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WHO IS RESPONSIBLE WHEN ALGORITHMS COMPETE? RECONSTRUCTING LIABILITY IN THE AI ECONOMY

AUTHORED BY - KRITIKA SINGH NATHAWAT
Designation - Student / 3rd Year BALLB (Honos.),
CHRIST (DEEMED TO BE UNIVERSITY) DELHI NCR

Abstract

The growing use of Artificial Intelligence (AI) in digital markets has transformed business competition while exposing significant gaps in legal responsibility. Algorithms now independently set prices, determine advertisement placement, rank products, and optimize supply chains, often with minimal human intervention. Although these systems enhance efficiency and responsiveness, they also introduce risks such as algorithmic collusion, discriminatory pricing, and exclusionary practices. Such developments challenge the traditional liability framework of competition law, which depends on human intent, agreement, and identifiable decision-makers to assign responsibility.

Algorithmic coordination can arise through explicit programming, shared pricing software, or autonomous systems that continuously optimize strategies. Research indicates that algorithmic pricing tools can sustain supra-competitive outcomes and coordinated market behavior without direct communication among firms, thereby challenging conventional antitrust doctrines. Competition authorities increasingly recognize that algorithms may enable parallel pricing and coordinated conduct without a human "meeting of minds," complicating evidentiary standards required to prove collusion.

This creates an attribution dilemma. Where algorithms execute pre-determined strategies, firms may be held liable under established corporate responsibility principles. However, self-learning systems complicate accountability because their outcomes may be unforeseen or unintended. Scholars argue that AI-enabled collusion and discrimination challenge core assumptions of competition law by shifting focus from conduct to market outcomes, raising risks of under-deterrence and enforcement gaps.

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Comparative regulatory advancements signify novel approaches for reinstating accountability. To reduce the harms caused by algorithms, the European Union has made risk-based governance, compliance-by-design, and regulatory supervision its top priorities. At the same time, U.S. antitrust enforcement continues to stress the importance of effects-based analysis and ideas of corporate responsibility. The OECD guidance stresses the need to rethink ideas like agreement and tacit coordination in order to deal with market behavior driven by algorithms. Regulators in India and other emerging areas have begun to recognize that Al systems can autonomously coordinate strategic actions and produce cartel-like outcomes, highlighting inadequacies in existing ex post enforcement mechanisms.

This paper argues that accountability in Al-driven markets should evolve from Intent-centric theories to a hybrid accountability framework grounded in foreseeability, control, risk generation, and compliance obligations throughout the Al lifecycle. When design choices or data governance frameworks create predictable anti-competitive threats, responsibility must include not only corporations but also developers, and platform intermediaries. Making algorithms more open, easy to check, and easy to watch can help with enforcement while still encouraging new ideas.

Rebuilding responsibility in the Al economy requires balancing the freedom of technology with the need for legal responsibility. A proactive framework must ensure that automated market coordination does not compromise fair competition, consumer welfare, and market integrity in increasingly algorithmic economic system.

KEYWORDS: Artificial Intelligence, Competition Law, Algorithmic Collusion, Antitrust Liability, Algorithmic Accountability.

1. Subject Matter of the Study

Artificial Intelligence (AI) has greatly affected the dynamics of the competition in the market. The contemporary market has experienced scenarios where digital platforms, e-commerce websites, and financial institutions have utilized algorithms in the decision-making process, which would have required the involvement of human beings. The ability of the algorithms to dictate prices, ad spaces, and the arrangement of the presentation of goods has greatly affected

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the market.[1] Even though the use of algorithms has made the digital platforms efficient and responsive, numerous intricate challenges have been created in the competition law domain.

The most significant issue that has been created in the domain of algorithms is the dynamics of the interaction of the algorithms in the market. The ability of the algorithms to learn and dictate prices, which are well above the competition level and may exclude the existence of other firms in the market, has been referred to as algorithmic collusion.[2]

Traditionally, the field of competition law is founded upon the assumption that anti-competitive conduct is caused by human actors that consciously engage in such practices. However, the presence of AI-driven markets challenges this assumption.[3] In such a setting, it is possible for artificial intelligence to cause anti-competitive conduct that was not programmed or intended to do so. This creates a legal ambiguity when such a situation arises.

The main subject that the research aims to explore is the concept of the reconstruction of liability in AI-driven markets, especially when the algorithms compete against each other to cause anti-competitive conduct. The research will explore the possibility of existing doctrines in the field of competition law to address the issue of algorithmic coordination and the restructuring of liability in the absence thereof.[4]

The major focus of the study is the construction of liability in AI-based markets, especially in algorithmic coordination. Moreover, the study examines the effectiveness of the existing competition law regimes in dealing with the issue of algorithmic coordination, as well as the construction of liability in case the existing regimes are deemed ineffective.

2. Statement of the Problem

The rapid integration of Artificial Intelligence (AI) into the digital market is posing a challenge to the assumptions that guide the implementation of the competition laws.[5]

[1] Ariel Ezrachi & Maurice E. Stucke, *Virtual Competition: The Promise and Perils of the Algorithm-Driven Economy* (Harvard University Press, 2016).
[2] Emilio Calvano, Giacomo Calzolari, Vincenzo Denicolò & Sergio Pastorello, "Artificial Intelligence, Algorithmic Pricing, and Collusion," 110 *American Economic Review* 3267 (2020).
[3] Organisation for Economic Co-operation and Development (OECD), *Algorithms and Collusion: Competition Policy in the Digital Age* (OECD Publishing, Paris, 2017).
[4] Herbert Hovenkamp, "Antitrust and the Algorithm," 81 *University of Colorado Law Review* 909 (2019).
[5] Ariel Ezrachi & Maurice E. Stucke, *Virtual Competition: The Promise and Perils of the Algorithm-Driven Economy* (Harvard University Press, 2016).

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Competition laws, such as antitrust laws, have traditionally focused on the regulation of human behavior in the digital market, with a special emphasis being given to the coordination of economic activities among different firms. The assumptions that guide the implementation of the competition laws are based on the existence of factors such as agreement, intentions, communication, and conscious parallelism among the economic competitors. However, the integration of AI into the digital market is posing a challenge to these assumptions. The integration of AI into the digital market suggests that the anti-competitive behavior could exist without the presence of coordination and intentions among different firms.[6]

One of the most significant concerns that has arisen from this is the issue of attribution. Indeed, the ability of contemporary machine learning algorithms to analyze and learn from the market environment without any external input is significant. Through continuous interaction with other algorithms in the same environment, they may eventually reach a point where they converge and start behaving in a similar fashion, almost akin to collusion.[7] For example, algorithms that are programmed to maximize profits may learn that keeping prices high is more profitable in the long run than lowering them. The question of who is liable when these forms of coordination happen without any external input is a problem that is difficult to resolve.[8]

This attribution problem is of particular interest because the firms will be able to claim that the uncompetitive outcome was not the intended outcome but the unintended outcome of the autonomous actions of the algorithm. On the other hand, the regulator will face the difficulty of proving the collusion in the absence of the traditional indicators of collusion, such as the communication and mutual agreement between the firms. It will be difficult for the regulator to apply the traditional legal doctrines that rely on the demonstration of the "meeting of minds" between the firms.[9]

[6] Organisation for Economic Co-operation and Development (OECD), *Algorithms and Collusion: Competition Policy in the Digital Age* (OECD Publishing, Paris, 2017).
[7] Emilio Calvano, Giacomo Calzolari, Vincenzo Denicolò & Sergio Pastorello, "Artificial Intelligence, Algorithmic Pricing, and Collusion," 110 *American Economic Review* 3267 (2020).
[8] Herbert Hovenkamp, "Antitrust and the Algorithm," 81 *University of Colorado Law Review* 909 (2019).
[9] Ariel Ezrachi & Maurice E. Stucke, "Artificial Intelligence & Collusion: When Computers Inhibit Competition," 2017 *University of Illinois Law Review* 1775.

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Yet another layer of complexity is added by the lack of clear decision-making algorithms, referred to as the 'black box' problem.[10] Some of the most advanced types of AI, especially those using deep learning, involve complex computational processes that cannot be easily grasped, even by their creators. The way these complex algorithms operate is dependent on the interaction of the training set, algorithm, optimization, and constant feedback from the market environment. Therefore, when there is evidence of anti-competitive effects by an algorithm, it is difficult for the authorities to understand the exact mechanisms of decision-making.

Apart from the issues that touch on transparency, the rate at which the interactions involving algorithms occur is also posing a challenge to the problems that the regulations are facing. This is due to the fact that the algorithms can interpret the signals that the market is sending and respond to them within milliseconds.[11] This means that the algorithms respond instantly to the actions of their competitors. This is different from the traditional cartels that usually exist through communication channels. In the case of the algorithms, the interactions that exist could be between two algorithms. This means that there could be no documentary evidence to prove the existence of the anti-competitive practices.

Such developments, therefore, create a significant risk of under-deterrence of regulations. [12]This is because, in the event that competition regulators would not effectively detect and prosecute such acts of collusion, there is an implication that firms might evade responsibility by claiming that there is a lack of clear regulations regarding the use of algorithms in decision-making. As discussed above, it is apparent that such developments might jeopardize the objectives of competition regulations.

It is for this reason that the major problem that the research in this paper aims at solving is the inability of intent-based liability systems to manage AI-driven markets. The problem is particularly evident in the presence of the rising influence of algorithms in the assessment of competitive practices. It is essential that the problem is addressed in order to ensure that advancement in technology does not undermine the sustainability of competitive markets.

[10] Frank Pasquale, *The Black Box Society: The Secret Algorithms That Control Money and Information* (Harvard University Press, 2015).
[11] OECD, *Algorithms and Collusion: Competition Policy in the Digital Age* (2017).
[12] Competition Commission of India, *Market Study on E-Commerce in India: Key Findings and Observations* (2020).

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3. Hypothesis

This paper develops the thesis that the standard approach to the concept of intent in the context of competition law is not well-suited for addressing the problem of algorithmic coordination in the context of AI-driven markets. Indeed, the standard approach to the concept of intent in the context of competition law is focused on the identification and deterrence of intentional coordination between firms, such as cartels or the intentional agreement to set prices. The standard approach to the concept of intent in the context of competition law often involves the demonstration of various factors such as communication, intent, or the concept of "meeting of the minds" between firms.[13] However, in the context of algorithmic markets, anti-competitive effects may occur in the absence of any intentional agreement or coordination between firms.

that algorithmic systems can be used to facilitate coordinated market behavior, even in the absence of direct communication. For instance, studies by Ariel Ezrachi and Maurice Stucke show that pricing algorithms can be used to generate favorable conditions for tacit collusion by quickly responding to changes in rival firms' pricing strategies, thereby maintaining supra-competitive prices.[14] Pricing algorithms also improve market transparency, making it less attractive for firms to engage in competitive pricing, thereby sustaining coordinated market behavior.[15] Other studies by Emilio Calvano, among other economists, have experimentally demonstrated that reinforcement learning algorithms can autonomously learn how to sustain collusive pricing strategies in repeated interactions in simulated markets.[16] This is evidence of a disconnection between traditional legal approaches and algorithmic systems.

In this context, this paper suggests that the key to accountability in such a scenario is the need for a hybrid liability structure that is informed by the principles of foreseeability, control, and risk generation in the context of the AI lifecycle. Rather than focusing on intent, competition law must begin to consider the extent to which firms were able to reasonably foresee the potential anti-competitive risks of deploying such algorithmic

[13] Richard A. Posner, *Antitrust Law* (2nd edn., University of Chicago Press, 2001).
[14] Ariel Ezrachi & Maurice E. Stucke, *Virtual Competition: The Promise and Perils of the Algorithm-Driven Economy* (Harvard University Press, 2016).
[15] Ariel Ezrachi & Maurice E. Stucke, "Artificial Intelligence & Collusion: When Computers Inhibit Competition," 2017 *University of Illinois Law Review* 1775.
[16] Emilio Calvano, Giacomo Calzolari, Vincenzo Denicolò & Sergio Pastorello, "Artificial Intelligence, Algorithmic Pricing, and Collusion," 110 *American Economic Review* 3267 (2020).

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systems and the extent to which they have implemented adequate controls. This is in line with the broader notion of corporate responsibility.

In this proposed structure, businesses that make use of algorithms in the market should remain the primary subject of responsibility with regards to anti-competitive practices. The businesses are the ones who set the objectives and parameters of the algorithms and are the ones who make use of them. Therefore, even if algorithms are used autonomously, businesses should not escape responsibility by stating that the processes are technological in nature. Several competition regulators have already indicated that businesses should not escape responsibility by stating that decisions are made autonomously.[17]

However, at the same time, the responsibility of the developers and designers of algorithmic systems can be implicated when the architecture of AI systems leads to foreseeable anti-competitive risks. For instance, the use of algorithms that track competitors' prices and engage in the automatic adaptation of pricing strategies can create the risk of coordination between firms.[18] If the developers of such systems know that they facilitate such practices, they can be implicated in the promotion of anti-competitive conduct.

Moreover, platform intermediaries, especially digital marketplaces and large online platforms, may have compliance obligations when they facilitate algorithmic interactions between competing firms.[19] They have the ability to control the infrastructure for algorithmic interaction, including pricing mechanisms, recommendation systems, and data access systems. Thus, they are in a better position to put in place measures that will reduce the possibility of algorithmic collusion.

This is particularly due to the fact that the hybrid approach of liability, by allocating responsibility throughout the lifecycle of AI systems, recognizes the socio-technical system in which the algorithmic markets are located.[20] By doing this, the regulators will

[17] Organisation for Economic Co-operation and Development (OECD), *Algorithms and Collusion: Competition Policy in the Digital Age* (2017).
[18] Ariel Ezrachi & Maurice E. Stucke, *Virtual Competition: The Promise and Perils of the Algorithm-Driven Economy* (2016).
[19] Competition Commission of India, *Market Study on E-Commerce in India: Key Findings and Observations* (2020).
[20] Nicolas Petit, "Antitrust and Artificial Intelligence: A Research Agenda," 8 *Journal of European Competition Law & Practice* 361 (2017).

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be in a position to address the issue of algorithmic collusion and any anti-competitive effects without the need for intent. The adaptation of the models is therefore critical in ensuring the success of competition law in the era of artificial intelligence.

4. Examination of the Hypothesis

4.1 Algorithmic Collusion and Market Coordination

The emergence of algorithmic pricing systems has greatly affected the dynamics of competition in the digital economy. Various companies in the economy, such as in the e-commerce industry, aviation, ride-hailing services, financial trading, among many more are using advanced algorithms in analyzing massive amounts of data in keeping track of the prices of their competitors in real-time.[21] Algorithmic pricing systems rely on the use of machine learning techniques and predictive analysis in generating the highest revenues, fulfilling the demands of the market, and keeping track of the changing dynamics in the market in real-time. Although the emergence of algorithmic pricing systems has greatly improved the efficiency of the market, it has also led to the phenomenon of algorithmic collusion, whereby the pricing algorithms used in the market are likely to interact in such a manner that it reduces the level of competition.[22]

There are various identifiable modes of algorithmic collusion. For instance, in their seminal paper on markets driven by algorithms, Ariel Ezrachi and Maurice Stucke propose that scenarios of algorithmic collusion can be categorized depending on the level of human involvement in the process.[23] This is in addition to the autonomy of the technology. This provides an understanding of how algorithmic collusion is made possible in the absence of the traditional cartelization process.

The first scenario is commonly referred to as the Messenger Model. In this case, the organizations have an express agreement to engage in cartel-like behavior and merely make use of the algorithms as an instrument to affect their agreement. The algorithm merely acts as a "messenger" that executes an agreed-upon pricing strategy and automatically adjusts prices

[21] Organisation for Economic Co-operation and Development (OECD), *Algorithms and Collusion: Competition Policy in the Digital Age* (OECD Publishing, Paris, 2017).
[22] Ariel Ezrachi & Maurice E. Stucke, *Virtual Competition: The Promise and Perils of the Algorithm-Driven Economy* (Harvard University Press, 2016).
[23] Ariel Ezrachi & Maurice E. Stucke, "Artificial Intelligence & Collusion: When Computers Inhibit Competition," 2017 *University of Illinois Law Review* 1775.

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in line with the objectives of the cartel. For instance, rival organizations may design their respective pricing algorithms to keep prices above a certain level or automatically react to raised prices by other organizations in the cartel.[24] As the intent to engage in cartel-like behavior is rooted in humans, this scenario is comfortably contained within the current competition law paradigm. The issue of liability is easy to determine in this case since the algorithm is merely facilitating an already illegal agreement between organizations.

A second form of coordination that has been identified is the Hub-and-Spoke Model, where the software provider acts as a third party and supplies pricing algorithms that are utilized by various competing firms. In the context of the hub-and-spoke model, the software developer essentially acts as the hub, and the firms that utilize the software are the spokes.[25] If the software allows for the coordination of pricing strategies among various users, whether intentionally or unintentionally, there are various implications that could arise, particularly in the context of facilitating a form of cartelization within the market. The issue of coordination among firms has been dealt with in the traditional context, particularly where there is an intermediary that coordinates pricing strategies among various competing firms. The algorithmic platforms, however, raise complex issues regarding the extent to which the software provider could be held liable for anti-competitive practices.

More complex from a legal viewpoint is the Predictable Agent Model. Under this model, different firms implement their own pricing algorithms that track competitors' prices and react accordingly. The algorithms may not engage in any communication with competitors, but they are quick to realize that intense price competition erodes profitability. As such, they may implement strategies that result in the maintenance of high prices and the avoidance of undercutting competitors. The issue is that the different firms may anticipate the predictable response of their algorithms to competitors and this could create an environment that is ripe for tacit coordination. However, there is no agreement among the different firms, but the predictable response could result in an outcome similar to that which occurs under collusion.

[24] Ariel Ezrachi & Maurice E. Stucke, *Virtual Competition: The Promise and Perils of the Algorithm-Driven Economy* (Harvard University Press, 2016).
[25] Organisation for Economic Co-operation and Development (OECD), *Algorithms and Collusion: Competition Policy in the Digital Age* (2017).

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The most complicated case is the Autonomous Collusion Model, in which sophisticated machine learning techniques learn the rules of cooperation by themselves in repeated market interactions. Research in computational economics has shown that reinforcement learning techniques can learn convergent rules of pricing collusion in repeated competition in a virtual market environment.[26] These techniques are not programmed with any knowledge of the rules of collusion; they simply learn by trial and error that keeping prices high is more profitable in the long run. Because the rules of cooperation are not explicitly programmed, it is virtually impossible to identify any specific human decision.

It is because of this that the Predictable Agent and Autonomous Collusion models pose the biggest challenge to the traditional competition regulations. The Predictable Agent and Autonomous Collusion models have created a new line of demarcation between intent-based collusion and the effects of autonomous technology. For instance, in these cases, it has not been easy for the regulators to rely on the traditional indicators of collusion and communication among the parties.[27] The sophistication of the level of algorithmic decision-making has a direct relationship with the sophistication of the level of coordination.

4.2 Limitations of Intent-Based Liability

A large part of the traditional framework of the competition law system has been the requirement of establishing the necessity of the "meeting of the minds" between the two or more competitors in order to establish the reality of the concept of cartelization. The enforcement of the concept of competition law in most of the jurisdictions of the world, including the US, the EU, and India, has traditionally been based on the necessity of establishing the reality of the existence of some form of communication or intent between the two or more competitors. This has included the establishment of the reality of the existence of emails, meetings, and price-fixing agreements between the two or more competitors. The part of the traditional framework of the system of competition law has been based on the traditional understanding that anti-competitive conduct is the result of

[26] Emilio Calvano, Giacomo Calzolari, Vincenzo Denicolò & Sergio Pastorello, "Artificial Intelligence, Algorithmic Pricing, and Collusion," 110 *American Economic Review* 3267 (2020).
[27] Herbert Hovenkamp, "Antitrust and the Algorithm," 81 *University of Colorado Law Review* 909 (2019).

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the decisions of individuals. The advent of algorithmic decision systems has exposed the limitation of such an understanding.[28]

In an algorithmic market, coordination may occur without the firms agreeing on anything. The pricing algorithms are becoming increasingly dependent on machine learning, which analyzes market trends and monitors their competitors' pricing strategies. The algorithms are able to perform at speeds and complexities that are beyond the scope of human thinking. The algorithms may independently learn that keeping higher price points or avoiding price wars leads to higher profitability. The algorithms may eventually agree on pricing strategies that could be seen as collusive, although the firms using the algorithms did not intend such an outcome.[29]

This concern finds backing in the empirical research carried out in the field of economics. In this regard, the research conducted by Calvano, Calzolari, Denicolò, and Pastorello shows that reinforcement learning algorithms have the potential to learn the adoption of collusive pricing strategies in a simulated economy.[30] In this study, the algorithms were simply programmed to maximize profits. However, the algorithms eventually learned the strategy of avoiding price competition and maintaining supra-competitive prices. It is imperative to note that the collusive strategy was learned autonomously by the algorithms and not programmed.

This, therefore, poses a problem in its enforcement. This is because, in order to prove collusion, intent or direct coordination would be needed. This, in turn, could allow firms to avoid being held accountable by arguing that the anti-competitive nature was a result of the autonomy of the algorithms. They could argue that these algorithms were not under their control, as the internal learning of these algorithms was beyond their expectations. This is because, in recent times, AI systems are best known for their complexity, being 'black boxes' even to their creators.[31]

[28] Ariel Ezrachi & Maurice E. Stucke, *Virtual Competition: The Promise and Perils of the Algorithm-Driven Economy* (Harvard University Press, 2016).
[29] Organisation for Economic Co-operation and Development (OECD), *Algorithms and Collusion: Competition Policy in the Digital Age* (OECD Publishing, Paris, 2017).
[30] Emilio Calvano, Giacomo Calzolari, Vincenzo Denicolò & Sergio Pastorello, "Artificial Intelligence, Algorithmic Pricing, and Collusion," 110 *American Economic Review* 3267 (2020).
[31] Frank Pasquale, *The Black Box Society: The Secret Algorithms That Control Money and Information* (Harvard University Press, 2015).

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As such, there is the possibility that an intent-based approach to antitrust policy might create blind spots in the regulation of AI markets.[32] If the relevant authorities are unable to properly address algorithmic coordination, there might be an increased reliance on automated systems that indirectly stabilize prices or facilitate tacit forms of collusion. As such, there is the possibility that the very purpose of antitrust policy, such as the promotion of consumer welfare, market efficiency, and the promotion of fair competition, might be undermined.

As such, various authors and policy think tanks, including the Organisation for Economic Co-operation and Development (OECD), have highlighted the importance of rethinking the approach that is taken in determining liability in algorithmic markets.[33] Rather than solely focusing on the requirement for proof of human intent, there is a possibility that various factors such as the potential risks associated with the algorithm, the approach taken by the firm in the design of the algorithm, and the competitive effects of the could be taken into account. The need for adapting the approach that is taken in determining liability is crucial for the continued effectiveness of competition law in dealing with the changing reality of AI economic activities.[34]

4.3 Corporate Responsibility for Algorithmic Conduct

Perhaps the most well-known solution to the problem of liability in AI-driven markets is to view algorithms as instruments or tools used by firms. This would imply that the firm would still bear responsibility in the event that an anti-competitive practice is implemented. This is because firms would not be able to escape liability simply by virtue of the fact that an automated system carried out the practice. This is in line with the general principle that firms must bear responsibility for the actions of the technologies that they utilize in pursuit of profit.[35]

This line of reasoning is in line with various established principles in different fields of law, such as product liability, corporate negligence, and agency law. For example, in product liability law, companies can be held responsible for defects in their products even

[32] Herbert Hovenkamp, "Antitrust and the Algorithm," 81 *University of Colorado Law Review* 909 (2019).
[33] OECD, *Algorithms and Collusion*, supra note 38.
[34] Hovenkamp, "Antitrust and the Algorithm," supra note 41.
[35] Herbert Hovenkamp, "Antitrust and the Algorithm," supra note 41.

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if the outcome was not intended by the company. Another example is in corporate negligence, where companies are expected to exercise reasonable care in the design of various technologies that might affect consumers or market conditions. Following these principles, it is apparent that companies can be held responsible if the algorithms that they design lead to anti-competitive behavior that was reasonably foreseeable.[36]

This point is supported by several competition law scholars. For example, Ariel Ezrachi and Maurice Stucke are of the opinion that "companies cannot escape liability simply by ceding decision-making authority to algorithms." They have further clarified that "algorithms are simply sophisticated means of implementing strategies that are in line with the incentives and objectives that the company sets." Thus, "if a company uses an algorithm that is programmed to maximize profits in a competitive environment, the company should be held liable for the consequences of the strategy, even if the consequences were not directly desired." This approach is in line with the approach proposed by the Organisation for Economic Co-operation and Development (OECD), which has emphasized the liability of the firms for the actions of the algorithms.[37]

However, corporate responsibility is also important from a policy point of view. If firms were allowed to avoid responsibility by arguing that anti-competitive effects were caused by autonomous algorithms, there could be a strong incentive for firms to use un-transparent technologies in order to avoid legal responsibility. This could create a loophole in competition laws, which could undermine their effectiveness.[38] By ensuring that firms remain responsible for the technologies they use, policymakers can ensure that firms continue to have an incentive to use algorithms that respect the principles of competition law.

However, such an approach that is based on liability might not capture the complexities of the digital markets properly. This is because the code that is used in the creation of the algorithm might not necessarily be created within the firm. Instead, it might have been created by a third-party developer, third-party data scientist, or even third-party software provider. It is possible that the developer might have some level of influence over the way that the algorithm is

[36] Hovenkamp, "Antitrust and the Algorithm," supra note 41.
[37] OECD, *Algorithms and Collusion*, supra note 38.
[38] Ezrachi & Stucke, *Virtual Competition*, supra note 37

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structured, as well as the way that it is utilized in relation to the interaction with numerous agents within the digital platform. It is also possible that the digital platform might have some level of influence over the way that the algorithm is structured, particularly in relation to pricing.

As such, algorithmic systems are often the result of an ecosystem of multi-layered technology, and therefore, the exclusive focus on the deploying firms might overlook the role of the developer, software, and platform intermediaries.[39] As such, although the concept of corporate responsibility is an integral part of the enforcement of competition law, there might be the need for the development of comprehensive approaches that consider shared responsibility.

4.4 Shared Accountability Across the AI Lifecycle

Though it is imperative to hold firms accountable for the algorithms that they use, it is equally important to recognize that, given the ever-increasing complexities of AI, it is no longer possible to attribute liability to a single actor. The AI ecosystem is usually built by different individuals, including software developers, data scientists, deploying firms, and digital platforms. The above assertion is true because, in recognizing a comprehensive approach to liability in AI-driven markets, it is imperative to recognize shared accountability in AI's entire lifecycle. The above assertion is true because it is important to recognize that anti-competitive outcomes may be attributed to different factors.

Firstly, the role of the developers and designers of the algorithmic systems must be considered. They are the ones responsible for the design of the algorithm's architecture, the models that the algorithm is trained on, the data that it is fed to learn from, and the objectives that it seeks to optimize. It is these factors that can lead to a considerable impact on the competitive markets that the algorithms operate within.[40] For instance, price algorithms that are programmed to monitor the prices set by competitors and respond to them accordingly could lead to a situation where these algorithms facilitate the setting of coordinated prices. Ariel Ezrachi and Maurice Stucke have argued that the design of these algorithms could lead to a predictable pattern that stabilizes the prices set within a market and reduces the incentive for price wars.[41] When the developers design the algorithms with

[39] OECD, *Algorithms and Collusion*, supra note 38.
[40] OECD, *Algorithms and Collusion*, supra note 38.
[41] Ariel Ezrachi & Maurice E. Stucke, "Artificial Intelligence & Collusion: When Computers Inhibit Competition," 2017 *University of Illinois Law Review* 1775.

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the intent to increase the likelihood of such a situation arising, it could be considered that they should be partially blamed for the situation that emerges.

Secondly, the firms that utilize algorithmic systems in the market ought to hold the primary responsibility for the competitive effects of such systems.[42] The deploying firms set the goals for the application of the algorithmic system, such as profit maximization, demand prediction, or market optimization. The firms are also responsible for the way the algorithmic system is integrated into their commercial strategies and the rate at which the algorithmic system is updated or monitored. As such, the firms that benefit from the increased efficiencies and profits derived from the algorithmic system ought to hold the primary responsibility for the algorithmic system. The OECD has highlighted that firms cannot escape responsibility for the anti-competitive effects of the algorithmic system by arguing that the effects are autonomously generated by the algorithmic system. Rather, firms ought to ensure that there are adequate checks in place for the algorithmic system.[43]

Third, digital platform operators, like online marketplaces, could also play an important role in facilitating algorithmic interactions among the market participants.[44] Indeed, digital platforms are often seen as a conduit for algorithmic pricing systems, including access to consumer data, market analytics, and pricing tools. There is also the possibility that digital platforms could design recommendation systems, ranking systems, and pricing interfaces that could indirectly influence the manner in which firms compete. The digital platform operators, like the online marketplaces, play an important role in shaping the digital environment in which algorithmic interactions take place. The digital platform operators, like the online marketplaces, could therefore potentially be in a position to implement measures that could mitigate anti-competitive algorithmic coordination.[45] For example, digital platform operators, like the online marketplaces, could monitor pricing patterns.

The shared accountability is in line with the reality that modern AI systems are not the result of actions taken by corporations in isolation from the socio-technical systems from which they

[42] Hovenkamp, "Antitrust and the Algorithm," supra note 41.
[43] OECD, *Algorithms and Collusion*, supra note 38.
[44] Competition Commission of India, *Market Study on E-Commerce in India: Key Findings and Observations* (2020).
[45] Competition Commission of India, *Market Study on E-Commerce in India: Key Findings and Observations* (2020).

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are developed. Rather, the outcomes of AI algorithms are the result of the combined actions of many actors whose actions drive the market dynamics. By recognizing the role of AI system developers, the firms that use AI systems, and the platform intermediaries, competition law is better positioned to address the challenges posed by AI-driven markets.[46] However, the approach is also valuable in facilitating compliance and innovation in AI systems while respecting the core principles of competition law, such as fairness in competition, consumer welfare, and market integrity.

4.5 Comparative Regulatory Approaches

The regulatory challenges posed by artificial intelligence in competitive markets have prompted different jurisdictions to review the approach to the application of competition law to algorithmic coordination and artificial intelligence-driven decision-making. The risks of algorithmic collusion and artificial intelligence-driven manipulation in the market are well acknowledged. However, the differences in the regulatory responses to these challenges from different jurisdictions are quite notable, depending on the legal traditions and the technology policy paradigms adopted in the different countries. The comparison of the regulatory responses adopted in the European Union, the United States, and India is highlighted in the subsequent parts of the chapter.

i. **European Union**

It is evident that the EU has taken the lead in the most proactive jurisdictions in the regulation of digital markets and artificial intelligence. The EU regulatory agenda is shifting towards the adoption of ex-ante regulatory measures that aim at addressing the issues that might arise in the market before they actually happen. The most prominent regulatory measures in this case are the Digital Markets Act (DMA) and the Artificial Intelligence Act (AI).

The DMA is focused on large digital platforms classified as “gatekeepers” and has obligations that aim to ensure fair competition in the digital environment. These obligations include aspects of transparency, access to data, interoperability, and restrictions on self-preferencing. Algorithmic pricing is not directly regulated by the DMA, although the DMA does address the structural environment in which algorithmic coordination or exclusionary behavior can occur.

The EU’s Artificial Intelligence Act also strengthens this regulatory approach by introducing a new risk-based governance regime for AI systems. The AI Act classifies AI applications based on the level of associated risks. The regime has strict rules for high-risk AI systems.

[46] OECD, *Algorithms and Collusion*, supra note 38

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Although the AI Act mainly addresses issues of safety, fundamental rights, and liability, the regulatory approach to transparency and auditability may also indirectly assist competition authorities in identifying potential issues of distorted competition. This forward-thinking regulatory approach can be understood in the context of the EU's general philosophy of digital markets needing to be governed by a set of preventative regulatory tools to address systemic risks associated with AI technologies.

ii. **United States**

In contrast, the United States has traditionally taken an effects-based approach to enforcing its antitrust laws. The United States has a competition law system that is based on specific statutes such as the Sherman Act and the Clayton Act.[47] The competition law system is primarily effects-based and not based on specific agreements or intent. The competition law system assesses the impact of business practices on competition and consumers, regardless of the specific technology used to implement them.

This framework could perhaps help the American authorities address the problem of algorithmic collusion by checking whether the automated pricing system leads to practices that are contrary to competition, such as the maintenance of supra-competitive prices and the weakening of market rivalry. It has even been proposed by various authors, such as Herbert Hovenkamp, that the entities must be held accountable for the practices of their algorithms, as these are simply instruments for the application of their competitive strategies.[48] The American authorities, including the Department of Justice (DOJ) and the Federal Trade Commission (FTC), have announced their concern regarding the application of algorithmic pricing tools that could allow the entities to coordinate in the market.

Nevertheless, the approach of the United States has been more measured in the adoption of ex-ante comprehensive regulations in relation to artificial intelligence. Instead, the focus has been on the application of existing competition policies, as well as the enforcement of competition policies on a case-by-case basis, including the application of antitrust policies and the investigation of practices in the digital market.

iii. **India**

In relation to the Indian competition law regime, as defined by the Competition Act, 2002, the focus has been on the application of competition law in relation to classical notions of cartelization and dominance.[49] The approach of the Competition Commission of India (CCI)

[47] The Sherman Antitrust Act, 15 U.S.C. §§ 1–7; the Clayton Act, 15 U.S.C. §§ 12–27.
[48] Hovenkamp, "Antitrust and the Algorithm," supra note 41.
[49] The Competition Act, 2002 (Act 12 of 2003).

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has been on the identification of specific forms of agreements or the existence of bid-rigging and coordinated behavior between undertakings. However, the application of existing principles is questionable in relation to the assessment of coordinated behavior in the absence of communication and intent.

Nevertheless, there is an increased recognition of the digital market issues within the regulatory sphere in India. For instance, the report published by the Competition Commission of India on the market study of E-commerce (2020) recognized the growing importance of data-driven decision-making, pricing algorithms, and other digital market issues.[50] This has therefore created an environment for debate on the implications for the application of competition law in addressing the technology-related risks.

India is also in the process of formulating policies on the regulation of AI and the digital economy, which could provide an opportunity for the incorporation of the necessary provisions for the application of competition law. As the digital market continues to grow and the adoption of AI technology increases in India, the need for the application of competition law could arise.

Thus, in summary, the above regulatory environment in a comparative context reveals that various countries and jurisdictions around the world are experimenting and trying different regulatory approaches in the AI-driven market. While the EU is promoting the regulation of AI, the USA is relying on the effects-based enforcement of antitrust regulations, and India is slowly but steadily exploring the regulation of antitrust laws. This reveals that it is imperative to develop a regulatory environment that can effectively deal with issues of algorithmic coordination.

5. Conclusion

The rapid integration of artificial intelligence in decision-making in the market is one of the most transformative phenomena in economic governance in recent times. Algorithms are now used in a variety of competitive processes in the market, including price strategies, product rankings, advertising strategies, and optimization strategies. In a digital economy, algorithms can process enormous information in real-time in response to changing market conditions, enabling firms to make strategic decisions in real-time with unprecedented accuracy. Although these algorithms have greatly contributed to a more efficient market with more innovation and convenience for consumers, they pose a complex challenge for competition law enforcement.

[50] Competition Commission of India, *Market Study on E-Commerce in India: Key Findings and Observations* (2020).

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One of the biggest issues of concern is that of algorithmic coordination, wherein prices determined by autonomous pricing algorithms may coordinate with each other to produce stability in prices, reduce competitive pressure, or lead to behaviors that are similar to cartelization. What is of key interest here is that such coordination may happen in the absence of any agreement or communication between firms. There is also evidence from the field of computational economics showing that machine learning algorithms, when programmed to maximize profits, may over time converge to coordination by engaging in repeated market interactions. What is of key interest here is that, as argued by Ariel Ezrachi and Maurice Stucke, algorithmic systems may create a new world in which tacit coordination may be easier to sustain since algorithms may instantaneously monitor and react to their competitors' actions.
The conventional antitrust approaches were designed in an era when anti-competitive behavior was conceived as the product of deliberate human choices. In this regard, antitrust approaches focus on the need to identify anti-competitive behavior through explicit agreements, communication between competitors, and intent to engage in anti-competitive behavior. However, the rise of AI markets presents a problem for antitrust approaches since it is difficult to identify a “meeting of the minds” when pricing algorithms develop independent learning strategies for engaging in supra-competitive behavior. In this regard, the lack of evidence of communication and coordination can create a problem for antitrust approaches in addressing anti-competitive behavior.

As this paper has demonstrated, this requires a move beyond intent-based frameworks of liability into a more comprehensive understanding of the concept of accountability in algorithmic markets. Rather than focusing on intent, a more comprehensive approach to understanding the application of competition law might encompass notions of foreseeability, control, and risk generation throughout the AI lifecycle. In this regard, companies utilizing algorithmic systems might still be held liable for the competitive effects of such systems, particularly where risks of coordination or distortion are reasonably foreseeable. At the same time, developers and platform intermediaries might also be seen as having a role to play in the creation of algorithmic systems, as part of a more comprehensive understanding of shared accountability.

By taking such a stance, the distributed character of technological decision-making in digital markets can be better appreciated. Algorithmic results are not the product of a single decision-maker but rather the outcome of complex interplay between developers, the deploying firm,

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and digital platforms. By acknowledging the complex interplay of actors in algorithmic decision-making processes, the law can more effectively address the allocation of responsibility and ensure that technological innovation does not undermine the structure of competitive markets.

Ultimately, the key to maintaining the principles of fair competition in AI-driven markets will be the adaptation and innovation of the regulatory framework. This will involve the creation of mechanisms that can improve transparency and algorithmic accountability while allowing competition authorities to effectively investigate automated market behavior. However, the regulatory framework should not be overly burdensome and inhibit the advancement of technological innovation. It is suggested that the delicate balance between innovation and accountability will be critical in ensuring that artificial intelligence enhances the principles of fair competition, rather than eroding them.

6. Suggestions and Policy Recommendations

The increasing use of artificial intelligence in competitive markets requires regulatory frameworks that can effectively address the risks associated with algorithmic decision-making. The traditional measures of competition laws are more reactive in nature and are geared towards imposing penalties on parties engaging in anticompetitive practices. However, this is not enough, as it is possible for anticompetitive practices to occur in markets utilizing algorithms before they can be addressed. For this reason, there is a need to develop multiple measures to ensure that markets utilizing algorithms are competitive. The following are policy recommendations on measures that can be adopted in ensuring market competition.

I. Algorithmic Transparency Requirements

One of the major difficulties which regulators often have to deal with is the fact that there is often little transparency in the way in which algorithms and AI-based systems operate. For example, there are many pricing algorithms which are based on artificial intelligence and are often complex systems which are difficult to understand, even for those who have developed them. This is an issue which has made it difficult for competition regulators to understand whether algorithms are being used to facilitate collusion between companies.

To deal with this, it is suggested that regulators should require companies which are using impactful algorithms to keep detailed records regarding the design and functionality of these algorithms. This can help regulators understand whether algorithms have been designed in a

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way which can foreseeably facilitate collusion between companies. Transparency can also be important in ensuring corporate accountability, as it can ensure that companies are more aware of the implications of the algorithms which they are using.

II. Algorithmic Auditing Mechanisms

In addition to that, there is a need to consider whether there is a need to create a system of algorithmic auditing. This is because independent audits by experts in the field could assist in establishing whether there are pricing patterns and competitive behaviors that could be a result of coordination and collusion between organizations. The audit could be done by analyzing whether pricing algorithms respond to competitor prices, whether they share data, and whether they use strategies to prevent price competition.

The audit could be done either periodically or after a detection of unusual pricing patterns in digital markets by competition authorities. The development of algorithmic audits would enable regulators to identify potential anti-competitive risks before they affect market competition in a significant way. Moreover, it would encourage organizations to use responsible practices by ensuring that their tools are subjected to external audit.

III. Compliance-by-Design Principles

Another significant policy intervention is the implementation of compliance-by-design principles in AI systems' design and deployment. In this regard, there is a need to incorporate compliance with competition laws in the design stage of algorithmic technologies. Instead of treating compliance as an afterthought, there is a need to incorporate compliance measures that reduce the possibility of anti-competitive behavior in the design of algorithmic technologies.

For instance, it is possible to design algorithmic technologies that prevent the monitoring of competitors' sensitive pricing information, raise alarms when there is suspicious pricing convergence, or prevent algorithmic responses that sustain supra-competitive prices. Such design-based solutions are likely to reduce the possibility of AI systems facilitating collusion.

IV. Shared Liability Frameworks

Algorithmic systems are generally a product of multi-layered technological ecosystems involving developers, deploying firms, data providers, and digital platforms. Hence, it is not always appropriate to hold a firm using an algorithm fully accountable for potential anti-competitive effects.

Competition law rules should therefore account for shared responsibility throughout the AI

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system's lifecycle. Developers of algorithmic architecture that creates a foreseeable risk of coordination may share responsibility for anti-competitive effects. The firm using the algorithm should remain fully accountable for anti-competitive effects since they decide how to use the algorithm in their commercial strategy. The platform operator hosting algorithmic interactions between competing firms should share responsibility for monitoring and controlling anti-competitive risks. This shared responsibility ensures all relevant actors are incentivized to act responsibly.

V. Regulatory Sandboxes for AI Markets

Regulators may also consider establishing regulatory sandboxes for AI-driven markets. Essentially, regulatory sandboxes are environments where companies can test new technologies under the close eye of the regulator before rolling out such technologies in the actual markets. These environments give competition regulators the opportunity to see how algorithmic systems interact with each other in order to identify potential risks.

Regulatory sandboxes give regulators access to technical expertise around algorithmic systems while at the same time allowing companies to test new technologies without risking potential harm to markets. This is likely to help regulators design better regulations while at the same time allowing for innovation to thrive.

VI. International Regulatory Cooperation

Finally, for algorithmic markets to be governed well, there is a need for international cooperation among competition authorities. This is because algorithmic markets and digital platforms tend to operate in multiple jurisdictions. This implies that anti-competitive practices may occur in multiple markets. Therefore, it would not be effective for competition authorities in individual countries to address algorithmic collusion.

It is recommended that competition authorities in various countries strengthen international cooperation in addressing algorithmic markets. This would involve sharing of information and establishing common regulatory guidelines. International organizations such as the Organisation for Economic Co-operation and Development (OECD) and the International Competition Network (ICN) would be of great importance in addressing algorithmic markets and competition.

Therefore, for algorithmic markets driven by artificial intelligence to be governed well, there is a need for proactive and adaptive regulatory approaches. This includes transparency measures, algorithmic audits, compliance-by-design approaches, shared liability approaches,

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and international cooperation. These approaches would collectively strengthen competition law enforcement in the age of artificial intelligence. By adopting these policy recommendations, it is likely that technological innovation would be of greater benefits to consumers while at the same time maintaining the basic principles of fair competition.