (AI) and big data analytics, which have developed rapidly in recent years, are revolutionising the way modern financial markets work. Increasingly, financial institutions and professional traders are deploying algorithmic trading systems, machine learning models and predictive data analytics in order to assess large quantities of structured and unstructured data in real-time. These technologies have greatly increased market efficiency and informed decision-making, but they also raise complex regulatory questions concerning market fairness and the evolving definition of insider trading.

The traditional goal of Insider Trading laws was to prevent corporate insiders, including directors, employees, and persons connected to them, from trading securities on the basis of Unpublished Price-Sensitive Information. However, now, the boundary between the data-driven analysis and the information advantage is being blurred in the digital age. AI systems may process an immense amount of diverse datasets, such as corporate disclosures, financial statements, social media sentiment, satellite imagery, or consumer behaviour, to create predictive intelligence reports about future stock price dynamics. In this regard, traders may obtain significant informational advantages without openly handling confidential corporate information, thus exceeding the traditional legal connotation of "Inside Information".

These developments clearly present profound challenges for market integrity regulators. The regulatory framework for insider trading in India is embedded in the SEBI (Prohibition of Insider Trading) Regulations, 2015, by the Securities and Exchange Board of India. These regulations primarily address the misuse of unpublished price-sensitive information, whereas they were designed to curb conventional market practices whose specificities do not hold good for AI-based trading strategies and big data analytics.

This paper examines the convergence of Artificial Intelligence (AI), Big Data, and insider trading regulation in the evolving digital securities landscape. The study takes a doctrinal and comparative approach to review regulatory developments in major jurisdictions and identify any gaps in the current legal framework.

It asserts that the increased usage of AI-enhanced analytics necessitates a reassessment of traditional insider trading principles. It follows that regulatory authorities need to embrace a conception of technologically informed governance strategies that integrates securities regulation, data governance, and algorithmic accountability. These reforms are necessary to keep our financial markets fair, transparent and resilient in an evolving economy

Keywords: Insider Trading, Artificial Intelligence, Big Data Analytics, Securities Regulation, Algorithmic Trading

ABBREVIATIONS		
SR. NO		
1	AI	Artificial Intelligence
2	CompLJ	Company Law Journal
3	ESMA	European Securities and Markets Authority
4	EU	European Union
5	MAR	Market Abuse Regulation
6	ML	Machine Learning
7	PFUTP	Prohibition of Fraudulent and Unfair Trade Practices
8	PIT	Prohibition of Insider Trading
9	SAT	Securities Appellate Tribunal
10	SCL	Securities Law Reports
11	SEBI	Securities and Exchange Board of India
12	SEC	Securities and Exchange Commission

13	UPSI	Unpublished Price-Sensitive Information
14	XBRL	eXtensible Business Reporting Language

INTRODUCTION

The boundary between data-driven analysis and information advantage is being blurred in the digital age. AI systems may process an immense amount of diverse datasets — corporate disclosures, financial statements, social media sentiment, satellite imagery, or consumer behaviour — to create predictive intelligence reports about future stock price dynamics. Recent empirical work shows that AI-assisted analysis materially alters how sell-side analysts synthesise public and proprietary information, such that the informational edge obtained need not derive from any privileged source but may emerge from how models aggregate publicly available data (Cao et al., 2021). When such gains accrue to traders without openly handling confidential corporate information, the conduct falls outside the definition of Unpublished Price-Sensitive Information under Regulation 2(n) of the SEBI Regulations, 2015, which presupposes information that is unpublished and transferred through a connected person. The paper argues that this exceeds the traditional legal connotation of Insider Information.

Artificial Intelligence can be understood as the set of computer systems capable of performing tasks that would otherwise require human intelligence — learning, reasoning, and decision-making. Big Data, in turn, refers to large, complex datasets collected across diverse digital media whose processing demands advanced computational techniques. Where the two converge, recent finance literature shows that market participants process huge volumes of heterogeneous data with speed and accuracy that no human analyst can match (Cao et al., 2021), and platforms such as Multibagg AI illustrate how such capabilities are already deployed to generate actionable trading intelligence. Yet the institutional premise of insider trading regulation — fairness, transparency, and equal access to information — is being unsettled by the same technological shift (Kamp, 2020). Empirical evidence confirms that the informational edge obtained through systematic analysis of public data is substantial even where no unpublished corporate information is involved (Crane et al., 2022; Katona et al., 2024). This article argues that the conceptual basis on which the SEBI Regulations, 2015 was crafted is increasingly inadequate to govern such AI-enabled informational asymmetries (Hansen & Borch, 2022).

The statutory architecture of insider trading regulation in India rests on the SEBI Regulations, 2015. Regulation 2 defines Insider Trading as "buying or selling of securities based on unpublished price sensitive information by persons having access to such unpublished price sensitive information due to their association with the company." An Insider under these Regulations is a person who is either a Connected Person or in possession of Unpublished Price-Sensitive Information. UPSI is defined in Regulation 2(n) as information relating to a company or its securities, "directly or indirectly, that is not generally available which upon becoming generally available, is likely to materially affect the price of the securities," and ordinarily includes financial results, dividends, change in capital structure, mergers, acquisitions and expansion of business, changes in key managerial personnel, and material events under the listing agreement (Saraswat, 2023). Closely read, the architecture presupposes that the informational advantage of an insider is traceable, on the one hand, to a relationship with the issuer through the category of Connected Person and, on the other, to a company-specific unpublished fact within UPSI (Biyani, 2018). The advantage that AI-assisted analysis obtains from publicly scattered data falls outside both categories, since the actor has neither a corporate connection nor unpublished company-specific information in the statutory sense, and the statutory definition has been observed to "pay no heed" to outside-generated information that may move prices (Biyani, 2018; Saraswat, 2023). The Regulations therefore attach the prohibition to the source of the data, while AI-derived informational advantages are typically distinguishable by the technique of processing the data alone (Deep & Das, 2026).

RESEARCH METHODOLOGY

The methodology adopted in this research is doctrinal in nature, with the principal aim of examining the legal framework governing insider trading in India and the manner in which artificial intelligence and big data have altered the informational asymmetries that framework was designed to address. Doctrinal research, as a method, is concerned with the systematic analysis of statutes, regulations, judicial decisions and authoritative commentary, and is well-suited to interpretive questions of statutory adequacy (Deep & Das, 2026). The research is based on secondary data drawn from legal scholarship, regulatory publications, securities-market empirical studies, and comparative literature on AI-driven trading. Special emphasis is placed on the SEBI Regulations, 2015, and the analysis proceeds from the statutory definitions of Insider, Connected Person and Unpublished Price-Sensitive Information in Regulations 2(g), 2(n) and the wider regulatory architecture, read together with relevant SEBI adjudication orders. A conceptual layer is superimposed on this doctrinal analysis to examine how algorithmic trading and data-driven decision-making generate informational advantages without direct access to unpublished price-sensitive information. This conceptual layer looks at the AI-insider-trading intersection at the level of technique — model synthesis, alternative-data scraping, sentiment aggregation — rather than at the level of any single market incident. The doctrinal method is recognised as inherently limited in that it does not generate primary empirical evidence on whether AI-derived informational asymmetries in fact distort market outcomes; the paper's findings are therefore confined to the legal-

interpretive plane and the comparative plane, and a quantitative follow-up is flagged for future work. Finally, a comparative approach is adopted, drawing briefly on the regulatory treatment of AI-enabled informational advantages in the United States under Section 10(b) of the Securities Exchange Act and the SEC's evolving guidance on alternative data (Kamp, 2020), and in the European Union under the Market Abuse Regulation (Regulation 596/2014). The comparative analysis is used strictly to highlight gaps in the Indian framework, rather than to suggest wholesale transplantation, and is consistent with the secondary-data doctrinal approach adopted throughout.

RESEARCH QUESTIONS

- Does the use of artificial intelligence and big data analytics create a position of informational advantage analogous to the concept of insider trading, and if so, by what mechanisms?
- To what extent are the existing insider trading laws in India — particularly the SEBI Regulations, 2015 — adequate to address AI-driven trading practices, and where do the principal statutory gaps lie?
- What regulatory challenges arise in dealing with AI-driven financial markets that use big data analytics, in the specific context of the Indian legal framework?
- How have other jurisdictions — notably the United States under Section 10(b) of the Securities Exchange Act and the European Union under the Market Abuse Regulation (Regulation 596/2014) — addressed the same regulatory challenges, and what lessons can be drawn for the reform of the Indian framework?

HYPOTHESIS

The existing framework for addressing insider trading in India is insufficient to address the complexities introduced by artificial intelligence and big data analytics, thereby creating regulatory challenges in ensuring fairness and transparency in financial markets; further, comparative engagement with the regulatory responses of the United States and the European Union indicates that statutory reform rather than soft-law guidance is the only reform pathway capable of meeting this challenge.

RESEARCH OBJECTIVES

- **To examine** the concept of insider trading under the existing framework of securities laws in India, particularly the SEBI Regulations, 2015.
- **To analyse** the role of artificial intelligence and big data analytics in generating informational advantages in modern financial markets.
- **To map** the impact of AI-driven informational advantages on the doctrinal categories of "insider," "connected person," and Unpublished Price-Sensitive Information under Regulation 2(g) and Regulation 2(n).
- **To critically assess** the adequacy of the existing Indian legal framework in addressing AI-driven trading practices, with specific reference to the regulatory gaps identified through doctrinal analysis.
- **To undertake a comparative analysis** of the regulatory responses of the United States and the European Union, and **to recommend** targeted reforms to the Indian framework in light of the doctrinal and comparative findings.

LITERATURE REVIEW

The existing legal literature and legal frameworks have largely focused on "Insider Trading" as a human-centric violation involving the misuse of Unpublished Price Sensitive Information. With the advent of Artificial Intelligence and Big Data analysis in financial markets, however, there has been a paradigm shift that has unsettled the existing legal foundations. The literature review sets out the doctrinal backbone of insider trading regulation in India, the corresponding human-centric limits of comparative regimes, the emergence of "Digital Information Asymmetry" as a distinct phenomenon in the academic literature, and the early regulatory responses that have begun to acknowledge this shift.

The Traditional Legal Paradigm in India

Indian regulations on "Insider Trading" are based on the SEBI Regulations, 2015, read with the SEBI Act, 1992. Indian law has traditionally relied on "parity of information" and "fiduciary duty" principles, and the doctrinal categories of Insider, Connected Person and Unpublished Price-Sensitive Information in Regulation 2(g), Regulation 2(d) and Regulation 2(n) respectively have been the analytical anchor of regulatory and adjudicatory reasoning (Biyani, 2018; Saraswat, 2023). In *Hindustan Lever Limited v. SEBI*, the regulator emphasised "fairness" and "integrity" as the constitutive values of insider trading jurisprudence, and the analytical treatment of that decision in subsequent scholarship has reinforced that the test is fundamentally relational — it asks who the actor is and what relationship the actor bore to the issuer. In *Rakesh Agrawal v. SEBI*, the Securities Appellate Tribunal placed reliance on "intent" (mens rea) as a constitutive element of the Insider Trading violation, framing the offence as one that presupposes a consciously wrongful human actor. Read together, these decisions indicate that the Indian framework is built around controlling human entities rather than machines, and that even within the human-centric frame the doctrine has been observed to "pay no

heed" to outside-generated information that may nonetheless move prices (Biyani, 2018). The doctrinal insufficiency, when AI-driven informational asymmetries are brought into view, is therefore not a recent accident but a structural feature of the categories themselves.

Global Judicial Precedents and the Limits of Human-Centric Doctrines

Comparable limitations are observed across other major jurisdictions. In the United States, judicial determinations on "Insider Trading" have relied on the "misappropriation theory" and "fiduciary duty" principles as established in *Dirks v. SEC* and *United States v. O'Hagan*. The US definitions of "Insider Trading" are anchored in "breach of duty." Yet with the emergence of "Predictive Insights" derived solely from public data and without any "tip" from human entities, the categories of "tippee" and "fiduciary breach" become analytically problematic, since the informational advantage owes nothing to a relationship of trust and everything to the technique of analysis (Kamp, 2020). The European Union's Market Abuse Regulation (Regulation 596/2014), and the European Parliament's subsequent 2020 resolution on artificial intelligence in financial services, took a partial step forward by treating "inside information" as a status tied to the content of the information rather than to the relational position of the actor, but the broader regime remains anchored in breach-of-duty logic. The cross-jurisdictional picture is one of doctrinal convergence on a human-centric foundation, even as the underlying market practice has begun to look very different.

The Shift to Digital Information Asymmetry

The most recent strand of academic literature identifies a phenomenon that does not fit the human-centric archetype: "Digital Information Asymmetry." Unlike the conventional asymmetry of information, where the privileged actor simply knows a corporate fact others do not, Digital Information Asymmetry arises from the "superior information-processing capabilities" of technologically advanced organisations. Recent empirical work shows that AI-assisted analysis materially alters how investment professionals synthesise public and proprietary information, such that the informational edge obtained need not derive from any privileged source but may emerge from how models aggregate publicly available data (Cao et al., 2021). Empirical research on hedge fund acquisition of public information confirms that sophisticated analysis of publicly disclosed data can yield durable informational advantages without any breach of fiduciary duty (Crane et al., 2022). The sentiment-analysis literature has further documented how algorithmic processing of unstructured, alternative data — satellite imagery of retail traffic, web-scraped consumer sentiment, alternative-data aggregators — can produce actionable signals prior to the price discovery of the broader market (Hansen & Borch, 2022). Capital-market evidence from "outer space" research confirms that the informational edge tied to alternative-data processing is now large enough to be measurable in systematic returns, with implications for the regulatory framing of who counts as informed (Katona et al., 2024). Across these studies, a stable empirical fact emerges: technological processing of public data alone can deliver informational advantages historically associated with insider access. The doctrinal categories of Indian insider trading law, which presuppose a corporate fact and a relational pathway, do not have a clean analytical handle on this kind of advantage.

Emerging Regulatory Responses

The early regulatory responses have begun to acknowledge, in cautious language, that the conventional frame is under pressure. The SEBI Annual Report (2024-25) records a "technology-first" approach in surveillance and supervision, in contrast to the regulator's earlier posture of treating technology as a simple efficiency-enhancing tool. Doctrinal scholarship evaluating the SEBI Regulations, 2015 in light of these developments has noted the increasing difficulty of confining the prohibition to a relational frame when the market-moving information advantage is increasingly generated, rather than received, by the actor (Deep & Das, 2026). The academic literature accordingly anticipates that meaningful reform will require conceptual changes to the law — particularly in the definition of UPSI, the duty owed by intermediaries operating algorithmic strategies, and the real-time surveillance obligations of the regulator — if transparency and market integrity are to be preserved (Cao et al., 2021; Hansen & Borch, 2022). The literature review accordingly situates the present research at a point where the doctrinal layer, the comparative layer, and the empirical literature on AI-driven informational advantages converge, and where the Indian framework has not yet articulated an adequate conceptual response

INSIDER TRADING: THE LEGAL FRAMEWORK

The concept of Insider Trading assumes great significance in the field of securities laws because of its implications in terms of maintaining the integrity of the stock-exchange market, maintaining the faith of the investors, and providing an equal opportunity of access to information. The concept can accordingly be described as "the buying or selling of securities by a person in possession of unpublished price sensitive information" [SEBI, 2015]. Thus, an unfair advantage is given to an insider in comparison to other players in the stock-exchange market, and it is this information asymmetry that is sought to be removed by the SEBI Act, 1992.

SEBI regulates Insider Trading in India through the SEBI Regulations of 2015. The SEBI Act of 1992 provides the Securities Exchange Board of India with regulatory power to regulate the stock-exchange markets in India in accordance with Section 11 of the SEBI Act, 1992. Regulation 2 of the SEBI Regulations of 2015 provides an exhaustive list of definitions. According to this regulation, an "Insider" is an individual who is either a

"connected person" or in possession of UPSI, which includes any type of information related to a company that may not be publicly available and has the potential to significantly influence the price of its securities [SEBI, 2015]. In addition, the SEBI Regulations, 2003, also play a significant role, because any "manipulative or deceptive device" affecting fair price discovery has been prohibited [SEBI, 2003].

Several responsibilities have been outlined for Insiders, which include strict regulations regarding the communication, acquisition, and disclosure of UPSI. This has been done to ensure that no participant gains any unfair advantage over others due to the availability of information. SEBI has taken many enforcement actions against violators to emphasise the importance of compliance. In its latest annual report, the regulator has stated its increased focus on "technology-driven surveillance and asymmetric data analysis" to detect sophisticated offences that may evade traditional oversight [SEBI, 2024]. In an unprecedented move towards a strategic shift, the SEBI Annual Report (2024-25) states that it is leveraging AI-based real-time surveillance tools to detect complex patterns of insider trading and market manipulation that might go unnoticed by conventional means [SEBI, 2025]. The report states that, as market players move towards better algorithms, SEBI is embracing a "technology-first" approach to address "Information Asymmetry" arising from greater computational power. This further emphasises the need to bridge the gap between the SEBI Act of 1992 and the ever-evolving technological scenario.

The definitional categories around which this statutory architecture is built — Insider, Connected Person and UPSI — were, however, designed for a market in which the informational edge moved through identifiable, relational channels from issuer to insider (Biyani, 2018; Saraswat, 2023). The growth of AI-driven analysis of publicly available data has now begun to generate informational asymmetries outside those channels, and the analytical consequence is that the foundational categories face a structural rather than peripheral limitation.

AI, BIG DATA AND THE PROBLEM OF DIGITAL INFORMATION ASYMMETRY

The advent of Artificial Intelligence and Big Data analysis has fundamentally changed the operational dynamics of modern financial markets. The technology leap allows financial-market participants to use sophisticated tools to process vast amounts of data with unprecedented speed, improving the performance of the market. As emphasised in the SEBI Annual Report (2024-25), this development calls for the adoption of a "technology-first" approach to regulation to ensure that such sophisticated tools do not lend themselves to the perpetuation of market abuse [SEBI, 2025].

AI may be defined as computer systems with the ability to perform tasks that were considered to require human intelligence, such as pattern recognition and complex decision-making [Stanford University, 2022]. When used with Big Data — vast amounts of data collected through complex digital media — AI tools need sophisticated computation to create value [IBM, n.d.]. While human analysts are limited to analysing only structured data, AI tools can also analyse unstructured data such as social media, satellite imagery, and global news feeds to identify market trends before they are apparent to the general public (Hansen & Borch, 2022). Another significant contribution of AI is the rise of Algorithmic Trading, in which the decisions are made on the basis of mathematical signals. The difficulty the regulator confronts, however, is the rise of a new phenomenon — "Digital Information Asymmetry." This is not the "theft" of information, but the advantage given to the party with better computing power and access to high-velocity data. The use of "Alternative Data" (information collected through unconventional means such as supply-chain data or weather patterns) allows AI-based parties to make predictions about the company with an accuracy similar to the possession of UPSI. The SEBI Act, 1992, mandates the regulator to ensure a level playing field. Yet the use of complex data to generate the "Predictive Insight" by the AI creates a "grey area" for the regulator which the SEBI Regulations, 2015 are not yet equipped to handle. The complex nature of AI also creates the problem of the "Black Box," where the rationale for the decision-making is hidden inside the complex neural network. It becomes almost impossible for the regulator to pinpoint the "mens rea" or "intent," which is necessary for any conviction under the PFUTP Regulations, 2003 [SEBI, 2003]. The SEBI Annual Report (2024-25) records that "in order to counter such sophisticated violations, the Exchange Regulator is now using its own AI-based real-time surveillance. The legal framework needs to evolve from 'Regulating Human Intent' to 'Auditing Algorithmic Transparency'" [SEBI, 2025].

The integration of AI and Big Data analytics has given rise to a fundamental challenge to the existing regulations on "Insider Trading" in India. The existing regulations — the SEBI Regulations, 2015 — are based on the premise of preventing UPSI from being used for trading advantage by individuals (connected persons). With the integration of AI and Big Data analytics for trading, however, there is now real ambiguity in defining "unfair advantage." Unlike in traditional insider trading, in which individuals gain advantage on the basis of information that has been leaked to them through human sources, AI and Big Data produce advantage based on the superior ability of the system to process and analyse publicly scattered information. The result is a "Digital Information Asymmetry" between technologically advanced institutional entities and retail investors, and a corresponding ambiguity in regulatory perimeter (Crane et al., 2022; Hansen & Borch, 2022; Katona et al., 2024).

Under Section 12A of the SEBI Act of 1992, the regulator is entrusted with the responsibility of prohibiting "deceptive devices." Predictive Insights gained through deep-learning models have, however, given rise to a

"grey area", because "technique" has now become the new "insider." The reliance on traditional interpretations of insider trading, as seen in *Rakesh Agrawal v. SEBI 1 Comp LJ 193* and *Hindustan Lever Ltd. v. SEBI 18 SCL 311*, where "fairness" and "intent" of individuals are evaluated to determine "Insider Trading," is no longer fully relevant, because those decisions did not contemplate any "informational advantage" that is synthesised without any explicit use of UPSI (Biyani, 2018; Saraswat, 2023).

The empirical literature now provides a sufficiently strong basis to say that the informational advantage tied to these techniques is real, durable, and consequential. Recent research on AI-assisted investment analysis demonstrates that AI materially alters how investment professionals synthesise public and proprietary information, and that the informational edge obtained often emerges from how models aggregate publicly available data (Cao et al., 2021). Studies on hedge fund acquisition of public information confirm that sophisticated analysis of publicly disclosed data can yield durable informational advantages without any breach of fiduciary duty (Crane et al., 2022). Capital-market evidence from non-traditional data sources shows that the informational edge tied to alternative-data processing is now large enough to be measurable in systematic returns, with implications for the regulatory framing of who counts as informed (Katona et al., 2024). Across these studies, the stable empirical fact emerging is that technological processing of public data alone can deliver informational advantages historically associated with insider access. The doctrinal categories that regulate insider access are not structured to engage with informational advantages generated through the technique of analysis itself.

The doctrinal difficulty is enhanced by three operational realities. First, the UPSI question: predictive intelligence generated from public alternative data is not "unpublished" in any sense the regulation recognises, because what is novel is the synthesis rather than the data itself. The Regulation 2(n) general-availability test treats each underlying data point individually rather than the synthesised intelligence as a whole, with the residual clause historically narrowed to prevent UPSI from collapsing into the public information base. Second, the mens rea question: AI-derived decisions do not carry intent in the consciously wrongful sense that Rakesh Agrawal requires; the rationale for the decision is embedded in a complex neural network, and pinning intent on the human operator is increasingly difficult where the operator cannot fully anticipate the model's output. Third, the surveillance question: detecting a pattern of technique-driven informational asymmetry requires the regulator to engage in AI-based real-time surveillance of trading patterns, model-deployment logs, and alternative-data feeds — an inversion of the traditional posture in which the regulator supervised human-authored trade records after the fact (Deep & Das, 2026).

The SEBI Annual Report (2024-25) marks an early recognition of these complications, though not yet in fully doctrinal language. The doctrinal substrate — the SEBI Regulations, 2015 — still speaks the language of 2015, while the operational reality of markets has moved on.

COMPARATIVE REGULATORY APPROACHES

a. United States

The limitations of the Indian framework are not limited to India; similar limitations can be witnessed all over the world. In the case of the United States, the entire legal framework surrounding insider trading — as dictated by judicial pronouncements such as *Dirks v. SEC*, 463 U.S. 646 and *United States v. O'Hagan*, 521 U.S. 642 — is centred on breaches of fiduciary duty or misappropriation of non-public information. Such a humanistic approach to legislation becomes strained in dealing with an instance of an AI algorithm aiming to achieve returns by correlating public information so effectively that the resulting intelligence essentially becomes "market-moving" information. Additionally, because of the "Black Box" nature of Neural Networks as an AI model, it is practically impossible for "mens rea" or "intent" to be established as is required by various securities fraud laws, including those of India in relation to insider trading under the PFUTP Regulations, 2003 (Kamp, 2020). The SEC has responded with evolving guidance on alternative data, clarifying boundaries such as when scraping satellite imagery, geolocation data or web-consumer data crosses into material non-public information if non-public corporate data is incidentally captured. The guidance stops short of treating the analytical technique itself as a regulatory handle; the U.S. framework is operationally supple through SEC guidance but doctrinally conservative through fiduciary-duty reasoning.

b. European Union

The European Union's Market Abuse Regulation (Regulation 596/2014) represents the most consequential doctrinal reformulation of insider trading law in any major jurisdiction in the past decade [EU, 2014]. Critically, the MAR defines "inside information" in content-based rather than relational terms: information is "inside" if it is precise, not public, and likely to have a significant effect on price. The relational pathway is preserved (information lawfully possessed in the course of business remains a defined category), but the analytical criterion has shifted from who the actor is to what the information is. This shift has two implications. First, the MAR is structurally better-positioned than the SEBI framework to capture informational asymmetries generated through alternative-data and AI analysis: the analytical question is what the synthesised intelligence contains, not who supplied it. Second, the relocation of the analytical lens has surfaced a new category of enforcement challenge — including the difficulty of assigning intent to algorithmic systems and the corresponding difficulty of applying intent-based prohibitions to AI-driven strategies. The European Securities

and Markets Authority's subsequent guidance, including the 2020 European Parliament resolution on artificial intelligence in financial services, has begun to recognise the same lacuna (Hansen & Borch, 2022).

c. What the Comparative Picture Tells Us

The comparative picture is one of doctrinal convergence on a human-centric foundation combined with operational divergence as the digital substrate of markets changes. The Indian framework is the most relational — anchored in Connected Person and UPSI — and therefore the most exposed to the technique-based asymmetry that the empirical literature now documents. The U.S. framework is operationally supple through SEC guidance but doctrinally conservative through fiduciary-duty reasoning. The EU framework is doctrinally the most ambitious — content-based, non-relational — but operationally constrained by intent-based enforcement (Deep & Das, 2026; Kamp, 2020). The implication for reform is selective integration rather than wholesale transplantation. The Indian framework can usefully import the MAR-style content-based reformulation of UPSI for the synthesised-intelligence case; can borrow from the SEC's evolving guidance on alternative data to clarify scraping limits; and can adopt the EU's growing recognition of algorithmic intent to populate the mens rea gap. The reform will, however, be uniquely Indian, because the regulatory apparatus — the PFUTP framework under the SEBI Regulations, 2003, the surveillance pivot recorded in the SEBI Annual Report (2024-25), and the structural reporting infrastructure — will determine whether doctrinal reform is operationally effective.

REGULATORY CHALLENGES AND THE PATH TO REFORM

The challenges posed by the application of Artificial Intelligence and Big Data analytics in financial markets call for an urgent need to re-evaluate the existing regulatory scenario in the context of insider trading. Currently, the SEBI Regulations of 2015 are mainly intended to address situations of abuse of UPSI by human entities. As AI-based trading strategies provide an informational advantage because of better processing of information, however, the regulatory focus must shift from "access to information" to "ability to process information."

a. Definitional Reform: Recasting UPSI

One major change that needs to be incorporated is in the context of "informational advantage." SEBI and other regulatory bodies must recognise that a high level of imbalance in the markets can arise because of the processing of publicly available information in such a way that it creates the functional effect of UPSI. Even though it is beyond human control to stop technological advancements, the doctrinal vocabulary must not allow such advantages to cause systemic unfairness. The reform pathway is to supplement — not replace — the Regulation 2(n) definition of UPSI with a content-based test that captures information and intelligence whose market-moving character arises from synthesis rather than from company-specific unpublished fact. The MAR formulation provides the cleanest doctrinal template: information is "inside" if it is precise, not public, and likely to have a significant effect on price [EU, 2014]. The reform should preserve the relational Connected Person category for the conventional case while extending the UPSI term to capture the technique-driven case through explicit statutory language. The reform is also doctrinally tractable because it does not require legislative action under the SEBI Act, 1992; it can be implemented through SEBI's regulatory amendment power, consistent with the regulatory evolution documented in the doctrinal literature (Deep & Das, 2026).

b. Surveillance Reform: Auditing Algorithmic Transparency

Another important reform is in the area of strengthening the regulatory framework in relation to algorithmic trading systems. SEBI can consider imposing greater disclosure norms in relation to entities that adopt AI-based trading strategies in order to avoid any circumvention of the PFUTP Regulations, 2003 [SEBI, 2003]. Additionally, it is of critical importance to address the "black box" problem in AI: greater transparency is essential in order to evaluate whether AI is functioning within permissible legal parameters. As highlighted in the SEBI Annual Report (2024-25), SEBI is already exploring ways in which advanced financial technology can be leveraged in order to fulfil its supervisory role in keeping pace with the dynamism of modern financial systems, to identify any instances of financial abuse [SEBI, 2025]. The reform pathway is twofold: explicit recognition in the SEBI Regulations, 2015 that algorithmic strategies are subject to disclosure obligations (including the obligation to disclose the data sources, model architecture, and trading parameters of the strategy above a defined threshold of activity); and a regulatory mandate for SEBI to maintain an algorithmic-audit capability with statutory powers to compel transparency from entities operating AI-driven strategies whose trading pattern is associated with information asymmetries the conventional framework cannot reach.

c. Capacity and Enforcement Reform

The SEBI Annual Report (2024-25) records that, as the dependency of Indian financial markets on AI-driven strategies is rising, the gap between sophisticated market participants and traditional supervisory tools is widening. The reform pathway is investment in technical surveillance capability — AI-based pattern detection, real-time alternative-data monitoring, and the technical capacity to audit algorithm outputs — combined with statutory recruitment frameworks that allow SEBI to engage and retain technical talent in competition with the private sector. The literature on AI-driven market analysis confirms that the regulatory capacity gap is not a uniquely Indian problem and is wider in jurisdictions with smaller regulator budgets, which prioritises inter-regulator cooperation across ESMA, the SEC, and SEBI on shared alternative-data monitoring, harmonised

disclosure thresholds, and joint technical standards (Cao et al., 2021; Deep & Das, 2026; Hansen & Borch, 2022).

The three reform pathways — definitional, surveillance-related, and capacity-related — form a coherent package. The comparative evidence suggests that partial reform — any one of these three without the others — will be insufficient. The Indian regulator's pivot toward AI-based surveillance is best understood as the first piece of a larger reform agenda, not as a standalone policy response.

CONCLUSION

The integration of Artificial Intelligence and Big Data Analytics has fundamentally transformed the manner in which financial trade is conducted, serving as the primary catalyst for the growth and development of modern financial systems. As illustrated through the course of the present study, such developments have also served to create challenges for the legal provisions surrounding insider trading. While the legal provisions, both in India and globally, have traditionally sought to deal with the abuse of unpublished price-sensitive information by identifiable individuals, the development of AI-based trading strategies has created a paradigm shift wherein information is being utilised for the creation of competitive advantages, which are yet to be categorised by the legal provisions. The utilisation of publicly accessible data for the formulation of predictive strategies has given rise to the concept of digital information asymmetry, raising pertinent questions regarding the viability of the established securities laws.

This study has shown that the challenges being created by such developments are not only legal in nature but also conceptual. The line dividing "fair data-driven evaluation" and "unfair informational advantage" is becoming more blurred in this digital age. In this context, it is of utmost importance for regulatory authorities such as SEBI to embrace a forward-thinking and adaptive model. While it is not advisable to stifle technological innovation, it is imperative to ensure that such development does not threaten the basic principles of transparency, fairness, and access to information. The success of securities regulation in this age of Big Data will depend on how effectively it evolves from traditional securities regulation to a more agile and technological form to cope with the dynamism of the global financial market. Based on the doctrinal and comparative analysis, four concluding observations follow. First, the doctrinal categories of the SEBI Regulations, 2015 — Insider, Connected Person and UPSI — were designed for a human-centric market where informational asymmetries flowed through identifiable relational channels; the growth of AI-driven analysis has now begun to generate asymmetries outside those channels, and the categories face a structural rather than peripheral limitation (Biyani, 2018; Saraswat, 2023). Second, the empirical literature provides a sufficiently strong basis to say that the technique-based informational advantage is real, durable and consequential, with the dominant informational asymmetries in modern markets increasingly generated by analysis rather than by access (Cao et al., 2021; Crane et al., 2022; Hansen & Borch, 2022; Katona et al., 2024). Third, the comparative picture shows that the doctrinal limitation is widely shared — the U.S. framework remains fiduciary-anchored, the EU framework has made doctrinal progress through the MAR but remains constrained in enforcement by intent-based reasoning, and the Indian framework bears the deepest exposure because its categories are the most relational (Kamp, 2020). Reform is therefore a matter of identifying what each comparative regime offers and integrating the gains, not of borrowing one model wholesale. Fourth, the reform agenda the paper recommends — definitional, surveillance-related, capacity-related — is concrete, sequenced and operationally tractable, with the SEBI Annual Report (2024-25)'s pivot toward AI-based surveillance providing a natural starting point and the doctrinal amendments to UPSI proceeding in parallel. The pace of the remaining reform, and the depth at which the doctrinal vocabulary is rewritten to match the operational reality of AI-driven markets, is the open empirical question that future research will need to address.

REFERENCES

- [1] Cao, S., Jiang, W., Wang, J., et al.. From Man vs. Machine to Man + Machine: The Art and AI of Stock Analyses. *NBER Working Paper No. 28800*. <https://doi.org/10.3386/w28800>
- [2] Crane, A. D., Crotty, K., & Umar, T.. Hedge Funds and Public Information Acquisition. *Management Science*. <https://doi.org/10.1287/mnsc.2022.4466>
- [3] Hansen, K. B., & Borch, C.. Alternative Data and Sentiment Analysis: Prospecting Non-Standard Data in Machine Learning-Driven Finance. *Big Data & Society*, 9. <https://doi.org/10.1177/20539517211070701>
- [4] Biyani, S.. Not So Watertight: The Scope of "Insider" Under the Insider Trading Laws in India. *Journal of Contemporary Studies in Law*. <https://lawjournals.celnet.in/index.php/jcml/article/view/224>
- [5] Saraswat, D.. Hindustan Unilever Ltd. vs. Securities and Exchange Board of India. *Journal of Contemporary Studies in Law*, 2. <https://dx.doi.org/10.59126/v2i4a5>
- [6] Kamp, F. N.. Alternative Data Accumulation, Investment Management and the Ever-Present Spectre of Insider Trading Liability – Should Hedge Funds Be Concerned About Trading on Scraped Data? *University of Pennsylvania Journal of Business Law*, 22. <https://scholarship.law.upenn.edu/jbl/vol22/iss3/4>
- [7] Deep, P., & Das, P. K.. A Decade of SEBI Prohibition of Insider Trading Regulation 2015: Reform, Uncertainty and Capacity. <https://doi.org/10.5281/zenodo.18490466>

- [8] Stanford University. *Brief Definitions of Key Terms in AI*. Stanford Institute for Human-Centered AI. <https://hai.stanford.edu/policy/brief-definitions-of-key-terms-in-ai>
- [9] IBM. *What Is Big Data?* <https://www.ibm.com/topics/big-data>
- [10] Securities and Exchange Board of India. *SEBI Regulations, 2015* (last amended March 12, 2025). <https://www.sebi.gov.in/legal/regulations/mar-2025/securities-and-exchange-board-of-india-prohibition-of-insider-trading-regulations-2015-last-amended-on-march-12-2025-92672.html>
- [11] Securities and Exchange Board of India. *SEBI Regulations, 2003* (last amended June 28, 2024). <https://www.sebi.gov.in/legal/regulations/jun-2024/sebi-prohibition-of-fraudulent-and-unfair-trade-practices-relating-to-securities-market-regulations-2003-last-amended-on-june-28-2024-84781.html>
- [12] Securities and Exchange Board of India. *Annual Report 2023-24*. https://www.sebi.gov.in/reports-and-statistics/publications/aug-2024/annual-report-2023-24_85764.html
- [13] Securities and Exchange Board of India. *Annual Report 2024-25*. https://www.sebi.gov.in/reports-and-statistics/publications/aug-2025/annual-report-2024-25_96014.html
- [14] Securities and Exchange Board of India. *The Securities and Exchange Board of India Act, 1992*. https://www.sebi.gov.in/sebi_data/attachdocs/1456380272563.pdf
- [15] Rakesh Agrawal v. Securities and Exchange Board of India, 1 Comp LJ 193.
- [16] Hindustan Lever Ltd. v. Securities and Exchange Board of India, 18 SCL 311.
- [17] Katona, Z., Painter, M., Patatoukas, P. N., et al.. On the Capital Market Consequences of Big Data: Evidence from Outer Space. *Journal of Financial and Quantitative Analysis*. <https://doi.org/10.1017/s0022109023001448>
- [18] Dirks v. Securities and Exchange Commission, 463 U.S. 646.
- [19] United States v. O'Hagan, 521 U.S. 642.
- [20] Regulation No 596/2014 of the European Parliament and of the Council of 16 April 2014 on Market Abuse. <https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32014R0596>
- [21] Securities Exchange Act of 1934, 15 U.S.C. § 78j(b).
- [22] Securities and Exchange Commission, Rule 10b-5, 17 C.F.R. § 240.10b-5.
- [23] European Parliament. *Resolution on Artificial Intelligence in Financial Services*.