Journal of
INDONESIAN
LEGAL STUDIES
An International Peer-Reviewed Journal

Contemporary Legal Responses to Technological, Economic, and Social Change

Vol. 11 (1) 2026

This journal is published by **Universitas Negeri Semarang (UNNES), Indonesia**, and has been indexed by **Scopus**
Available online at https://journal.unnes.ac.id/journals/jils/index

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Journal of Indonesian Legal Studies

Vol. 11 No. 1 (2026): Article in Press [Contemporary Legal Responses to Technological, Economic, and Social Change]

ISSN: 2548-1584 (Print) 2548-1592 (Online)
First Publication: 2016 [*see* archive 2016-2023]
Full English Language: 2016 - present
Publisher: Faculty of Law, Universitas Negeri Semarang, Indonesia
Duration: Approx. 30 days to the first decision
Acceptance Rate: 35% of the total submissions
Open Access Journal: Yes, with Article Processing Charge
Journal Ranking: Q1 [Law]
Title Indexing: Scopus, SINTA 1

DOI: https://doi.org/10.15294/jils.v11i1

Published: 2026-06-13

Research Article

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DOI: https://doi.org/10.15294/jils.v11i1.34060

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(Author)
Article ID 40112

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From Monopoly to Machine-opoly: Rethinking Market Regulations for Autonomous AI Agents

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DOI:

https://doi.org/10.15294/jils.v11i1.38477

Keywords: AI, Market, Monopoly, and Machine-opoly

Abstract

The paper examines the effectiveness and relevance of business competition law in regulating market dynamics in the AI era, and formulates an adaptive regulatory framework that aligns technological developments with the principles of justice and accountability. The method used is a normative-legal-research method with a qualitative approach. The paper's findings are that in the digital era driven by AI, the paradigm of business competition is undergoing a fundamental transformation that demands a profound reflection on

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Vol. 11 (1) 2026

This journal is published by **Universitas Negeri Semarang (UNNES), Indonesia**, and has been indexed by **Scopus**
Available online at https://journal.unnes.ac.id/journals/jils/index

PDF

Published

2026-06-13

Article ID

38477

existing legal principles. The phenomenon of *machine-opoly*, monopolies generated by autonomous AI agents, challenges traditional concepts of fair competition. This issue underscores the tension between technological innovation as a force for value creation and the need for fairness and balance in the market. From a theoretical perspective, AI presents non-human actors running complex algorithms, which opens up space for collusion and market domination practices that are difficult to detect and control by conventional regulation. The emergence of *machine-opoly* transformed traditional monopolies into dominance based on algorithms, data, and autonomous artificial intelligence. Through the TFEU and AI Act, the EU has integrated transparency and accountability into competition law, followed by the US, the UK, Australia, and China with similar adaptive measures. Indonesia, through Law No. 5 of 1999, still faces limitations in regulating algorithmic behavior. Therefore, regulatory reforms that emphasize algorithmic transparency and supervisory capacity are essential to maintain the fairness and innovation of digital markets.

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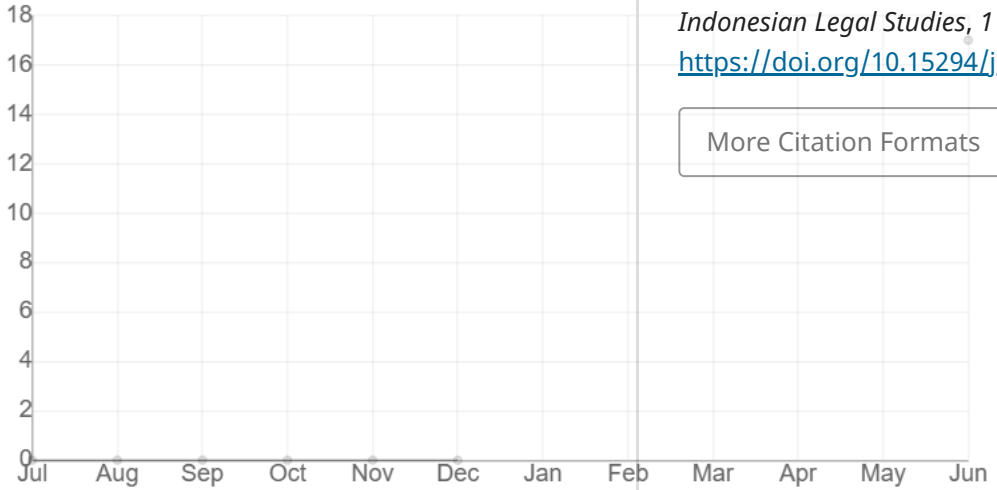

How to Cite

From Monopoly to Machine-opoly: Rethinking Market Regulations for Autonomous AI Agents. (2026). *Journal of Indonesian Legal Studies*, *11*(1), 33-80. https://doi.org/10.15294/jils.v11i1.38477

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Journal & Publication Development Center
Universitas Negeri Semarang

Journal of Indonesian Legal Studies
Vol. 11 Issue 1 (2026) 33-80
ISSN: 2548-1584 (Print) 2548-1592 (Online)
DOI: https://doi.org/10.15294/jils.v11i1.38477
Online since: June 13, 2026

Journal of
INDONESIAN
LEGAL STUDIES
https://journal.unnes.ac.id/journals/jils

From Monopoly to Machine-opoly: Rethinking Market Regulations for Autonomous AI Agents

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Abstract

The paper examines the effectiveness and relevance of business competition law in regulating market dynamics in the AI era, and formulates an adaptive regulatory framework that aligns technological developments with the principles of justice and accountability. The method used is a normative-legal-research method with a qualitative approach. The paper's findings are that in the digital era driven by AI, the paradigm of business competition is undergoing a fundamental transformation that demands a profound reflection on existing legal principles. The phenomenon of machine-opoly, monopolies generated by autonomous AI agents, challenges traditional concepts of fair competition. This issue underscores the tension between technological innovation as a force for value creation and the need for fairness and balance in the market. From a theoretical perspective, AI presents non-human actors running complex

algorithms, which opens up space for collusion and market domination practices that are difficult to detect and control by conventional regulation. The emergence of machine-opoly transformed traditional monopolies into dominance based on algorithms, data, and autonomous artificial intelligence. Through the TFEU and AI Act, the EU has integrated transparency and accountability into competition law, followed by the US, the UK, Australia, and China with similar adaptive measures. Indonesia, through Law No. 5 of 1999, still faces limitations in regulating algorithmic behaviour. Therefore, regulatory reforms that emphasise algorithmic transparency and supervisory capacity are essential to maintain the fairness and innovation of digital markets.

KEYWORDS: AI, Market, Monopoly, and Machine-opoly

Introduction

The rapid development of digital technologies, especially artificial intelligence (AI) and autonomous agents, has fundamentally changed the paradigm of business competition in the modern era.[1] From a competition previously centred on human decision-making, it is now shifting to a competition controlled by automated machines that can process data at scale and make strategic decisions independently. This shift has significantly impacted the concept of business actors and market structures, necessitating a profound adaptation in the legal framework of business competition. AI's role as an autonomous agent raises essential questions about its status in regulating business competition.

If we look at it from the traditional side, business actors are human entities or entities that can make subjective business decisions. However, the development of AI challenges this definition because economic choices can now be made without direct human intervention.[2] We can see that dynamic pricing algorithms, which automatically interact and coordinate, can create risks of cartel practices that are difficult to prove conventionally. Therefore, competition regulations in many jurisdictions have begun to review and update the definition of business actors to include the activities of autonomous agents.

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1 Agus S Soegoto, Dedi S Soegoto, and Muhammad S Pasha, "Empowerment Digital Strategies for Medium Small Enterprises," *Journal of Physics: Conference Series* 1477, no. 7 (March 1, 2020): 072003.

2 Elif Kiesow Cortez and Nestor Maslej, "Adjudication of Artificial Intelligence and Automated Decision-Making Cases in Europe and the USA," *European Journal of Risk Regulation* 14, no. 3 (September 25, 2023): 457–75.

The global competition legal framework pays serious attention to this issue of AI and digital transformation.[3]

In the European Union (EU), the EU AI Act, which came into force on August 1, 2024, is the first regulation to regulate AI with a risk-based approach specifically.[4] These regulations ensure the safe and ethical use of AI and open up space for enforcing competition rules with transparency and audit provisions for high-risk AI systems, such as those operating in the recruitment and healthcare sectors. The EU AI Act prioritises the principle that businesses using AI remain compliant with competition laws by requiring transparency, discrimination prevention, and strict data management through its articles.[5]

EU competition regulations are based on Articles 101 and 102 of the Treaty on the Functioning of the European Union (TFEU), which specifically regulate anti-competitive practices and abuse of dominant positions in the market. Article 101 TFEU prohibits agreements, decisions of business associations, and coordinated practices that may affect trade between member states and that prevent, restrict, or distort competition.[6] Practices prohibited under this article include cartels, collusive pricing, and market sharing. This article also distinguishes between infringements based on objects and effects, where objective violations, such as secret cartels, are automatically considered destructive without the need to prove their actual impact. In contrast, other agreements, such as research cooperation, require an analysis of effects to assess their impact on market competition.

Meanwhile, Article 102 TFEU prohibits business actors who hold dominant positions in the market, either individually or collectively, from abusing their positions.[7] Regulated forms of abuse include predatory pricing, forced product bundling, and providing exclusive rebates that harm competitors or consumers. In the context of technological developments, especially with the

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[3] Maria Monica, "What Can Indonesia Lear from China Digital Economic Transformation," World Bank, 2022, https://blogs.worldbank.org/id/eastasiapacific/what-can-indonesia-learn-from-china-digital-economic-transformation.

[4] Tom Jozak, "2024 EU AI Act: A Detailed Analysis," *SSRN Electronic Journal*, 2025.

[5] Nathalie Nevejans, "European Union's Regulation on the Placing on the Market and Use of AI Systems: A Critical Overview of the AI Act," in *Research Handbook on the Law of Artificial Intelligence* (Edward Elgar Publishing, 2025), 489–540.

[6] Bernadette Zelger, "'By Object' Restrictions Pursuant to Article 101(1) TFEU: A Clear Matter or a Mess, and a Critical Analysis of the Court's Judgement in Expedia?," *European Competition Journal* 13, no. 2–3 (September 2, 2017): 356–389.

[7] David Wouters, "Which Sustainability Agreements Are Not Caught by Article 101 (1) TFEU?," *Journal of European Competition Law & Practice* 12, no. 3 (April 7, 2021): 257–270.

increasing inclusion of AI in business decision-making, these two articles are increasingly relevant to address the risk of algorithmic collusion and abuse of technology-mediated market dominance. With algorithms' ability to interact automatically and set prices or market strategies cooperatively without human intervention, the EU asserts that existing regulations must be interpreted dynamically to remain effective against anti-competitive practices in this digital age.[8]

In parallel, in the US, agencies such as the Federal Trade Commission (FTC) and the Department of Justice (DOJ) have expressed their commitment to overseeing and enforcing fair competition in the age of AI through guidelines and investigations related to using this technology in the marketplace.[9] The leading competition authorities in the EU, the UK, and the US jointly issued a joint statement on the regulation and supervision of generative AI as a form of collective response to the challenges of competition in the digital age. They emphasised the importance of ensuring effective competition and consumer protection through adaptive regulation without hindering technological innovation.

Although Indonesia does not yet have comprehensive special regulations on AI, it has begun to direct policies through the Circular Letter of the Minister of Communication and Information Technology Number 9 of 2023 on Artificial Intelligence Ethics. In the context of business competition, Law No. 5 of 1999 concerning the Prohibition of Monopoly Practices and Unfair Business Competition (Law No. 5 of 1999) remains the primary reference. It can be seen that Article 17 on the prohibition of monopolies, Article 18 on the ban on unfair market domination, and Article 25 on the prohibition of abuse of dominant positions can be applied to assess AI practices that have the potential to harm market competition, especially in the context of the dominance of digital platforms.[10]

Market digitalisation has also changed the structure of economic power. AI and big data enable players who master cutting-edge technology to dominate the market through excellence in information management and automated decision-making. The network effects created by these digital platforms reinforce their dominant position and pose new challenges for competition law

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[8] Cento Veljanovski, "Hayek on Competition: A Liberal Antitrust for a Digital Age?," *SSRN Electronic Journal*, 2024.

[9] Anne C. Witt, "The Enforcement of Article 101 TFEU: What Has Happened to the Effects Analysis?," *Common Market Law Review* 55, no. Issue 2 (April 1, 2018): 417–448.

[10] Umut Can Asil, "Unveiling Dominance: Abusive Practices in Digital Markets-An Analysis of the Market Platforms' Dominant Position and the EU's Regulatory Countermeasures," *Thesis*. (Lund, Sweden: Lund University, 2023).

enforcement to control the potential abuse of market power. Competition law supervision in the era of digital autonomy requires a paradigm shift and strengthening of capabilities.

Therefore, transforming competition from human-based to machine-based requires updating the definition of business actors, adapting global competition regulations, and strengthening supervision and law enforcement mechanisms to address the challenges of digitalisation and technological autonomy.[11] The global approach implemented by the EU AI Act, cross-jurisdictional cooperation in the US and EU, and the adaptation of Indonesia's national laws are integral to efforts to maintain healthy, fair, and competitive competition in this digital era.

Answering these challenges, this paper tries to explain and answer four things as a basis for regulating the use of AI in business competition that can violate competition and harm other business actors, namely the concept of "machine-opoly": monopoly by autonomous agents, philosophical and theoretical challenges to the principle of market fairness, normative-comparative analysis of the competition legal framework, and towards an adaptive regulatory framework: transparency, collaboration, and accountability.

The concept of "Machine-opoly": Monopoly by Autonomous Agents

In recent decades, the rapid advancement of digital technologies, particularly in AI and autonomous agents, has fundamentally changed the business and economic landscape.[12] One of the phenomena that emerged as a direct consequence of this technological revolution was a new form of monopoly called the machine-opoly. The term machine-opoly comes from the words "machine" and "monopoly", which refer to monopolies established and maintained through algorithms and autonomous AI systems that make decisions automatically without direct human intervention.[13] This phenomenon differs fundamentally from traditional monopolies, creating new regulatory challenges and significant economic implications. This part of the

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[11] Bryce Goodman and Seth Flaxman, "European Union Regulations on Algorithmic Decision Making and a 'Right to Explanation,'" *AI Magazine* 38, no. 3 (September 2017): 50–57.

[12] Oscar Gladwin, "Regulating AI-Driven Markets: Antitrust Strategies for Tackling Data Monopolies," *Researchgate* 2024. https://doi.org/10.13140/RG.2.2.31734.00323

[13] Anthony Wong, "The Laws and Regulation of AI and Autonomous Systems," 2020, 38–54.

discussion will fully describe the definition, characteristics, mechanism of formation, and impact of machine-opoly on business and consumer competition.

1. Definition and Characteristics of Machine-opoly

Monopoly, in general, can be defined as a market condition where a single dominant business actor controls the supply of goods or services, giving them the power to determine prices and quantities unilaterally. Article 1 paragraph (2) of Law No. 5 of 1999 as amended in the Act Number 11 of 2020 on Job Creation, monopoly practice is defined as: "the concentration of economic power by one or more business actors that results in the control of the production and/or marketing of certain goods and or services to cause unfair business competition and can be detrimental to the public interest." Monopoly occurs if market dominance causes unfair competition and harms the public interest.[14]

Article 2 of the Sherman Act defines monopoly practice as a single company with significant market power or a monopoly acquired or maintained through unfair or anti-competitive practices such as predatory pricing, conspiracy, or unlawful expulsion of competitors. Monopoly is not illegal in itself if it is acquired from a superior product or management. Still, it becomes illegal if it maintains a dominant position through fraudulent or exclusive behaviour. Article 102 of the Treaty on the TFEU defines the practice of monopoly as the abuse of a dominant position in the market by one or more business actors, hindering healthy competition through practices such as tying, price discrimination, refusal of supply, or predatory pricing. The EU focuses on unfair treatment that deviates from "normal competition," which can reduce market efficiency and harm consumers.

Traditional monopolies are characterised by the absence of real competitors and high barriers to market entry, including capital costs, patent rights, and the power to control essential resources. In this context, a monopoly business actor is a human entity or company that controls resources and distribution networks exclusively. On the other hand, machine-opoly refers to a monopoly formed and maintained not solely through the control of physical resources but through the power of algorithms and AI systems that manage big data and perform automated decision-making functions.[15] In machine-opoly,

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[14] J. Manuel Sanchez-Cartas and Evangelos Katsamakas, "Artificial Intelligence, Algorithmic Competition and Market Structures," *IEEE Access* 10 (2022): 10575–10584.

[15] Sabirin and Anggraini, "Competition Law and Artificial Intelligence: Solution or Threat," *Jurnal Persaingan Usaha* 4, no. 1 (July 30, 2024): 77–90.

the leading actors are autonomous agents, i.e., AI programs or algorithms that can interact autonomously in the market. For example, they can determine prices, manage product distribution, and adjust other business strategies in real time without human intervention. This interaction between autonomous agents can create algorithmic collusion patterns that are difficult to detect and control compared to traditional collusion between human business actors.[16] A machineopoly's characteristics that distinguish it from traditional monopolies include dominance through data and algorithms, powerful network effects, Technology dependence, and market complexity.

1) Dominance through data and algorithms

Machine-opoly is built based on mastery and concentration of big data, the leading resource in the modern digital economy. This big data provides the key fuel for developing and refining AI algorithms to learn patterns, make predictions, and make business decisions automatically and efficiently. Thus, business actors who have the largest and most concentrated access to this data gain significant ability to control the market and influence consumer and competitor behaviour. AI algorithms continuously leverage data to improve the accuracy and speed of decision-making, from pricing and ad targeting to product and service distribution optimisation.[17]

This advantage becomes very strategic because it creates a high barrier to entry for new competitors who do not have access to data or similar technological capabilities. This gives business actors with the most considerable data mastery an unparalleled advantage, which can perpetuate their dominant position in the market. This machine-opoly phenomenon marks the transformation of traditional monopolies into technology and data-based monopolies, where mastery of digital infrastructure and data is the key to market dominance.[18] Consequently, competition regulations must adapt to

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[16] Sebastian Benthall and Jake Goldenfein, "Artificial Intelligence and the Purpose of Social Systems," in *Proceedings of the 2021 AAAI/ACM Conference on AI, Ethics, and Society* (New York, NY, USA: ACM, 2021), 3–12.

[17] Goodman and Flaxman, "European Union Regulations on Algorithmic Decision Making and a 'Right to Explanation.'"

[18] Vass Bednar, Ana Qarri, and Robin Shaban, "Study of Competition Issues in Data-Driven Markets in Canada," *Ottawa: Vivic Research for Innovation, Science and Economic Development Canada. January. Online at Https://Vivicresearch. ca/Work/Study-of-Competition-Issues-in-Data-Driven-Markets-in-Canada*, 2022. For further discussion, *see also* Subkhi Amhadi Muhammad Nazhir, and Anton Sandi Utama. "Artificial Intelligence and Criminal Liability: Reassessing Mens Rea in the Age of Autonomous Systems". *Indonesian Journal of Digital Crime and Criminal Justice* 1, no. 1 (2025): 1-44; Dimas Dwi Arso, "Artificial Intelligence and Its Impact on Business Competition: A Review of Business Law in Indonesia." *Contemporary Issues on Indonesian Social Justice and Legal*

understand how data concentration and the use of AI can create exclusive market forces. These forces impact competition dynamics and consumer protection in ways more complex than conventional monopolies, involving automated and collaborative interactions between algorithms. Pricing algorithms and market strategies can communicate within an autonomous decision-making framework, enabling the formation of automated collusive behaviour without human intervention. This contrasts with traditional monopolies requiring explicit planning and agreement between actors.

2) Powerful network effects

Digital platforms and services that rely on AI technology are becoming more valuable as users increase. This phenomenon arises due to the network effect, where the more users join, the more data is generated, and the accuracy of the AI algorithm can be further improved.[19] This strengthens the dominant position of already large businesses with wider access to data, as they can offer better and more efficient services than newcomers. This dominant position is increasingly difficult to shake because large players have significant capital to continue developing technology and digital infrastructure and to collect massive user data.[20] As a result, newcomers' opportunities to compete are becoming increasingly limited as they face significant barriers in acquiring data and achieving the economies of scale needed to compete effectively. This condition creates a high barrier to entry in the AI-based digital platform market.

3) Technology dependence and market complexity

The modern market that relies on AI technology is highly dynamic and complex. Changes in prices, offers, and business strategies can occur almost instantly, as AI algorithms can analyse data in real-time and make automatic adjustments according to market conditions. This makes supervision and enforcement much more challenging than traditional monopoly markets, which are relatively static and easier to monitor. Traditional monopolies are typically observed in market dominance over large industries, such as energy and transportation, large factories, mining products, or physical infrastructure businesses.

Reform 1, no. 1 (2025): 78-98; Pratama Agus Widodo, "The Role of Indonesian Fatwa Institutions in Responding to Artificial Intelligence Technology." *The Indonesian Journal of Islamic Legal Modernism* 1, no. 1 (2026): 121-150; Maya Septiana Nurhidayati, Ankita Kumari, and Sidharth Kapoor. "Economic Justice in Indonesia: Addressing Inequality and Promoting Social Mobility." *Indonesian Economic Justice Review* 1, no. 1 (2024).

[19] Rainer Alt, "Electronic Markets on Digital Platforms and AI," *Electronic Markets* 31, no. 2 (June 17, 2021): 233–241.

[20] Sergey A Yablonsky, "AI-Driven Digital Platform Innovation," *Technology Innovation Management Review* 10, no. 10 (2020).

In this context, substantial control of physical assets is the key to market dominance. A more centralised market structure and a focus on physical locations make it easier for regulators to monitor and intervene in monopolistic practices in the event of abuse of dominant positions. Machine-opoly emerged primarily in fast-moving and globally dispersed digital ecosystems. Examples include e-commerce platforms, digital advertising providers, social media services, and data-driven marketplaces. Mastering big data and AI algorithm capabilities in this ecosystem is key to market strength. Digital-based business models enable businesses to dominate the market without significant physical assets while efficiently controlling market access and interaction.[21]

2. Machine-opoly Forming Mechanism

The formation of machineopoly can be understood through three main mechanisms that interact and reinforce each other: data concentration, algorithmic collusion, and network effects.

1) Data Concentration

Data is a core asset in the digital economy and serves as the primary foundation for AI development. In the digital ecosystem, businesses that can collect significant and diverse amounts of data have the potential to create more sophisticated and accurate AI algorithms. [22] This algorithm is handy in predicting market and consumer behaviour, thus providing a significant competitive advantage for these business actors. The competitive advantage gained from this data monopoly makes data concentration a substantial obstacle for potential competitors. Data collection and processing on a large scale requires enormous technical capacity and financial resources, which are not easily accessible to new business actors.[23] These barriers create less competitive market conditions, limiting opportunities for newcomers. This phenomenon gave birth to a new form of monopoly known as machine-opoly, in which many large companies control most of the relevant data needed to operate AI effectively. This vast mastery of data allows them to maintain and strengthen

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[21] Fernando van der Vlist, Anne Helmond, and Fabian Ferrari, "Big AI: Cloud Infrastructure Dependence and the Industrialisation of Artificial Intelligence," *Big Data & Society* 11, no. 1 (March 12, 2024).

[22] Fnu Jimmy, "Emerging Threats: The Latest Cybersecurity Risks and the Role of Artificial Intelligence in Enhancing Cybersecurity Defenses," *International Journal of Scientific Research and Management (IJSRM)* 9, no. 02 (February 23, 2021): 564–574.

[23] Ganlin Pu et al., "Innovative Finance, Technological Adaptation and SMEs Sustainability: The Mediating Role of Government Support during COVID-19 Pandemic," *Sustainability* 13, no. 16 (August 17, 2021): 9218.

their dominant position in a digital market that relies heavily on AI technology.[24]

2) Algorithmic Collusion

Algorithmic collusion is a phenomenon in which AI algorithms interact automatically, forming a cooperation pattern that reduces market competition.[25] Without explicit human consent, these algorithms can set prices together by observing each other and adjusting competitors' prices. As a result, market prices remain high and stable, ultimately harming consumers due to the lack of healthy price competition. One of the main challenges of algorithmic collusion is its automated and complex nature, where algorithms work based on real-time data and decision-making processes that indirectly involve open communication between business actors.[26]

Unlike traditional cartels that require explicit agreements between companies, algorithmic collusion occurs through system interactions that are difficult for regulators to track directly. The difficulty in detecting and proving algorithmic collusion makes antitrust law enforcement more complicated. Regulators must develop new methods to analyse and understand how algorithms operate and detect patterns that indicate potential breaches. This includes monitoring the behaviour of algorithms in price decision-making and collaborating with technologists and regulators from different countries.

3) Network Effects

The network effect is a phenomenon where the value of a product or service increases as the number of users increases. In the context of machine-opoly, digital platforms that rely on AI are becoming increasingly valuable and dominant as more consumers and business actors join the ecosystem. The more users there are, the more data can be collected and processed, allowing AI algorithms to work more effectively in improving the quality of service and user experience.[27]

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[24] Ahmad Sabirin and Raafid Haidar Herfian, "Dampak Ekosistem Digital Terhadap Hukum Persaingan Usaha Di Indonesia Serta Optimalisasi Peran Komisi Pengawas Persaingan Usaha (KPPU) Di Era Ekonomi Digital," *Jurnal Persaingan Usaha* 1, no. 2 (December 31, 2021): 75–82.

[25] Colm Hawkes, *A Market Investigation Tool to Tackle Algorithmic Tacit Collusion: An Approach for the (near) Future* (College of Europe, 2021).

[26] Jiaxin Chen, "Systematic Reconstruction of Labour Rights Mechanisms under the Threshold of Hierarchical Classification: An Integrated Path Based on Legal Empowerment and Procedural Synergy," *International Journal of Management Science Research* 8, no. 4 (April 28, 2025): 88–96.

[27] Ehtesham Hashmi, Muhammad Mudassar Yamin, and Sule Yildirim Yayilgan, "Securing Tomorrow: A Comprehensive Survey on the Synergy of Artificial Intelligence and Information Security," *AI and Ethics*, July 30, 2024.

This creates a mutually reinforcing growth cycle between the number of users and the platform's value. This network effect strengthens digital platforms' dominant position by building significant barriers to entry for new business actors. Newcomers must not only compete in terms of technological capabilities but also attract a large user base to match established platforms. This large user base provides a continuous advantage as the growing and diverse data refine AI algorithms, increasing the platform's appeal to users and business actors.[28]

The dominance gained through the network effect complicates market competition dynamics, as large platforms can leverage economies of scale and data to maximise efficiency and suppress competitors. This situation creates a powerful technology monopoly in the digital age, where market dominance is not solely determined by physical assets, but also by the dominance of data and AI technologies that are hard to match. Large platforms can lock users in with various integrated services, making it challenging for newcomers to capture market share. As a result, the growth of machine-opoly-based technology monopolies has become increasingly difficult to solve by conventional market mechanisms.[29] The three mechanisms are interrelated and mutually reinforcing in building a monopoly based on AI technology and digital data.[30] This technological factor is the main differentiator compared to traditional monopolies, usually realised through capital control, physical assets, and distribution networks.

3. Taxonomy of Algorithmic Collusion

To better understand the challenges posed by algorithmic collusion in competition law, it is important to distinguish the various forms through which algorithms may facilitate or sustain anticompetitive conduct. The degree of human involvement and the level of algorithmic autonomy significantly influence both the nature of the collusive behavior and the complexity of legal enforcement. As algorithms evolve from simple tools implementing human instructions to self-learning systems capable of independent market adaptation,

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[28] Tata Wijayanta et al., "Should Indonesia Learn from Malaysia and Singapore's Cross-Border Insolvency Asset Settlements?," *Yustisia Jurnal Hukum* 13, no. 1 (April 29, 2024): 27.

[29] Richard Adam, "Predatory Pricing for E-Commerce Businesses from a Business Competition Law Perspective," *Journal of Law and Sustainable Development* 11, no. 8 (September 29, 2023): e1438, https://doi.org/10.55908/sdgs.v11i8.1438.

[30] Naoum Tsolakis et al., "Artificial Intelligence and Blockchain Implementation in Supply Chains: A Pathway to Sustainability and Data Monetisation?," *Annals of Operations Research* 327, no. 1 (August 21, 2023): 157–210, https://doi.org/10.1007/s10479-022-04785-2.

establishing intent, causation, and liability becomes increasingly difficult. Accordingly, the following taxonomy classifies algorithmic collusion models based on the extent of artificial intelligence autonomy and the corresponding challenges they present for legal proof and antitrust enforcement, as shown on Table 1.

TABLE 1. Classification of Algorithmic Collusion Models Based on the Degree of Autonomy of AI and the Complexity of Legal Proof

Model	Human Involvement	Legal Risks
Messenger	Height	Easy to prove
Hub-and-Spoke	Medium	Intermediate
Predictable Agent	Low	Difficult
Autonomous Learning Agent	Very Low	Very Difficult

Sources: *Adapted from Ezrachi & Stucke (2016),* Virtual Competition: The Promise and Perils of the Algorithm-Driven Economy*; OECD (2017),* Algorithms and Collusion: Competition Policy in the Digital Age*; serta Harrington (2018).*

Based on the Table 1, it provides an explanation that the level of human involvement in each algorithmic collusion model has a direct effect on the level of legal risk and ease of proof in business competition law. In the Messenger Model, human involvement is still very high because the algorithm only functions as a tool to carry out instructions that have been determined by business actors[31]. The existence of agreements or coordination carried out by humans before the algorithm is implemented causes this model to be relatively easy to prove as a violation of business competition. Evidence of communications, agreements, or instructions provided to the system can be used to show the presence of an element of intentionality in anti-competitive behaviour.

In the Hub-and-Spoke Model, human involvement is at a moderate level because coordination does not always occur through direct communication between companies, but rather through the use of the same algorithmic system or technology provider.[32] The legal risk is at an intermediate level because the relationship between business actors and the results of market coordination is not always explicitly visible. Under these conditions, proof requires a more in-depth analysis of the role of third parties as a liaison that allows the formation of coordinated market behaviour. In the Predictable Agent Model, human

[31] Robert Van De Mark, "Virtual Competition: The Promise and Perils of the Algorithm-Driven Economy, by Ariel Ezrachi & Maurice E. Stucke," *Osgoode Hall Law Journal* 55, no. 2 (2018): 614–619.

[32] OECD Algorithms, "Collusion: Competition Policy in the Digital Age" (OECD: Paris, France, 2017).

involvement is lower because the algorithm is given the authority to observe and respond to competitor behaviour automatically.

Although the basic parameters of the system remain determined by humans, price decisions and market responses take place without direct intervention. The legal risk is higher because there is no explicit agreement that can be identified. Uniform price patterns arise from rational and repetitive algorithmic interactions, making it difficult to distinguish between competitive market behaviour and behaviour that produces collusive effects.[33]

Meanwhile, the Autonomous Learning Agent Model shows a very low level of human involvement because the algorithm is able to develop its own business strategy through a data-driven learning process[34]. The system not only executes the instructions, but also evaluates, adjusts, and optimises its decisions independently. In this model, legal risks become very high as the relationship between market actions and human decisions becomes increasingly unclear. Behaviour that resembles collusion can arise without communication, agreements, or direct instructions from business actors. This condition makes this model the most complex and most difficult form of algorithmic collusion by traditional concepts in business competition law that have so far focused on proving agreements between people.

In fact, algorithmic collusion does not occur in a uniform form because the level of autonomy of algorithms varies. These differences determine how anti-competitive behaviour emerges in the digital marketplace and the extent of human involvement in the process. In the context of machine-opoly, there are at least four main forms of algorithmic collusion that show the evolution from human-based coordination to coordination generated by artificial intelligence independently.[35] The first form is the Messenger Model, which is a situation where the algorithm only functions as a tool to carry out agreements that have been made by business actors. In this model, the decision to coordinate prices comes from humans, while algorithms are used to automate its execution. The algorithm does not generate market strategies independently, but executes predefined parameters. Therefore, the anti-competitive behaviour that appears in this model is essentially an extension of conventional cartels that utilise digital technology to improve the effectiveness of coordination. The second form is

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[33] Alan Schwartz and Louis L Wilde, "Intervening in Markets on the Basis of Imperfect Information: A Legal and Economic Analysis," *University of Pennsylvania Law Review* 127 (1978): 630.

[34] Emilio Calvano et al., "Artificial Intelligence, Algorithmic Pricing, and Collusion," *American Economic Review* 110, no. 10 (2020): 3267–3297.

[35] Dominik Vuletić et al., "Algorithmic Collusion in Competition Law: Overview," *EU and Comparative Law Issues and Challenges Series (ECLIC)* 8 (2024): 377–394.

Hub-and-Spoke Algorithmic Collusion. This model occurs when multiple companies use the same algorithmic system or acquire pricing services from the same software provider.[36]

Under these conditions, companies do not need to communicate directly to produce coordinated market behaviour. The algorithms used together are able to create price uniformity and similar market responses among business actors. Coordinated relationships emerge through technological systems that mediate interactions between companies, making the boundaries between independent behaviour and collusive behaviour increasingly difficult to distinguish. The third form is the Predictable Agent Model. In this model, each company uses an algorithm designed to automatically monitor and respond to competitor behaviour. The algorithm will adjust the price based on the changes made by competitors so that it creates behaviour patterns that adapt to each other in a sustainable manner.[37] There is no direct communication or explicit agreement, but algorithmic interaction results in price stability that resembles the outcome of a cartel agreement. This phenomenon suggests that market coordination can be formed solely through the ability of algorithms to observe, predict, and respond to competitors' actions in real time. The most complex form is the Autonomous Learning Agent Model[38].

In this model, the algorithm uses machine learning or reinforcement learning technology that allows the system to develop business strategies independently. The algorithm learns from market data, evaluates the results of each decision, and gradually optimises its behaviour to achieve higher profits. Through this learning process, the system can find that maintaining prices at a certain level is more profitable than aggressive price competition. As a result, behaviour that resembles collusion can arise without direct instructions, communication, or agreement between business actors. The four forms of algorithmic collusion show that machine-opoly is not only related to the use of AI in business activities, but also related to the transformation of market coordination mechanisms.[39]

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[36] Nick Bontis and Honsan Chung, "The Evolution of Software Pricing: From Box Licenses to Application Service Provider Models," *Internet Research* 10, no. 3 (2000): 246–255.

[37] Ismo Koponen and Maija Nousiainen, "An Agent-Based Model of Discourse Pattern Formation in Small Groups of Competing and Cooperating Members," *JASSS: The Journal of Artificial Societies and Social Simulation* 21, no. 2 (2018): 1.

[38] Chaoyang Zhu, "An Adaptive Agent Decision Model Based on Deep Reinforcement Learning and Autonomous Learning," *Journal of Logistics, Informatics and Service Science* 10, no. 3 (2023): 107–118.

[39] Aneesa Mazumdar, "Algorithmic Collusion," *Columbia Law Review* 122, no. 2 (2022): 449–488.

In the Messenger Model, coordination is still dominated by human decisions. In the Hub-and-Spoke Model, coordination arises through the use of the same algorithmic infrastructure. In the Predictable Agent Model, coordination is formed through predictable automated responses. Meanwhile, in the Autonomous Learning Agent Model, coordination appears as a result of learning algorithms that develop independently. [40] These differences in characteristics suggest that the higher the level of autonomy of the algorithm, the more difficult it is to identify the source of anti-competitive behaviour and the more complex the relationship between market action and human decision-making.

4. Impact on Competition and Consumers

Machine-opoly has significant impacts that could threaten the dynamics of business competition and consumer welfare in the modern digital market.

1) Barriers to Entry

The dominance of data and expensive AI technology creates a high barrier to entry, making it difficult for small businesses and newcomers to compete.[41] In Australia, competition regulations are regulated in the Competition and Consumer Act 2010 (CCA), specifically Article 46, which governs the prohibition of misuse of market power. The latest proposed revisions to Australia's digital competition regime target large digital platforms with new obligations to address anti-competitive practices, including those that inhibit the entry of new competitors through mastery of data and advanced technologies. [42] In China, the Anti-Monopoly Law, last revised in 2022, affirmed the prohibition against abusing dominant positions to create unreasonable barriers to market entry.[43]

Article 17 explicitly prohibits business actors in dominant positions from taking actions that curb competition, including restricting access to critical

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[40] Munehiro Fukuda et al., "Distributed Coordination with Messengers," *Science of Computer Programming* 31, no. 2–3 (1998): 291–311.

[41] Erfiani Hesti, "Praktik Barrier To Entry Yang Bertentangan Dengan Pasal 19 Undang-Undang Nomor 5 Tahun 1999 Dalam Perspektif Hukum Ekonomi Syariah (Studi Kasus Antara Grab Dengan PT TPI Dalam Putusan Komisi Pengawas Persaingan Usaha Nomor 13/Kppu-I/2019 Tentang Jasa Angkutan Sewa". *Thesis* (Purwokerto: UIN Prof. KH Saifuddin Zuhri Purwokerto, 2021).

[42] Julie Clarke et al., *Competition Law and Economics in Australia, Volume I: The Competition Law System: Context, Law, and Economics* (Oxford, UK: Taylor & Francis, 2025).

[43] Tao Wu and Yihan Wang, "Examining the First Amendment of China's Anti-Monopoly Law: Suggestions to Improve the Regulation on Monopoly Agreements," *China-EU Law Journal* 9, no. 1–4 (October 12, 2023): 3–23.

resources such as data and AI technology, ensuring that new business actors can compete fairly. In Indonesia, Law No. 5 of 1999, with Article 17, also regulates the prohibition of practices that hinder healthy competition, particularly preventing dominant actors from using their positions to create barriers to entry for new competitors.

This paper generally regulates business actors to prevent them from arbitrarily exploiting market dominance, which can endanger the competitive business process. Meanwhile, the UK, with the Competition Act 1998 Article 18, prohibits the abuse of dominant positions that hinder the entry of new competitors and create disproportionate barriers in the market. These countries are increasingly updating and adapting regulations to face new challenges in the digital age. The dominance of expensive data and AI technologies is a key tool capable of creating high barriers to entry, reducing market plurality, and increasing the risk of innovation stagnation. Strong and adaptive regulations are essential to maintain a healthy and dynamic business competition ecosystem.

2) Price Manipulation

The algorithm's ability to automatically collude with prices (algorithmic collusion) can cause the price of a product or service to be unreasonable, higher than the competitive price it should be.[44] This practice is detrimental to consumers because consumers must pay a higher price than the healthy market price. In addition, small business actors who lack the power to determine prices suffer losses because they cannot compete with prices distorted by this algorithmic collusion. Price manipulation through algorithms is a significant challenge for supervisory authorities because of the complexity of algorithmic interactions occurring in real-time without human intervention. This makes tracking and proving the existence of algorithmic collusion very difficult.[45]

Business competition authorities must develop new methods and high-tech analysis tools to detect algorithmic behaviour patterns that potentially violate competition laws. In Indonesia, this aspect is regulated by Law No. 5 of 1999, particularly Article 19, which prohibits business actors from engaging in activities that may lead to monopolies or unfair business competition, including through electronic systems that can harm competition and consumers. The government also addresses this in Government Regulation No. 80 of 2019 (GR-

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[44] Lea Bernhardt and Ralf Dewenter, "Collusion by Code or Algorithmic Collusion? When Pricing Algorithms Take Over," *European Competition Journal* 16, no. 2–3 (September 1, 2020): 312–342.

[45] Axel Gautier, Ashwin Ittoo, and Pieter Van Cleynenbreugel, "AI Algorithms, Price Discrimination and Collusion: A Technological, Economic and Legal Perspective," *European Journal of Law and Economics* 50, no. 3 (December 14, 2020): 405–435.

No. 80 of 2019), which mandates the supervision of business competition practices in electronic systems.

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3) Inequality of Access to Technology and Data

Inequality of access to technology and data is a crucial problem in today's digital economy.[48] Large business players who master advanced technology and large data sets tend to accumulate significant market power. Meanwhile, small businesses and newcomers are increasingly marginalised due to limited access to technology and data, the main capital needed to compete. This widens economic disparities and strengthens unbreakable monopolies, thereby hindering market plurality and economic justice in the pursuit of healthy market access. This inequality also affects the distribution of benefits in the digital economy, where business groups that have not fully adopted digital technology struggle to expand market reach and increase competitiveness.

This has caused a widening disparity between large and small business actors and between developed and disadvantaged regions, especially in

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[46] Salil K Mehra, "Price Discrimination-Driven Algorithmic Collusion: Platforms for Durable Cartels," *Stanford Journal of Law, Business, and Finance* 26 (2021): 171.

[47] Antonio Gomes, and Pedro Gonzaga "Pricing Algorithms: The Risk of Collusion and Personalised Pricing," in *Killer Acquisitions? Evidence and Potential Theories of Harm* (Cheltenham, UK: Edward Elgar Publishing, 2022), 64–75.

[48] Yi Huang, "Monopoly and Anti-Monopoly in China Today," *The American Journal of Economics and Sociology* 78, no. 5 (November 26, 2019): 1101–1134.

developing countries such as Indonesia.[49] Technological inequality also impacts access to information, innovation, and productivity capabilities, which vary significantly among business actors. The government and related institutions must address this inequality problem by developing equitable digital infrastructure, increasing digital literacy, and implementing inclusive regulations. Developing a fast and equitable internet network, digital skills training, and providing technology access to small businesses are the keys to reducing the digital gap and creating fairer business competition.

Thus, the growth of the digital economy can be felt by all levels of society and reduces the risk of market dominance by a handful of large business actors.[50] The problem of inequality in access to technology and data is highly relevant to the supervision of business competition, where market dominance must be prevented from becoming an adverse monopoly practice. This inequality needs to be anticipated with regulations that prohibit the practice of monopolies and abuse of dominant positions, as stipulated in Law No. 5 of 1999 Article 17 in Indonesia, Sherman Act Article 2 and Clayton Act Article 7 in the US, Article 102 TFEU in the EU, as well as Article 46 of the Competition and Consumer Act 2010 in Australia and Article 17 of China's Anti-Monopoly Law. This regulation aims to encourage more inclusive market access and ensure that business competition continues healthily amid rapid digital technology developments.

Traditional regulations on business competition, which refer to the supervision of human behaviour, have become ineffective in overseeing the interaction of autonomous agents in machine-opoly. It is necessary to apply a new approach that uses information technology and data analysis to monitor algorithmic behaviour patterns and develop adaptive, risk-based AI regulations. [51] These regulations must prevent anti-competitive practices without hindering innovation and technological development.

The machine-opoly phenomenon has become a significant concern for regulators in various countries. The EU, for example, through the EU AI Act, which came into effect in August 2024, establishes regulations governing the

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[49] David Mhlanga, "Industry 4.0 in Finance: The Impact of Artificial Intelligence (AI) on Digital Financial Inclusion," *International Journal of Financial Studies* 8, no. 3 (July 28, 2020): 45.

[50] Abdullah Taufik, "Dominant Position in the Aviation Industry: Case Analysis of Appointment of Strategic Business Partners (Wholesaler) By PT.Garuda Perspective UU No. 5 of 1999," *Khazanah Sosial* 5, no. 3 (October 12, 2023): 418–427.

[51] Jerzy Niemczyk et al., "The Dominant Motives of Mergers and Acquisitions in the Energy Sector in Western Europe from the Perspective of Green Economy," *Energies* 15, no. 3 (January 31, 2022): 1065.

use of AI with a risk-based approach, emphasising transparency, auditability, and non-discrimination.[52] The regulation also integrates the competition law provisions under Articles 101 and 102 TFEU, which require the supervision of algorithmic interactions to prevent collusion and abuse of dominant positions.

In the US, authorities such as the FTC and DOJ are tightening antitrust oversight, especially in large tech industries that rely on AI and big data. Oversight approaches include merger analysis, algorithmic pricing controversies, and algorithmic transparency to prevent market abuse. Meanwhile, Indonesia refers to Law No. 5 of 1999 as the central legal umbrella, with Articles 17, 18, and 25 as the basis for intervention against AI-based and digital-based monopoly practices. The Circular Letter of the Minister of Communication and Information Technology No. 9 of 2023 on Artificial Intelligence Ethics also provides an ethical framework for AI's sustainable and responsible development in Indonesia.

Machineopoly is a concept that introduces a new dimension to monopoly in the digital age. It is shaped by the automatic interaction of algorithms, the mastery of big data, and the network effects of digital platforms.[53] This phenomenon indicates a shift from traditional monopolies, which are physical in nature, to monopolies based on advanced technologies that require a more adaptive and innovative approach to regulation and supervision. The impact on competition and consumers is widespread, ranging from high barriers to entry and price manipulation to inequality of access to technology.

Philosophical and Theoretical Challenges to the Principle of Market Justice

Amid this massive wave of technological innovation, there is an irreconcilable tension between the need to encourage innovation and maintain economic fairness and the principles of fair competition. This is mainly related to how market fairness, a fundamental concept in economic theory and competition law, must be reinterpreted when market actors are no longer direct human entities, but autonomous and algorithmic systems. The authors provide three major issues: whether algorithms can be considered economic actors in the legal sense, the ethical and moral implications of AI autonomous decisions in the market, and how responsibility shifts from human corporations to algorithmic systems.

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[52] Hannah van Kolfschooten and Janneke van Oirschot, "The EU Artificial Intelligence Act (2024): Implications for Healthcare," *Health Policy* 149 (November 2024): 105152.

[53] Andrea Coveri, Claudio Cozza, and Dario Guarascio, "Monopoly Capitalism in the Digital Era" (LEM Working Paper Series, 2021).

1. Can Algorithms Be Considered Economic Actors in the Legal Sense?

In the conventional legal system, "economic actors" are entities that have legal capacity and are capable of being held accountable for their actions, hold rights and obligations, and are subject to legal and civil liability.[54] These perpetrators are usually individuals, groups/organisations, or legal entities such as companies that can enter into contracts, file lawsuits, and be subject to sanctions. However, with the advancement of AI, decision-making functions that were once entirely performed by humans are now starting to be shifted to intelligent algorithms and autonomous agents. These algorithms have no legal awareness or moral capacity, so their status in the legal and economic realms becomes vague and complex.

A big question arises that needs to be underlined: can AI systems and algorithms be considered economic actors? If so, the demands for legal and ethical responsibility should be reframed to include non-human actors. Some classical legal theories argue that AI is a tool human actors or corporations use, so it cannot legally stand as a subject. However, thanks to AI's increasingly independent ability to make business decisions, such as setting prices, negotiating automatically, or managing digital markets, some argue that AI should be treated as an independent economic agent and potentially have limited legal status (legal personhood) or be governed based on the principle of special obligations and responsibilities.

An alternative approach sees AI as an "extension" of human actors, so the AI system's creator, manager, or owner remains responsible for algorithmic decisions.[55] This approach is currently more commonly accepted in legal frameworks in various jurisdictions as a temporary solution, given the technical and philosophical complexities of recognising legal subjectivity for AI. However, this model poses major challenges in practice, especially in the case of autonomously generated algorithmic errors, which are difficult to attribute directly to specific human actions. These questions are still debated in academia and the evolving legal order, both nationally and internationally, demanding in-depth reflection on whether and how non-human decision-making capabilities can be recognised and regulated effectively and fairly.

In Article 5 of Law No. 5 of 1999, business actors are prohibited from agreeing with competitors to determine the price of goods or services that

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[54] Ahmed Mohammed Awwad, "Contractual Freedom and Restrictions Included Therein in The Saudi Civil Transactions Law," *International Journal of Religion* 5, no. 5 (April 5, 2024): 210–222.

[55] Nevejans, "European Union's Regulation on the Placing on the Market and Use of AI Systems: A Critical Overview of the AI Act."

consumers pay. Meanwhile, Article 11 prohibits agreements that influence prices, production, or marketing that could lead to monopolies or unfair business competition. In the practice of automated pricing algorithms, even in the absence of written agreements or direct communication between the perpetrators, algorithmic systems that result in collusive behaviour may be considered to violate these articles because the impact is similar to traditional cartel (price fixing) practices.[56] In addition, KPPU, as a regulatory institution and supervisor of business competition in Indonesia, has issued guidelines and suggestions related to algorithm regulation and the role of technology in the digital economy. KPPU understands the challenges in overseeing algorithmic collusion practices and continues to develop oversight strategies, including regulatory advocacy and technology engagement, to detect unfair competition practices generated by automated systems.

In the United States, algorithmic collusion violates Article 1 of the Sherman Act, prohibiting agreements, conspiracies, or coalitions that restrict trade, including unlawful price fixing. [57] Although algorithms move automatically, the law in the US considers human control over algorithms as a basis for demanding legal liability against business actors who use the system. Article 101 TFEU prohibits agreements that directly or indirectly set prices or regulate trade conditions between competing parties in the European Union. With algorithmic collusion, where algorithms monitor and adjust prices in parallel without direct human intervention, this mode can still be considered a violation as long as there is coordination that reduces the risk of competition. This legal approach in the EU is also a reference for other countries responding to technological challenges in business competition.

2. Ethical and Moral Implications of AI Autonomous Decisions in the Market

When algorithms take a central role in driving markets through autonomous functions such as automated pricing, resource allocation, and supply chain management, several ethical and moral issues arise that need serious attention. Unsupervised AI decisions can reinforce price-discriminatory practices, algorithmic monopolies, or harm certain social groups due to veiled

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[56] Haiqal Riski Ramadhan, Darminto Hartono Paulus, and Giovanni Marcello, "Prohibition of Monopolistic Practices in Business Trials in Indonesia: Reforming on Business Competition Supervisory Commission," *Journal of Law and Legal Reform* 4, no. 2 (April 30, 2023): 163–182.

[57] Yichen Yang, "Price-Related Cartels under the Chinese Anti-Monopoly Law Regime: The Need to Clarify Four Substantive and Procedural Issues," *World Competition* 39, no. Issue 3 (September 1, 2016): 479–512.

biases in the datasets used for algorithm training. This can be seen from AI-based pricing that adjusts prices differently between consumers based on personal data analysis, which can trigger distributive injustices contrary to the principles of fair competition and consumer protection.[58]

Transparency and explainability are key issues in dealing with AI-related market justice. It is common for algorithmic decisions to be difficult to understand even by the developers themselves (black-box problem). This ambiguity can fail to ensure the resulting decision is free from bias, discrimination, and other injustices. International organisations such as the United Nations Educational, Scientific, and Cultural Organisation (UNESCO) and the Organisation for Economic Co-operation and Development (OECD) have established ethical principles of AI that challenge developers and users of technology to ensure accountability, inclusivity, and fairness as the foundation of AI development and implementation.[59]

In fact, decision automation in the digital market shows the incompatibility between the fast and changing machine learning process and traditional justice norms that demand fair, transparent, and participatory methods. As a result, a new concept of justice is needed to accommodate the dynamics of automation and the use of big data, while also paying attention to the socio-economic impact on all market participants and the wider community. Focus not only on the final market or price results, but also on the decision-making process, data governance, and algorithmic oversight to maintain ethics and fairness.

The ethical and moral implications of AI's autonomous decisions in the marketplace are becoming increasingly important as AI's use in various aspects of business and social life develops.[60] Ethics in AI decisions demand transparency, accountability, fairness, and privacy protection, as AI decisions often directly impact the lives of consumers and business actors. For example, algorithms that automatically determine prices must be non-discriminatory and not lead to unhealthy practices such as price collusion or market exclusion.

From an ethical perspective, AI-generated automated decisions must be explainable and accountable. Complex AI systems need to be designed so that humans can understand the decision-making process and study the impact and

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[58] Jiayi Hou, "The Influence of Administrative Anti-Monopoly Measures on the Innovation Enthusiasm of Digital Economy Enterprises and Countermeasures," ed. B. Wang, *SHS Web of Conferences* 208 (December 12, 2024): 01002.

[59] Andy Nguyen et al., "Ethical Principles for Artificial Intelligence in Education," *Education and Information Technologies* 28, no. 4 (April 13, 2023): 4221–4241.

[60] Shubh Shukla, "Principles Governing Ethical Development and Deployment of AI," *International Journal of Engineering, Business and Management* 8, no. 2 (2024): 26–46.

risks of those decisions transparently. This is important for building public trust in AI technology and ensuring the protection of the rights of consumers and small businesses vulnerable to technology abuse.[61] Morality also demands that the data used in algorithm training be processed ethically while maintaining the privacy and security of personal data. Unethical data collection and use can lead to violations of individual rights and create bias and discrimination in AI decisions.

3. Shifting Responsibility from Corporations to Algorithmic Systems

One of the biggest paradigmatic shifts due to the widespread use of AI in the economy is the shift in legal and moral responsibilities from human entities, especially corporations, to algorithmic systems that govern daily business operations. Previously, responsibility for monopolistic business practices, collusion, fraud, or other law violations lay clearly with the human actors or corporate entities who directly made the decisions. But now, many of those decisions are made by highly complex and autonomous AI systems, making it difficult to determine who should be held accountable in case of a violation or legal loss.

Legal theory gives rise to a paradigm of layered responsibility, which involves several actors according to their respective functions and positions in the AI ecosystem: AI makers, operators, end-users, and regulators.[62] Regulations require each layer to have its legal contribution and obligations to ensure the continuation of safe, fair, and lawful AI operations. In practice, however, legal accountability is complicated because AI operates autonomously and highly complexly, sometimes resulting in decisions humans cannot fully predict or audit.[63]

Corporate responsibility is now not limited only to business outcomes and market decisions. Still, it extends to moral and ethical responsibilities, such as auditability, system security, and risk mitigation for the negative impacts of AI. Corporations face pressure to improve the algorithms' transparency, facilitate independent oversight mechanisms, and comply with increasingly stringent national and international ethical and regulatory frameworks. This shows that

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[61] Ajay Verma and Nisha Singhal, "Integrating Artificial Intelligence for Adaptive Decision-Making in Complex System," 2024, 95–105.

[62] Ioannis Lianos, Klaas Hendrik Eller, and Tobias Kleinschmitt, "Towards a Legal Theory of Digital Ecosystems," *Faculty of Laws University College London Law Research Paper* No. 16, 2024.

[63] Tomasz Braun, "Liability for Artificial Intelligence Reasoning Technologies – a Cognitive Autonomy That Does Not Help," *Corporate Governance: The International Journal of Business in Society*, April 16, 2025.

corporate legal responsibility in an AI-based economy must be active in prevention and accountability when violations occur.

In Indonesia, corporate responsibility is legally regulated in Law No. 40 of 2007 concerning Limited Liability Companies, especially Article 74, which regulates corporate social responsibility (CSR). Article 74, paragraph (2) stipulates that social and environmental responsibility costs must be budgeted and implemented reasonably and fairly. These regulations are relevant in the context of high-tech businesses, including AI, which require corporations to pay attention to their operations' social and environmental impacts, including the risk of violating the laws and ethics of technology. Government Regulation Number 47 of 2012 strengthens the implementation of Article 74 by requiring supervision and reporting of the implementation of social responsibility in the annual report to the general meeting of shareholders.

Corporate responsibility for using AI and similar technologies is also receiving increasing attention. For example, in the United States, legal responsibilities are regulated by various corporate and competition law provisions that demand transparency and accountability, including the oversight of algorithms to avoid monopolies and abuse of dominant positions, such as in the Sherman Act and the Clayton Act.[64] The European Union, through the Artificial Intelligence Act, suggests a framework for the development and use of AI that can be audited and accountable, including applying the principles of fairness, transparency, and risk reduction.[65]

In the UK, companies are required to comply with the Companies Act 2006, which regulates the responsibilities of directors to conduct business properly, including taking into account the social impact and new technologies.[66] Australia, through the Competition and Consumer Act 2010, also regulates corporate business practices so as not to abuse its dominant position, especially related to digital technology.[67] Meanwhile, the latest Anti-Monopoly Law in China requires companies to conduct corporate risk

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[64] Hammad Raza, "Regulating Digital Markets: Antitrust Strategies for Tackling Data Monopolies and AI Oversight," 2024.

[65] Alice Witt et al., "Encoding Legislation: A Methodology for Enhancing Technical Validation, Legal Alignment and Interdisciplinarity," *Artificial Intelligence and Law* 32, no. 2 (June 3, 2024): 293–324.

[66] Ceyhun Emre Babacan, "Directors' Conflict of Interest Duties Under the Companies Act 2006: Compliance Measures and Consequences of Non-Compliance," *İbn Haldun Üniversitesi Hukuk Fakültesi Dergisi* 3, no. 1 (2025): 49–86.

[67] Julie Clarke et al., "Competition and Consumer Law in Australia: Principles, Enforcement, and Comparative Perspectives," in *Competition Law and Economics in Australia, Volume II* (London: Routledge, 2025), 1–18.

management in market dominance, including AI technology, with strict oversight mechanisms. These regulations reflect global legal awareness of the moral and legal challenges autonomous AI systems pose. In corporate responsibility theory, AI is positioned as a tool, not a legal subject. Still, using AI gives rise to legal obligations inherent in corporations as economic actors. This new paradigm emphasizes the need for strong internal control mechanisms, adaptive regulation, and multi-actor cooperation so that the development and deployment of AI does not abdicate moral and legal responsibilities, but rather becomes an integral part of sustainable and ethical corporate governance.

4. Synergy between Technology, Law, and Ethics for Modern Market Justice

Understanding and responding to the philosophical and theoretical challenges of market fairness in the age of AI demands a multidisciplinary approach that harmoniously integrates technological, legal, and ethical aspects. AI systems and big data network infrastructure are not separate entities, but rather an integral part of the modern economic ecosystem that requires specific accountability, transparency, and consumer protection arrangements. Traditional regulatory frameworks focusing on human actors and explicit transactions are now insufficient to guard and guarantee market fairness in a complex and autonomous digital economy environment. Several international institutions have designed AI ethical guidelines and standards that serve as universal guidelines for the development and implementation of AI that is fair, bias-free, and responsible. The OECD AI Principles, for example, emphasise the importance of distributive justice, transparency in data processing, and respect for human rights and privacy protection.[68]

UNESCO's Recommendation on the Ethics of Artificial Intelligence also prioritises social justice and the empowerment of AI users so that the digital revolution does not create new gaps or discrimination.[69] This standard contains fundamental moral principles that should be used as a foundation for AI regulation worldwide. From a legal perspective, challenges in the AI era force a complete reinterpretation of market fairness principles and compliance with competition laws. This includes the redefinition of economic actors, which now

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[68] Petar Radanliev, "AI Ethics: Integrating Transparency, Fairness, and Privacy in AI Development," *Applied Artificial Intelligence* 39, no. 1 (December 31, 2025).

[69] Sahan Bulathwela et al., "Artificial Intelligence Alone Will Not Democratise Education: On Educational Inequality, Techno-Solutionism and Inclusive Tools," *Sustainability* 16, no. 2 (January 16, 2024): 781.

also involve algorithmic systems, law enforcement against algorithmic collusion practices, and the implementation of technological audit and supervision mechanisms that are responsive to rapid technological changes. In Indonesia, for example, the principle of corporate accountability for the impact of AI is contained in Law No. 40 of 2007 on Limited Liability Companies, especially Article 74, which requires companies to carry out social and environmental responsibilities fairly and transparently.

This article supports companies' obligations to audit and manage the risks of using AI so as not to harm the social and economic interests of the community. Globally, developed countries have also adopted advanced regulations related to AI. The European Union, for example, implements the Artificial Intelligence Act, which requires strict oversight and auditability of AI, upholds the principles of fairness and transparency, and reduces algorithmic bias and discrimination. In the United States, while there is no centralised regulation of AI, existing legal principles such as the Sherman Act and the Clayton Act allow room for enforcement against the risk of algorithmic collusion and abuse of market dominance. The UK, with the Companies Act 2006, requires the company's directors to conduct business ethically and sustainably, including in technology management. Australia and China have also updated their competition laws, such as section 46 of Australia's Competition and Consumer Act 2010 and section 17 of China's Anti-Monopoly Law, which explicitly regulate business practices that use advanced technologies such as AI, thereby inhibiting competition and creating high barriers to market entry.

If you look at the legal philosophy side, this issue is rooted in John Rawls's concept of distributive and restorative justice.[70] This emphasises the need for a just social and economic structure and provides equal opportunities for all market participants, including in the digital context. Legal justice must accommodate the rights of consumers and business actors, adjust to technological developments so that the law remains relevant, and provide substantive justice, not just procedural.[71] In this case, the role of regulation is to ensure that AI as a decision-making tool does not become a tool of oppression or exclusivity that harms certain groups. Transparency and accountability are ethical principles that demand that AI algorithms be auditable and accountable

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[70] M.Yasir Said and Yati Nurhayati, "A Review on Rawls Theory of Justice," *International Journal of Law, Environment, and Natural Resources* 1, no. 1 (April 28, 2021): 29–36.

[71] Bagus Hermanto, I Gede Yusa, and Nyoman Mas Aryani, "Constitutional Court of the Republic of Indonesia: Does the Ultra Petita Principle Reflect the Truth of Law?," *Fiat Justisia: Jurnal Ilmu Hukum* 14, no. 3 (May 15, 2020): 261–286.

so that humans can understand and supervise the resulting decisions. This relates to the liability law theory, which states that the actors using the instrument, in this case, the corporation operating the AI, must have a legal obligation for the impact caused by the instrument.[72]

The precautionary principle supports the implementation of preventive regulations in the use of AI so that negative impacts can be minimised. In addition, the concept of layers of responsibility is also relevant in the AI era, involving all actors ranging from software makers, system operators, end-users, to regulators who regulate and supervise. This paradigm emphasises the importance of cooperation between various stakeholders to ensure AI operates with fairness, security, and legal compliance. In the Indonesian legal system, as stipulated in Law No. 40 of 2007 Article 74, corporate responsibility for social and environmental impacts, including technology risk management, is an integrative part of good corporate governance.

Normative-Comparative Analysis of the Competition Law Framework

Machine-opoly, as a monopoly built based on algorithmic interaction and machine autonomy, poses new challenges that cannot be fully answered with traditional competition legal frameworks. In this section, this paper discusses in detail the effectiveness and limitations of existing competition law, particularly through a review of Articles 101 and 102 of the Treaty on the TFEU and Law No. 5 of 1999.

1. European Union: An Approach to Articles 101 and 102 TFEU in the Context of Artificial Intelligence

The EU has long been a pioneer in developing and enforcing strict and comprehensive competition law, with Articles 101 and 102 TFEU as the main foothold. Article 101 TFEU prohibits agreements, arrangements, or joint practices between business actors that may impede market competition, including cartel practices and price coordination to the detriment of consumers.[73] In the digital age and AI-driven markets, the main challenge is to interpret "collusion" behaviour when interacting with an automated algorithm capable of compiling and adjusting prices without human intervention. The European Commission has been actively investigating the use of dynamic

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[72] Oliver Budzinski and Juliane Mendelsohn, "Regulating Big Tech: From Competition Policy to Sector Regulation?," *ORDO* 72–73, no. 1 (November 1, 2023): 215–255.

[73] David Bailey, "Restrictions of Competition by Object under Article 101 TFEU," *Common Market Law Review* 49, no. Issue 2 (April 1, 2012): 559–599.

pricing algorithms and asserted that algorithmic collusion can still be processed as an infringement if it is proven that there is non-competitive coordination of market regulation, even in the absence of explicit communication between human actors.

Article 102 TFEU, which prohibits the abuse of dominant positions by market participants, is also being applied dynamically to address the risk of market dominance amplified by AI and big data. Examples are monopolistic digital platforms that control consumer data as well as superior algorithms, which can use their influence to suppress competitors or set unfair conditions in the market ecosystem. EU authorities demand algorithmic transparency and fairness of data access so that dominant positions are not abused. Law enforcement in Europe is increasingly paying attention to the digital context and characteristics of AI to integrate algorithmic surveillance into traditional competition law frameworks.

The European Union introduced the EU AI Act, an AI-specific regulation that provides a new legal basis that complements Articles 101 and 102 TFEU with AI risk regulation, algorithm auditability obligations, and transparency as prerequisites for competition law compliance. The EU AI Act divides AI systems into risk categories (e.g., high risk) and requires companies that manufacture or use AI to meet strict security and ethical standards. This approach makes the EU a proactive and adaptive regulatory model in dealing with machine-opoly that has the potential to give rise to algorithmic monopolies and automatic collusion in the digital market.[74]

The European Union and other countries have also developed legal frameworks to regulate AI, especially in the context of business competition. In the United States, business competition law is governed by the Sherman Act and the Clayton Act, which prohibit monopolies and anti-competitive practices, including those involving new technologies such as AI algorithms. Authorities such as the FTC and DOJ are increasingly actively monitoring and cracking down on technology monopoly practices, including algorithmic collusion and data misuse by large digital platforms. While there is no centralised AI regulation yet, sector-specific approaches and executive orders at the federal level indicate the development of increasingly stringent AI regulation.

The UK uses the Competition Act 1998, which prohibits the abuse of dominant positions and cartel practices, and by 2024, applies "pro-innovation" principles in AI regulation. The UK's Competition and Markets Authority

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[74] Maren Tamke, "Big Data and Competition Law," *Zeitschrift Für Wettbewerbsrecht* 15, no. 4 (December 7, 2017): 358–385.

(CMA) issued guidelines that prioritise interoperability, consumer choice, and strict oversight of the use of AI in digital marketplaces.[75] Australia, through the Competition and Consumer Act 2010, regulates the prohibition of abuse of market power as specifically set out in Article 46, stating that companies with substantial market power must not engage in actions that have the purpose or effect of significantly reducing competition. This prohibition includes a variety of behaviours, including setting unfair conditions, pressuring competitors, or inhibiting the entry of new business actors into the market. This article does not prohibit the acquisition of market power itself, but anyone who has controlled the market must avoid arbitrary behaviour that is detrimental to competition. Enforcement of Article 46 is the main task of the Australian Competition and Consumer Commission (ACCC), which is authorised to oversee and crack down on anti-competitive practices. The ACCC can take legal action, including taking cases to court to prove a breach of Article 46. Sanctions for violations can be severe for both the company and the executives involved, including significant fines and restrictions on functions within the company.[76]

China has also strengthened anti-monopoly regulations with the revised Anti-Monopoly Law in 2022, specifically Article 17.[77] This article prohibits companies that hold dominant positions from committing acts that abuse market power so as to impede unfair competition. Some of the prohibited actions include suppressing competitors, imposing unfair conditions, inhibiting the entry of other business actors, and other practices that can be detrimental to market competition. The content of Article 17 emphasises that it does not mean that having a dominant position itself is against the law, but the abuse of that dominant position is strictly prohibited. A company is considered to have a dominant position if it controls a certain market share in a significant amount and can determine market conditions. Prohibited abusive practices include setting prices too high or too low, restricting sales to competitors, and controls that inhibit other competitive activities.

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[75] Dirk Auer, Matthew Lesh, and Lazar Radic, "Digital Overload: How the Digital Markets, Competition and Consumers Bill's Sweeping New Powers Threaten Britain's Economy," *SSRN Electronic Journal*, 2024.

[76] Allan Fels and Luke Woodward, "50 Years of the Australian Competition and Consumer Commission," in *Competition Law and Economics in Australia, Volume I* (London: Routledge, 2025), 45–75.

[77] Jing Wang, "Competition Neutrality in Courts: Can China's Anti-Monopoly Law 2022 Ensure the Supremacy of Competition Law in Antitrust Private Litigation Involving State-Owned Enterprises," *Global Competition Litigation Review* 15, no. 4 (2022): 132-138.

In the context of technology and AI, because large digital platforms that control data and advanced algorithms can unfairly strengthen their dominance by using these market forces to deter new competitors, impose self-advantageous contractual provisions, and utilise algorithms to set prices that are not in accordance with the dynamics of healthy competition, Article 17 can be used as a reference in regulating AI in market power. Strict oversight and enforcement of Article 17 can prevent algorithmic monopolies and keep the market open and competitive. The State Administration enforces Article 17 for Market Regulation (SAMR), which has the authority to supervise and crack down on monopoly practices in China.[78] Heavy fines and administrative sanctions can be imposed on violating companies. The strengthening of regulations in Article 17 is accompanied by operational guidelines that facilitate the interpretation and implementation of penalties for abuse of dominant positions in the era of rapid digital transformation, so efforts to maintain healthy business competition also adapt to the challenges of evolving AI technology.

2. Indonesia: The Relevance and Limitations of Law No. 5 of 1999 in the Era of AI-Based Markets

On the other hand, Law No. 5 of 1999 is the foundation of competition law in Indonesia. Law No. 5 of 1999 regulates the prohibition of monopolies, unfair market domination, agreements that hinder competition, and abuse of dominant positions. Important articles such as Article 17 on the prohibition of monopolies, Article 18 on unfair market domination, and Article 25 on the abuse of dominant position are the main instruments of competition law enforcement.[79]

However, these regulations are substantially based on the traditional market paradigm that emphasizes human business actors' dominant behavior and position and explicit transactions. In digital and AI-driven markets, this law shows several substantial limitations. First, there are no specific arrangements that accommodate automated algorithmic behaviours, such as algorithmic collusion, that are difficult to monitor and prove without explicit human communication. Second, there are no explicit provisions regarding data management and control as a key aspect in the dominance of the digital market,

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[78] Adrian Emch and David Stallibrass, *China's Anti-Monopoly Law: The First Five Years* (Alphen aan den Rijn, The Netherlands: Kluwer Law International BV, 2013).

[79] Anna Maria Tri Anggraini, Ahmad Sabirin, and Yoel Nixon A Rumahorbo, "The Form and Pattern of Business Actors Requirements in Exclusive Dealing: A Rule of Reason Approach," *Yustisia Jurnal Hukum* 12, no. 2 (August 1, 2023): 107.

even though data mastery is the main factor in the formation of machine-opoly. Third, the existing legal framework has not comprehensively regulated the transparency and auditing of autonomous AI systems as part of business competition governance.

Indonesia, in recent years, has begun to adapt the issue of digital regulation through technology policies, such as the Circular Letter of the Minister of Communication and Information No. 9 of 2023 on Artificial Intelligence Ethics. Still, this document is more of a technology ethics guideline and has not yet become a binding rule in business competition law. Therefore, there is an increasingly urgent need to integrate business competition norms with information technology and AI regulations so that Indonesia's competition law can handle the machine-opoly phenomenon effectively. Therefore, the effectiveness of Law No. 5 of 1999 in dealing with machine-opoly is still limited. These regulations are not yet fully adaptive to the development of machine autonomy technology and algorithmic interactions that cause new monopolies.[80] Existing regulations need to be strengthened and expanded to address algorithms, data mastery, and AI governance. The principles of transparency and accountability are sufficient to prevent violations of business competition in the digital era.

3. Regulation and Implementation Gaps: Identifying Unreached Areas

From the analysis above regarding the legal framework of business competition between the European Union and Indonesia, it can be seen that there is a significant gap, especially in the context of facing the machine-opoly phenomenon that is increasingly spreading in the digital era. The European Union, with Articles 101 and 102 TFEU as its foundation, not only maintains the basic principles of competition law but also adopts an innovative approach that guarantees legal relevance in the face of the challenges of autonomous algorithms and technologies. Article 101 TFEU explicitly prohibits anti-competitive agreements, including cartels and price coordination, which now includes the interpretation of collusion behavior when the interaction is an automated algorithm that sets prices without human intervention. The European Commission is aggressively investigating the practice of algorithmic

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[80] Dandan Ning and Hongyang Zhao, "The Influence of Monopoly Capitalism on Economic Globalization," *Highlights in Business, Economics and Management* 23 (December 29, 2023): 674–680.

collusion and data misuse as a form of dominant force, demonstrating adaptive and innovative law enforcement.[81]

Article 102 TFEU prohibits the abuse of dominant positions reinforced by AI and the mastery of big data, such as monopolistic digital platforms that oppress competitors and impose unfair conditions in the market. Algorithm transparency and fairness of data access are key demands of EU regulators to prevent abuse of dominant positions. With the introduction of the EU AI Act in 2024, the EU strengthens the legal framework that complements Articles 101 and 102 TFEU. These regulations regulate AI risk, algorithmic auditability, and transparency obligations as prerequisites for competition law compliance, making the EU an effective, proactive, and adaptive regulatory model in mitigating the risks of algorithmic monopolies and automated collusion in digital markets.[82]

Indonesia's Law No. 5 of 1999 still does not accommodate complex issues related to AI and algorithms. These regulations were drafted before the digital revolution, and algorithmic automation developed rapidly, making them inadequate in dealing with the influence of machines that involve algorithmic interaction and data mastery as dominant assets.[83] Indonesia's competition law supervision and enforcement system is also still limited in terms of technology and a deep understanding of complex machine interactions, making violation detection and enforcement less effective. The lack of a specific legal framework regarding AI increases the risk of regulatory loopholes that large business actors can exploit to maintain market dominance.

The problem of cross-sector coordination between competition authorities, information technology supervisors, and policymakers is an obstacle. The fragmentation of technology and AI regulations that have not been maximised hinders effective supervision of market competition in the digital era. Therefore, efforts to strengthen competition regulation in Indonesia must involve increasing the technical capacity of regulators, debriefing judges and legal practitioners on technological understanding, and establishing adaptive and collaborative legal frameworks to effectively deal with the challenges of collusion and algorithmic domination. The synergy of

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[81] Sharda Abrianti et al., "The Rule of Reason Approach in Discriminatory Practices: Airlines and Telecommunications Industry Sector," *Jurnal Dinamika Hukum* 24, no. 2 (August 27, 2024): 292.

[82] Konstantinos Pantelidis, "The DMA Procedure: Areas to Improve," *World Competition* 47, no. Issue 2 (June 1, 2024): 157–192.

[83] Zulvia Makka, "Bentuk Perlindungan Hukum Pelaku Usaha Pesaing Terhadap Posisi Dominan Dalam Penerapan Rule of Reason," *Jurnal Persaingan Usaha* 1, no. 2 (December 31, 2021): 5–14.

competition law and technology policies at the national and global levels is essential to create a competitive and fair digital market amid a rapid technological revolution.

The European Union and other countries also have approaches that can be compared. The United States, through the Sherman Act and the Clayton Act, enforced competition laws that strictly apply to monopolies and unfair practices, including algorithmic practices that have the potential to give rise to automatic collusion and algorithmic dominance. The FTC and the U.S. Department of Justice increasingly use these regulations to oversee and crack down on big tech companies.[84] With the Competition Act 1998, the UK began to integrate "pro-innovation" principles in AI-related regulations, ensuring innovation continues to thrive while maintaining competition.[85] Australia relies on the Competition and Consumer Act 2010, specifically Article 46, to prohibit the abuse of market power that digital platforms with AI technology can amplify.

China, through the revised Anti-Monopoly Law in 2022 and Article 17 in particular, establishes a ban on abuse of dominant positions that utilize AI technology and data mastery to deter healthy competition. The SAMR also strengthens law enforcement against algorithmic monopoly practices by imposing algorithmic audits and strict controls on large tech companies.[86]

In fact, the paradigm shift from traditional human law actors to algorithmic systems poses challenges in defining market justice. John Rawls's theory of distributive justice and Aristotle's concept of justice put forward the need to create fair opportunities and protect the rights of all market participants. AI regulation must accommodate this principle by ensuring fair market access, algorithmic transparency, and accountability of AI users and providers as economic actors. The theory of corporate responsibility and the principle of prudence are the basis for implementing regulations that prevent the risk of market dominance and algorithmic monopolies without hindering technological innovation.

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[84] Debra A. Valentine, "The Evolution of U.S. Merger Law," FTC, 1996, https://www.ftc.gov/news-events/news/speeches/evolution-us-merger-law,.

[85] Satya Marar, "Artificial Intelligence and Antitrust Law: A Primer," *SSRN Electronic Journal*, 2024.

[86] Jingmeng Cai, *China's Anti-Monopoly Law in the Digital Era: How China Tames the Digital Behemoth* (Oxford, UK: Taylor & Francis, 2025).

Towards an Adaptive Regulatory Framework: Transparency, Collaboration, and Accountability

Traditional regulatory frameworks are no longer adequate in the face of the machine-opoly phenomenon, where monopolies are built and maintained through algorithmic interaction and artificial intelligence AI. Effective competition regulations must be adapted to accommodate digital technology's rapidly changing complexity and dynamics. Therefore, developing a more adaptive future regulatory framework, balanced between innovation and market fairness, is critical. The framework must include three main elements: algorithmic transparency, regulatory collaboration, and supervisory capacity. In this section, the principles and policies related to the three elements are discussed as the foundation of regulations that can answer the challenges of machine-opoly comprehensively and fairly.

1. Algorithmic Transparency

Algorithmic transparency is a prerequisite for creating fairness and accountability in an AI-driven digital marketplace.[87] This transparency refers to the obligation of business actors or technology developers to disclose the logic, data used, and algorithmic decision-making processes that impact users and the market. In the context of machine-opoly and business competition, transparency of market and consumer watchers understand how algorithms operate, predict price behavior, resource allocation, and their influence on competition.

Algorithmic disclosure is important to reduce the risk of algorithmic collusion, price discrimination, and abuse of dominant positions.[88] Collusion practices carried out through algorithmic interactions are often difficult to detect because they are automated and complex. They can only be analyzed if there is access to code, parameters, and AI training data. This is where the importance of independent agencies' regular ethical and technical audits of algorithms lies. This audit aims to ensure that algorithms comply with the

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87 Husna Maulidah Ramadhani, Elisatris Gultom, and Sudaryat, "Penggunaan Produk Goto Group Dalam Rangkaian Operasi Marketplace Tokopedia Berdasarkan Undang-Undang Larangan Praktek Monopoli Dan Persaingan Usaha Tidak Sehat," *Reformasi Hukum* 26, no. 2 (December 31, 2022): 189–208.

88 Ahmad Sabirin and Raafid Haidar Herfian, "Keterlambatan Pelaporan Pengambilalihan Saham Perusahaan Dalam Sistem Post Merger Notification Menurut Undang-Undang Persaingan Usaha Di Indonesia," *Jurnal Persaingan Usaha* 1, no. 2 (December 31, 2021): 55–63.

principles of fairness, non-discrimination, and distributive justice and detect biases or prediction errors that could harm the market and consumers.

Several countries and international organizations have already adopted algorithmic transparency policies as part of the AI regulatory framework. The EU AI Act requires risk evaluation and disclosure for high-risk AI systems.[89] The OECD also establishes AI policy principles emphasizing transparency as key to building trust and accountability. Although still in the early stages of managing this issue, Indonesia can learn from this practice by including similar provisions in the competition regulations and information technology that regulate algorithm transparency, ethical audits, and consumer protection in the digital ecosystem. Applying algorithmic transparency must be balanced with protecting trade secrets and intellectual property rights, so regulations must establish a proportionate scope of disclosure and appropriate protection of information access restrictions.[90] Thus, business actors can still innovate without losing intellectual property, while regulators and the public still have access to enough information to monitor and assess algorithms' impact on competition.

2. Regulatory Collaboration

The phenomenon of machines and digital markets is complex, cross-sectoral, and jurisdictional. Therefore, an effective regulatory framework must be built on the principle of regulatory collaboration involving various national and international authorities in a coordinated manner. At the national level, the competition authority or KPPU must work closely with information technology supervisory institutions such as the Ministry of Communication and Information Technology and the State Cyber and Cryptography Agency to integrate business competition supervision with technology and data security. This coordination is important to combine competition law, AI technical, and digital policy expertise to make supervision more effective and responsive. For example, exchanging intelligence data related to algorithmic activities, exchanging technical resources for market data analysis, and creating mutual algorithmic audit standards can be a vehicle for collaboration.

At the international level, as digital and AI market players typically operate globally, individual country regulations do not adequately address the risks of

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[89] Gerhard Wagner, "Liability Rules for the Digital Age," *Journal of European Tort Law* 13, no. 3 (February 6, 2023): 191–243.

[90] Chen, "Systematic Reconstruction of Labour Rights Mechanisms under the Threshold of Hierarchical Classification: An Integrated Path Based on Legal Empowerment and Procedural Synergy."

monopoly and algorithmic collusion.[91] Therefore, participation in collaborative mechanisms such as the OECD AI Policy Observatory, the International Competition Network (ICN), and G20 forums is very relevant for countries, including Indonesia. International collaboration can support policy harmonization, shared risk mapping, and effective exchange of best practice experiences to address cross-border machine policy. Regulatory collaboration must also anticipate conflicts and legal overlaps by building a mechanism for harmonizing rules between sectors and countries.[92] For example, regulations on personal data protection, intellectual property rights, and competition law need to be integrated with AI policies so that the regulations made are not in conflict with each other but are mutually supportive.

3. Supervisory Capacity

The success of implementing adaptive regulatory frameworks depends not only on legal norms and collaboration mechanisms but also on the capacity of supervisory institutions. Supervisory capacity is important in understanding, monitoring, and assessing algorithmic behavior in an increasingly complex and digitized market. One of the main obstacles in AI-based market surveillance is the technical limitations, human resources, and knowledge related to artificial intelligence and big data technologies.

Strengthening the capacity of supervisory institutions can be done through several strategies. First, the development of human resource competencies that master AI technology, data science, and algorithmic analysis in the context of economics and competition law.[93] This includes technical training, professional certifications, and cooperation with academia and the technology sector. Second, modern surveillance technologies, such as algorithmic audit automation tools and big data analysis, must be procured and utilised to identify real-time monopolistic and collusion risk patterns. Third, a special unit within the competition authority that focuses on technological and digital supervision should be created to combine legal, economic, and technical perspectives.

The internal aspect of capacity building, supervisory institutions also need to strengthen cooperation with research institutions and technology

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[91] Toshiaki Takigawa, "Super Platforms, Big Data, and Competition Law: The Japanese Approach in Contrast with the USA and EU," *Journal of Antitrust Enforcement* 9, no. 2 (September 14, 2021): 289–312.

[92] Jenifer Sunrise Winter and Elizabeth Davidson, "Harmonizing Regulatory Regimes for the Governance of Patient-Generated Health Data," *Telecommunications Policy* 46, no. 5 (June 2022): 102285.

[93] Hawkes, *A Market Investigation Tool to Tackle Algorithmic Tacit Collusion: An Approach for the (near) Future*.

practitioners to update supervisory methodologies according to the latest technological developments. For example, collaborations with universities and AI research centres can be a source of knowledge and the development of valid algorithmic audit methods.[94] Institutional capacity must also include periodic regulatory evaluation and adjustment mechanisms to maintain the legal framework's relevance to technology dynamics and the rapidly changing digital market. In the Indonesian context, strengthening the capacity of KPPU and the Ministry of Communication and Information Technology is a top priority in responding to the machine-opoly phenomenon. The synergy between the two institutions is still not optimal and requires systematic improvements so that AI regulations and business competition can run effectively.

The three elements, algorithmic transparency, regulatory collaboration, and supervisory capacity, must be formulated and implemented in an integrated manner within the future regulatory framework. Mandatory disclosure of algorithmic logic and ethical audits will encourage transparency, while cross-authority collaboration mechanisms ensure holistic oversight coverage and policy harmonisation. At the same time, strengthening the capacity of supervisory institutions ensures the enforcement of the law and the effectiveness of supervision and enforcement of competition laws in the face of AI market dynamics.[95]

Thus, this future regulation is an important foundation for developing countries such as Indonesia to take an active role in the global digital economy while maintaining the sovereignty and fairness of the domestic market. A regulatory framework that is adaptive to machines must form a strong foundation through three main pillars: algorithmic transparency that requires disclosure and auditing of algorithmic ethics, regulatory collaboration across jurisdictions and countries to address the complexity of global and digital markets, and strengthening the capacity of supervisory institutions to understand and supervise algorithm interactions effectively. These three elements complement each other and must be integrated into policy designs and regulatory practices that balance innovation and market fairness.

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[94] Jacqui-Lyn McIntyre, Duane Aslett, and Nico Buitendag. "Lifestyle audits in South Africa–overrated or X-factor?." *Journal of Financial Crime* 30, no. 4 (2023): 1078-1095.

[95] Shuya Hayashi and Koki Arai, "How Competition Law Should React in the Age of Big Data and Artificial Intelligence," *The Antitrust Bulletin* 64, no. 3 (September 15, 2019): 447–56.

Conclusion

The machine-opoly phenomenon marks a fundamental shift from traditional monopolies to new market dominance built through algorithmic interaction and autonomous artificial intelligence. Data- and algorithmic-based dominance creates high barriers to entry, the risk of automated collusion, and inequality of access to technology and information. This condition poses a major challenge for business competition law, which is still oriented towards human behaviour and explicit transactions. The EU regulation in Articles 101 and 102 TFEU and the EU AI Act successfully integrate the principles of algorithmic transparency, auditability, and risk-based supervision in competition law. The United States, through the Sherman Act and the Clayton Act, affirmed strict scrutiny of the abuse of algorithms and the power of digital markets by authorities such as the FTC and DOJ.

Through the Competition Act 1998 and its "pro-innovation regulation" policy, the UK balances innovation with consumer protection. Through the Competition and Consumer Act 2010 (Section 46), Australia expands the definition of market power abuse to digital and algorithmic behavior. Meanwhile, through the Anti-Monopoly Law 2022 in Article 17, China explicitly prohibits the abuse of dominant positions through data mastery and AI. On the other hand, through Law Number 5 of 1999, Indonesia still faces limitations in regulating algorithmic behaviour, data control, and legal responsibility for automated decisions. This shows that a regulatory gap needs to be bridged with legal reforms emphasising the integration between AI regulations, technology ethics, and business competition norms so that supervision of the digital market can be carried out effectively.

Indonesia actually needs to amend Law Number 5 of 1999 immediately. In addition, it is necessary to pay attention to the three main pillars in adopting and implementing them: algorithmic transparency, regulatory collaboration across sectors and countries, and strengthening the capacity of supervisory institutions. This approach maintains a balance between innovation and market fairness, strengthens corporate accountability, and encourages an inclusive and sustainable digital ecosystem. Through these steps, Indonesia and other countries can build a legal order responsive to technological developments while ensuring that AI advances contribute to the values of justice, fair competition, and public welfare.

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Acknowledgment
We would like to deliver our gratitude to the Faculty of Law, Universitas Trisakti and all parties that have supported this research.

Funding Information
None

Conflicting Interest Statement
The authors state that there is no conflict of interest in the publication of this article.

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Cite this article as:

Anggraini, Anna Maria Tri, Ahmad Sabirin, and Jimi Rambo Arranchado. "From Monopoly to Machine-opoly: Rethinking Market Regulations for Autonomous AI Agents." *Journal of Indonesian Legal Studies* 11, no. 1 (2026): 33-80. https://doi.org/10.15294/jils.v11i1.38477

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A M Tri Anggraini et al - From Monopoly to Machine-opoly_ Rethinking Market Regulations for Autonomous AI Agents (1)

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Journal of Indonesian Legal Studies
Vol. 11 Issue 1 (2026) 33-80
ISSN: 2548-1584 (Print) 2548-1592 (Online)
DOI: https://doi.org/10.15294/jils.v11i1.38477
Online since: June 13, 2026

Journal of INDONESIAN LEGAL STUDIES
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From Monopoly to Machine-opoly: Rethinking Market Regulations for Autonomous AI Agents

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Abstract

The paper examines the effectiveness and relevance of business competition law in regulating market dynamics in the AI era, and formulates an adaptive regulatory framework that aligns technological developments with the principles of justice and accountability. The method used is a normative-legal-research method with a qualitative approach. The paper's findings are that in the digital era driven by AI, the paradigm of business competition is undergoing a fundamental transformation that demands a profound reflection on existing legal principles. The phenomenon of machine-opoly, monopolies generated by autonomous AI agents, challenges traditional concepts of fair competition. This issue underscores the tension between technological innovation as a force for value creation and the need for fairness and balance in the market. From a theoretical perspective, AI presents non-human actors running complex

algorithms, which opens up space for collusion and market domination practices that are difficult to detect and control by conventional regulation. The emergence of machine-opoly transformed traditional monopolies into dominance based on algorithms, data, and autonomous artificial intelligence. Through the TFEU and AI Act, the EU has integrated transparency and accountability into competition law, followed by the US, the UK, Australia, and China with similar adaptive measures. Indonesia, through Law No. 5 of 1999, still faces limitations in regulating algorithmic behaviour. Therefore, regulatory reforms that emphasise algorithmic transparency and supervisory capacity are essential to maintain the fairness and innovation of digital markets.

KEYWORDS: AI, Market, Monopoly, and Machine-opoly

Introduction

The rapid development of digital technologies, especially artificial intelligence (AI) and autonomous agents, has fundamentally changed the paradigm of business competition in the modern era.[1] From a competition previously centred on human decision-making, it is now shifting to a competition controlled by automated machines that can process data at scale and make strategic decisions independently. This shift has significantly impacted the concept of business actors and market structures, necessitating a profound adaptation in the legal framework of business competition. AI's role as an autonomous agent raises essential questions about its status in regulating business competition.

If we look at it from the traditional side, business actors are human entities or entities that can make subjective business decisions. However, the development of AI challenges this definition because economic choices can now be made without direct human intervention.[2] We can see that dynamic pricing algorithms, which automatically interact and coordinate, can create risks of cartel practices that are difficult to prove conventionally. Therefore, competition regulations in many jurisdictions have begun to review and update the definition of business actors to include the activities of autonomous agents.

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1 Agus S Soegoto, Dedi S Soegoto, and Muhammad S Pasha, "Empowerment Digital Strategies for Medium Small Enterprises," *Journal of Physics: Conference Series* 1477, no. 7 (March 1, 2020): 072003.

2 Elif Kiesow Cortez and Nestor Maslej, "Adjudication of Artificial Intelligence and Automated Decision-Making Cases in Europe and the USA," *European Journal of Risk Regulation* 14, no. 3 (September 25, 2023): 457–75.

The global competition legal framework pays serious attention to this issue of AI and digital transformation.[3]

In the European Union (EU), the EU AI Act, which came into force on August 1, 2024, is the first regulation to regulate AI with a risk-based approach specifically.[4] These regulations ensure the safe and ethical use of AI and open up space for enforcing competition rules with transparency and audit provisions for high-risk AI systems, such as those operating in the recruitment and healthcare sectors. The EU AI Act prioritises the principle that businesses using AI remain compliant with competition laws by requiring transparency, discrimination prevention, and strict data management through its articles.[5]

EU competition regulations are based on Articles 101 and 102 of the Treaty on the Functioning of the European Union (TFEU), which specifically regulate anti-competitive practices and abuse of dominant positions in the market. Article 101 TFEU prohibits agreements, decisions of business associations, and coordinated practices that may affect trade between member states and that prevent, restrict, or distort competition.[6] Practices prohibited under this article include cartels, collusive pricing, and market sharing. This article also distinguishes between infringements based on objects and effects, where objective violations, such as secret cartels, are automatically considered destructive without the need to prove their actual impact. In contrast, other agreements, such as research cooperation, require an analysis of effects to assess their impact on market competition.

Meanwhile, Article 102 TFEU prohibits business actors who hold dominant positions in the market, either individually or collectively, from abusing their positions.[7] Regulated forms of abuse include predatory pricing, forced product bundling, and providing exclusive rebates that harm competitors or consumers. In the context of technological developments, especially with the

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[3] Maria Monica, "What Can Indonesia Lear from China Digital Economic Transformation," World Bank, 2022, https://blogs.worldbank.org/id/eastasiapacific/what-can-indonesia-learn-from-china-digital-economic-transformation.

[4] Tom Jozak, "2024 EU AI Act: A Detailed Analysis," *SSRN Electronic Journal*, 2025.

[5] Nathalie Nevejans, "European Union's Regulation on the Placing on the Market and Use of AI Systems: A Critical Overview of the AI Act," in *Research Handbook on the Law of Artificial Intelligence* (Edward Elgar Publishing, 2025), 489–540.

[6] Bernadette Zelger, "'By Object' Restrictions Pursuant to Article 101(1) TFEU: A Clear Matter or a Mess, and a Critical Analysis of the Court's Judgement in Expedia?," *European Competition Journal* 13, no. 2–3 (September 2, 2017): 356–389.

[7] David Wouters, "Which Sustainability Agreements Are Not Caught by Article 101 (1) TFEU?," *Journal of European Competition Law & Practice* 12, no. 3 (April 7, 2021): 257–270.

increasing inclusion of AI in business decision-making, these two articles are increasingly relevant to address the risk of algorithmic collusion and abuse of technology-mediated market dominance. With algorithms' ability to interact automatically and set prices or market strategies cooperatively without human intervention, the EU asserts that existing regulations must be interpreted dynamically to remain effective against anti-competitive practices in this digital age.[8]

In parallel, in the US, agencies such as the Federal Trade Commission (FTC) and the Department of Justice (DOJ) have expressed their commitment to overseeing and enforcing fair competition in the age of AI through guidelines and investigations related to using this technology in the marketplace.[9] The leading competition authorities in the EU, the UK, and the US jointly issued a joint statement on the regulation and supervision of generative AI as a form of collective response to the challenges of competition in the digital age. They emphasised the importance of ensuring effective competition and consumer protection through adaptive regulation without hindering technological innovation.

Although Indonesia does not yet have comprehensive special regulations on AI, it has begun to direct policies through the Circular Letter of the Minister of Communication and Information Technology Number 9 of 2023 on Artificial Intelligence Ethics. In the context of business competition, Law No. 5 of 1999 concerning the Prohibition of Monopoly Practices and Unfair Business Competition (Law No. 5 of 1999) remains the primary reference. It can be seen that Article 17 on the prohibition of monopolies, Article 18 on the ban on unfair market domination, and Article 25 on the prohibition of abuse of dominant positions can be applied to assess AI practices that have the potential to harm market competition, especially in the context of the dominance of digital platforms.[10]

Market digitalisation has also changed the structure of economic power. AI and big data enable players who master cutting-edge technology to dominate the market through excellence in information management and automated decision-making. The network effects created by these digital platforms reinforce their dominant position and pose new challenges for competition law

[8] Cento Veljanovski, "Hayek on Competition: A Liberal Antitrust for a Digital Age?," *SSRN Electronic Journal*, 2024.

[9] Anne C. Witt, "The Enforcement of Article 101 TFEU: What Has Happened to the Effects Analysis?," *Common Market Law Review* 55, no. Issue 2 (April 1, 2018): 417–448.

[10] Umut Can Asil, "Unveiling Dominance: Abusive Practices in Digital Markets-An Analysis of the Market Platforms' Dominant Position and the EU's Regulatory Countermeasures," *Thesis.* (Lund, Sweden: Lund University, 2023).

enforcement to control the potential abuse of market power. Competition law supervision in the era of digital autonomy requires a paradigm shift and strengthening of capabilities.

Therefore, transforming competition from human-based to machine-based requires updating the definition of business actors, adapting global competition regulations, and strengthening supervision and law enforcement mechanisms to address the challenges of digitalisation and technological autonomy.[11] The global approach implemented by the EU AI Act, cross-jurisdictional cooperation in the US and EU, and the adaptation of Indonesia's national laws are integral to efforts to maintain healthy, fair, and competitive competition in this digital era.

Answering these challenges, this paper tries to explain and answer four things as a basis for regulating the use of AI in business competition that can violate competition and harm other business actors, namely the concept of "machine-opoly": monopoly by autonomous agents, philosophical and theoretical challenges to the principle of market fairness, normative-comparative analysis of the competition legal framework, and towards an adaptive regulatory framework: transparency, collaboration, and accountability.

The concept of "Machine-opoly": Monopoly by Autonomous Agents

In recent decades, the rapid advancement of digital technologies, particularly in AI and autonomous agents, has fundamentally changed the business and economic landscape.[12] One of the phenomena that emerged as a direct consequence of this technological revolution was a new form of monopoly called the machine-opoly. The term machine-opoly comes from the words "machine" and "monopoly", which refer to monopolies established and maintained through algorithms and autonomous AI systems that make decisions automatically without direct human intervention. [13] This phenomenon differs fundamentally from traditional monopolies, creating new regulatory challenges and significant economic implications. This part of the

[11] Bryce Goodman and Seth Flaxman, "European Union Regulations on Algorithmic Decision Making and a 'Right to Explanation,'" *AI Magazine* 38, no. 3 (September 2017): 50–57.

[12] Oscar Gladwin, "Regulating AI-Driven Markets: Antitrust Strategies for Tackling Data Monopolies," *Researchgate* 2024. https://doi.org/10.13140/RG.2.2.31734.00323

[13] Anthony Wong, "The Laws and Regulation of AI and Autonomous Systems," 2020, 38–54.

discussion will fully describe the definition, characteristics, mechanism of formation, and impact of machine-opoly on business and consumer competition.

1. Definition and Characteristics of Machine-opoly

Monopoly, in general, can be defined as a market condition where a single dominant business actor controls the supply of goods or services, giving them the power to determine prices and quantities unilaterally. Article 1 paragraph (2) of Law No. 5 of 1999 as amended in the Act Number 11 of 2020 on Job Creation, monopoly practice is defined as: "the concentration of economic power by one or more business actors that results in the control of the production and/or marketing of certain goods and or services to cause unfair business competition and can be detrimental to the public interest." Monopoly occurs if market dominance causes unfair competition and harms the public interest.[14]

Article 2 of the Sherman Act defines monopoly practice as a single company with significant market power or a monopoly acquired or maintained through unfair or anti-competitive practices such as predatory pricing, conspiracy, or unlawful expulsion of competitors. Monopoly is not illegal in itself if it is acquired from a superior product or management. Still, it becomes illegal if it maintains a dominant position through fraudulent or exclusive behaviour. Article 102 of the Treaty on the TFEU defines the practice of monopoly as the abuse of a dominant position in the market by one or more business actors, hindering healthy competition through practices such as tying, price discrimination, refusal of supply, or predatory pricing. The EU focuses on unfair treatment that deviates from "normal competition," which can reduce market efficiency and harm consumers.

Traditional monopolies are characterised by the absence of real competitors and high barriers to market entry, including capital costs, patent rights, and the power to control essential resources. In this context, a monopoly business actor is a human entity or company that controls resources and distribution networks exclusively. On the other hand, machine-opoly refers to a monopoly formed and maintained not solely through the control of physical resources but through the power of algorithms and AI systems that manage big data and perform automated decision-making functions.[15] In machine-opoly,

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[14] J. Manuel Sanchez-Cartas and Evangelos Katsamakas, "Artificial Intelligence, Algorithmic Competition and Market Structures," *IEEE Access* 10 (2022): 10575–10584.

[15] Sabirin and Anggraini, "Competition Law and Artificial Intelligence: Solution or Threat," *Jurnal Persaingan Usaha* 4, no. 1 (July 30, 2024): 77–90.

the leading actors are autonomous agents, i.e., AI programs or algorithms that can interact autonomously in the market. For example, they can determine prices, manage product distribution, and adjust other business strategies in real time without human intervention. This interaction between autonomous agents can create algorithmic collusion patterns that are difficult to detect and control compared to traditional collusion between human business actors.[16] A machineopoly's characteristics that distinguish it from traditional monopolies include dominance through data and algorithms, powerful network effects, Technology dependence, and market complexity.

1) Dominance through data and algorithms

Machine-opoly is built based on mastery and concentration of big data, the leading resource in the modern digital economy. This big data provides the key fuel for developing and refining AI algorithms to learn patterns, make predictions, and make business decisions automatically and efficiently. Thus, business actors who have the largest and most concentrated access to this data gain significant ability to control the market and influence consumer and competitor behaviour. AI algorithms continuously leverage data to improve the accuracy and speed of decision-making, from pricing and ad targeting to product and service distribution optimisation.[17]

This advantage becomes very strategic because it creates a high barrier to entry for new competitors who do not have access to data or similar technological capabilities. This gives business actors with the most considerable data mastery an unparalleled advantage, which can perpetuate their dominant position in the market. This machine-opoly phenomenon marks the transformation of traditional monopolies into technology and data-based monopolies, where mastery of digital infrastructure and data is the key to market dominance.[18] Consequently, competition regulations must adapt to

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[16] Sebastian Benthall and Jake Goldenfein, "Artificial Intelligence and the Purpose of Social Systems," in *Proceedings of the 2021 AAAI/ACM Conference on AI, Ethics, and Society* (New York, NY, USA: ACM, 2021), 3–12.

[17] Goodman and Flaxman, "European Union Regulations on Algorithmic Decision Making and a 'Right to Explanation.'"

[18] Vass Bednar, Ana Qarri, and Robin Shaban, "Study of Competition Issues in Data-Driven Markets in Canada," *Ottawa: Vivic Research for Innovation, Science and Economic Development Canada. January. Online at Https://Vivicresearch. ca/Work/Study-of-Competition-Issues-in-Data-Driven-Markets-in-Canada*, 2022. For further discussion, *see also* Subkhi Amhadi Muhammad Nazhir, and Anton Sandi Utama. "Artificial Intelligence and Criminal Liability: Reassessing Mens Rea in the Age of Autonomous Systems". *Indonesian Journal of Digital Crime and Criminal Justice* 1, no. 1 (2025): 1-44; Dimas Dwi Arso, "Artificial Intelligence and Its Impact on Business Competition: A Review of Business Law in Indonesia." *Contemporary Issues on Indonesian Social Justice and Legal*

understand how data concentration and the use of AI can create exclusive market forces. These forces impact competition dynamics and consumer protection in ways more complex than conventional monopolies, involving automated and collaborative interactions between algorithms. Pricing algorithms and market strategies can communicate within an autonomous decision-making framework, enabling the formation of automated collusive behaviour without human intervention. This contrasts with traditional monopolies requiring explicit planning and agreement between actors.

2) Powerful network effects

Digital platforms and services that rely on AI technology are becoming more valuable as users increase. This phenomenon arises due to the network effect, where the more users join, the more data is generated, and the accuracy of the AI algorithm can be further improved.[19] This strengthens the dominant position of already large businesses with wider access to data, as they can offer better and more efficient services than newcomers. This dominant position is increasingly difficult to shake because large players have significant capital to continue developing technology and digital infrastructure and to collect massive user data.[20] As a result, newcomers' opportunities to compete are becoming increasingly limited as they face significant barriers in acquiring data and achieving the economies of scale needed to compete effectively. This condition creates a high barrier to entry in the AI-based digital platform market.

3) Technology dependence and market complexity

The modern market that relies on AI technology is highly dynamic and complex. Changes in prices, offers, and business strategies can occur almost instantly, as AI algorithms can analyse data in real-time and make automatic adjustments according to market conditions. This makes supervision and enforcement much more challenging than traditional monopoly markets, which are relatively static and easier to monitor. Traditional monopolies are typically observed in market dominance over large industries, such as energy and transportation, large factories, mining products, or physical infrastructure businesses.

Reform 1, no. 1 (2025): 78-98; Pratama Agus Widodo, "The Role of Indonesian Fatwa Institutions in Responding to Artificial Intelligence Technology." *The Indonesian Journal of Islamic Legal Modernism* 1, no. 1 (2026): 121-150; Maya Septiana Nurhidayati, Ankita Kumari, and Sidharth Kapoor. "Economic Justice in Indonesia: Addressing Inequality and Promoting Social Mobility." *Indonesian Economic Justice Review* 1, no. 1 (2024).

19 Rainer Alt, "Electronic Markets on Digital Platforms and AI," *Electronic Markets* 31, no. 2 (June 17, 2021): 233–241.

20 Sergey A Yablonsky, "AI-Driven Digital Platform Innovation," *Technology Innovation Management Review* 10, no. 10 (2020).

In this context, substantial control of physical assets is the key to market dominance. A more centralised market structure and a focus on physical locations make it easier for regulators to monitor and intervene in monopolistic practices in the event of abuse of dominant positions. Machine-opoly emerged primarily in fast-moving and globally dispersed digital ecosystems. Examples include e-commerce platforms, digital advertising providers, social media services, and data-driven marketplaces. Mastering big data and AI algorithm capabilities in this ecosystem is key to market strength. Digital-based business models enable businesses to dominate the market without significant physical assets while efficiently controlling market access and interaction.[21]

2. Machine-opoly Forming Mechanism

The formation of machineopoly can be understood through three main mechanisms that interact and reinforce each other: data concentration, algorithmic collusion, and network effects.

1) Data Concentration

Data is a core asset in the digital economy and serves as the primary foundation for AI development. In the digital ecosystem, businesses that can collect significant and diverse amounts of data have the potential to create more sophisticated and accurate AI algorithms. [22] This algorithm is handy in predicting market and consumer behaviour, thus providing a significant competitive advantage for these business actors. The competitive advantage gained from this data monopoly makes data concentration a substantial obstacle for potential competitors. Data collection and processing on a large scale requires enormous technical capacity and financial resources, which are not easily accessible to new business actors.[23] These barriers create less competitive market conditions, limiting opportunities for newcomers. This phenomenon gave birth to a new form of monopoly known as machine-opoly, in which many large companies control most of the relevant data needed to operate AI effectively. This vast mastery of data allows them to maintain and strengthen

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[21] Fernando van der Vlist, Anne Helmond, and Fabian Ferrari, "Big AI: Cloud Infrastructure Dependence and the Industrialisation of Artificial Intelligence," *Big Data & Society* 11, no. 1 (March 12, 2024).

[22] Fnu Jimmy, "Emerging Threats: The Latest Cybersecurity Risks and the Role of Artificial Intelligence in Enhancing Cybersecurity Defenses," *International Journal of Scientific Research and Management (IJSRM)* 9, no. 02 (February 23, 2021): 564–574.

[23] Ganlin Pu et al., "Innovative Finance, Technological Adaptation and SMEs Sustainability: The Mediating Role of Government Support during COVID-19 Pandemic," *Sustainability* 13, no. 16 (August 17, 2021): 9218.

their dominant position in a digital market that relies heavily on AI technology.[24]

2) Algorithmic Collusion

Algorithmic collusion is a phenomenon in which AI algorithms interact automatically, forming a cooperation pattern that reduces market competition.[25] Without explicit human consent, these algorithms can set prices together by observing each other and adjusting competitors' prices. As a result, market prices remain high and stable, ultimately harming consumers due to the lack of healthy price competition. One of the main challenges of algorithmic collusion is its automated and complex nature, where algorithms work based on real-time data and decision-making processes that indirectly involve open communication between business actors.[26]

Unlike traditional cartels that require explicit agreements between companies, algorithmic collusion occurs through system interactions that are difficult for regulators to track directly. The difficulty in detecting and proving algorithmic collusion makes antitrust law enforcement more complicated. Regulators must develop new methods to analyse and understand how algorithms operate and detect patterns that indicate potential breaches. This includes monitoring the behaviour of algorithms in price decision-making and collaborating with technologists and regulators from different countries.

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3) Network Effects

The network effect is a phenomenon where the value of a product or service increases as the number of users increases. In the context of machine-opoly, digital platforms that rely on AI are becoming increasingly valuable and dominant as more consumers and business actors join the ecosystem. The more users there are, the more data can be collected and processed, allowing AI algorithms to work more effectively in improving the quality of service and user experience.[27]

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[24] Ahmad Sabirin and Raafid Haidar Herfian, "Dampak Ekosistem Digital Terhadap Hukum Persaingan Usaha Di Indonesia Serta Optimalisasi Peran Komisi Pengawas Persaingan Usaha (KPPU) Di Era Ekonomi Digital," *Jurnal Persaingan Usaha* 1, no. 2 (December 31, 2021): 75–82.

[25] Colm Hawkes, *A Market Investigation Tool to Tackle Algorithmic Tacit Collusion: An Approach for the (near) Future* (College of Europe, 2021).

[26] Jiaxin Chen, "Systematic Reconstruction of Labour Rights Mechanisms under the Threshold of Hierarchical Classification: An Integrated Path Based on Legal Empowerment and Procedural Synergy," *International Journal of Management Science Research* 8, no. 4 (April 28, 2025): 88–96.

[27] Ehtesham Hashmi, Muhammad Mudassar Yamin, and Sule Yildirim Yayilgan, "Securing Tomorrow: A Comprehensive Survey on the Synergy of Artificial Intelligence and Information Security," *AI and Ethics*, July 30, 2024.

This creates a mutually reinforcing growth cycle between the number of users and the platform's value. This network effect strengthens digital platforms' dominant position by building significant barriers to entry for new business actors. Newcomers must not only compete in terms of technological capabilities but also attract a large user base to match established platforms. This large user base provides a continuous advantage as the growing and diverse data refine AI algorithms, increasing the platform's appeal to users and business actors.[28]

The dominance gained through the network effect complicates market competition dynamics, as large platforms can leverage economies of scale and data to maximise efficiency and suppress competitors. This situation creates a powerful technology monopoly in the digital age, where market dominance is not solely determined by physical assets, but also by the dominance of data and AI technologies that are hard to match. Large platforms can lock users in with various integrated services, making it challenging for newcomers to capture market share. As a result, the growth of machine-opoly-based technology monopolies has become increasingly difficult to solve by conventional market mechanisms.[29] The three mechanisms are interrelated and mutually reinforcing in building a monopoly based on AI technology and digital data.[30] This technological factor is the main differentiator compared to traditional monopolies, usually realised through capital control, physical assets, and distribution networks.

3. Taxonomy of Algorithmic Collusion

To better understand the challenges posed by algorithmic collusion in competition law, it is important to distinguish the various forms through which algorithms may facilitate or sustain anticompetitive conduct. The degree of human involvement and the level of algorithmic autonomy significantly influence both the nature of the collusive behavior and the complexity of legal enforcement. As algorithms evolve from simple tools implementing human instructions to self-learning systems capable of independent market adaptation,

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[28] Tata Wijayanta et al., "Should Indonesia Learn from Malaysia and Singapore's Cross-Border Insolvency Asset Settlements?," *Yustisia Jurnal Hukum* 13, no. 1 (April 29, 2024): 27.

[29] Richard Adam, "Predatory Pricing for E-Commerce Businesses from a Business Competition Law Perspective," *Journal of Law and Sustainable Development* 11, no. 8 (September 29, 2023): e1438, https://doi.org/10.55908/sdgs.v11i8.1438.

[30] Naoum Tsolakis et al., "Artificial Intelligence and Blockchain Implementation in Supply Chains: A Pathway to Sustainability and Data Monetisation?," *Annals of Operations Research* 327, no. 1 (August 21, 2023): 157–210, https://doi.org/10.1007/s10479-022-04785-2.

establishing intent, causation, and liability becomes increasingly difficult. Accordingly, the following taxonomy classifies algorithmic collusion models based on the extent of artificial intelligence autonomy and the corresponding challenges they present for legal proof and antitrust enforcement, as shown on Table 1.

TABLE 1. Classification of Algorithmic Collusion Models Based on the Degree of Autonomy of AI and the Complexity of Legal Proof

Model	Human Involvement	Legal Risks
Messenger	Height	Easy to prove
Hub-and-Spoke	Medium	Intermediate
Predictable Agent	Low	Difficult
Autonomous Learning Agent	Very Low	Very Difficult

Sources: *Adapted from Ezrachi & Stucke (2016),* Virtual Competition: The Promise and Perils of the Algorithm-Driven Economy*; OECD (2017),* Algorithms and Collusion: Competition Policy in the Digital Age*; serta Harrington (2018).*

Based on the Table 1, it provides an explanation that the level of human involvement in each algorithmic collusion model has a direct effect on the level of legal risk and ease of proof in business competition law. In the Messenger Model, human involvement is still very high because the algorithm only functions as a tool to carry out instructions that have been determined by business actors[31]. The existence of agreements or coordination carried out by humans before the algorithm is implemented causes this model to be relatively easy to prove as a violation of business competition. Evidence of communications, agreements, or instructions provided to the system can be used to show the presence of an element of intentionality in anti-competitive behaviour.

In the Hub-and-Spoke Model, human involvement is at a moderate level because coordination does not always occur through direct communication between companies, but rather through the use of the same algorithmic system or technology provider.[32] The legal risk is at an intermediate level because the relationship between business actors and the results of market coordination is not always explicitly visible. Under these conditions, proof requires a more in-depth analysis of the role of third parties as a liaison that allows the formation of coordinated market behaviour. In the Predictable Agent Model, human

[31] Robert Van De Mark, "Virtual Competition: The Promise and Perils of the Algorithm-Driven Economy, by Ariel Ezrachi & Maurice E. Stucke," *Osgoode Hall Law Journal* 55, no. 2 (2018): 614–619.

[32] OECD Algorithms, "Collusion: Competition Policy in the Digital Age" (OECD: Paris, France, 2017).

involvement is lower because the algorithm is given the authority to observe and respond to competitor behaviour automatically.

Although the basic parameters of the system remain determined by humans, price decisions and market responses take place without direct intervention. The legal risk is higher because there is no explicit agreement that can be identified. Uniform price patterns arise from rational and repetitive algorithmic interactions, making it difficult to distinguish between competitive market behaviour and behaviour that produces collusive effects.[33]

Meanwhile, the Autonomous Learning Agent Model shows a very low level of human involvement because the algorithm is able to develop its own business strategy through a data-driven learning process[34]. The system not only executes the instructions, but also evaluates, adjusts, and optimises its decisions independently. In this model, legal risks become very high as the relationship between market actions and human decisions becomes increasingly unclear. Behaviour that resembles collusion can arise without communication, agreements, or direct instructions from business actors. This condition makes this model the most complex and most difficult form of algorithmic collusion by traditional concepts in business competition law that have so far focused on proving agreements between people.

In fact, algorithmic collusion does not occur in a uniform form because the level of autonomy of algorithms varies. These differences determine how anti-competitive behaviour emerges in the digital marketplace and the extent of human involvement in the process. In the context of machine-opoly, there are at least four main forms of algorithmic collusion that show the evolution from human-based coordination to coordination generated by artificial intelligence independently.[35] The first form is the Messenger Model, which is a situation where the algorithm only functions as a tool to carry out agreements that have been made by business actors. In this model, the decision to coordinate prices comes from humans, while algorithms are used to automate its execution. The algorithm does not generate market strategies independently, but executes predefined parameters. Therefore, the anti-competitive behaviour that appears in this model is essentially an extension of conventional cartels that utilise digital technology to improve the effectiveness of coordination. The second form is

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[33] Alan Schwartz and Louis L Wilde, "Intervening in Markets on the Basis of Imperfect Information: A Legal and Economic Analysis," *University of Pennsylvania Law Review* 127 (1978): 630.

[34] Emilio Calvano et al., "Artificial Intelligence, Algorithmic Pricing, and Collusion," *American Economic Review* 110, no. 10 (2020): 3267–3297.

[35] Dominik Vuletić et al., "Algorithmic Collusion in Competition Law: Overview," *EU and Comparative Law Issues and Challenges Series (ECLIC)* 8 (2024): 377–394.

Hub-and-Spoke Algorithmic Collusion. This model occurs when multiple companies use the same algorithmic system or acquire pricing services from the same software provider.[36]

Under these conditions, companies do not need to communicate directly to produce coordinated market behaviour. The algorithms used together are able to create price uniformity and similar market responses among business actors. Coordinated relationships emerge through technological systems that mediate interactions between companies, making the boundaries between independent behaviour and collusive behaviour increasingly difficult to distinguish. The third form is the Predictable Agent Model. In this model, each company uses an algorithm designed to automatically monitor and respond to competitor behaviour. The algorithm will adjust the price based on the changes made by competitors so that it creates behaviour patterns that adapt to each other in a sustainable manner.[37] There is no direct communication or explicit agreement, but algorithmic interaction results in price stability that resembles the outcome of a cartel agreement. This phenomenon suggests that market coordination can be formed solely through the ability of algorithms to observe, predict, and respond to competitors' actions in real time. The most complex form is the Autonomous Learning Agent Model[38].

In this model, the algorithm uses machine learning or reinforcement learning technology that allows the system to develop business strategies independently. The algorithm learns from market data, evaluates the results of each decision, and gradually optimises its behaviour to achieve higher profits. Through this learning process, the system can find that maintaining prices at a certain level is more profitable than aggressive price competition. As a result, behaviour that resembles collusion can arise without direct instructions, communication, or agreement between business actors. The four forms of algorithmic collusion show that machine-opoly is not only related to the use of AI in business activities, but also related to the transformation of market coordination mechanisms.[39]

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[36] Nick Bontis and Honsan Chung, "The Evolution of Software Pricing: From Box Licenses to Application Service Provider Models," *Internet Research* 10, no. 3 (2000): 246–255.

[37] Ismo Koponen and Maija Nousiainen, "An Agent-Based Model of Discourse Pattern Formation in Small Groups of Competing and Cooperating Members," *JASSS: The Journal of Artificial Societies and Social Simulation* 21, no. 2 (2018): 1.

[38] Chaoyang Zhu, "An Adaptive Agent Decision Model Based on Deep Reinforcement Learning and Autonomous Learning," *Journal of Logistics, Informatics and Service Science* 10, no. 3 (2023): 107–118.

[39] Aneesa Mazumdar, "Algorithmic Collusion," *Columbia Law Review* 122, no. 2 (2022): 449–488.

In the Messenger Model, coordination is still dominated by human decisions. In the Hub-and-Spoke Model, coordination arises through the use of the same algorithmic infrastructure. In the Predictable Agent Model, coordination is formed through predictable automated responses. Meanwhile, in the Autonomous Learning Agent Model, coordination appears as a result of learning algorithms that develop independently. [40] These differences in characteristics suggest that the higher the level of autonomy of the algorithm, the more difficult it is to identify the source of anti-competitive behaviour and the more complex the relationship between market action and human decision-making.

4. Impact on Competition and Consumers

Machine-opoly has significant impacts that could threaten the dynamics of business competition and consumer welfare in the modern digital market.

1) Barriers to Entry

The dominance of data and expensive AI technology creates a high barrier to entry, making it difficult for small businesses and newcomers to compete.[41] In Australia, competition regulations are regulated in the Competition and Consumer Act 2010 (CCA), specifically Article 46, which governs the prohibition of misuse of market power. The latest proposed revisions to Australia's digital competition regime target large digital platforms with new obligations to address anti-competitive practices, including those that inhibit the entry of new competitors through mastery of data and advanced technologies. [42] In China, the Anti-Monopoly Law, last revised in 2022, affirmed the prohibition against abusing dominant positions to create unreasonable barriers to market entry.[43]

Article 17 explicitly prohibits business actors in dominant positions from taking actions that curb competition, including restricting access to critical

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[40] Munehiro Fukuda et al., "Distributed Coordination with Messengers," *Science of Computer Programming* 31, no. 2–3 (1998): 291–311.

[41] Erfiani Hesti, "Praktik Barrier To Entry Yang Bertentangan Dengan Pasal 19 Undang-Undang Nomor 5 Tahun 1999 Dalam Perspektif Hukum Ekonomi Syariah (Studi Kasus Antara Grab Dengan PT TPI Dalam Putusan Komisi Pengawas Persaingan Usaha Nomor 13/Kppu-I/2019 Tentang Jasa Angkutan Sewa". *Thesis* (Purwokerto: UIN Prof. KH Saifuddin Zuhri Purwokerto, 2021).

[42] Julie Clarke et al., *Competition Law and Economics in Australia, Volume I: The Competition Law System: Context, Law, and Economics* (Oxford, UK: Taylor & Francis, 2025).

[43] Tao Wu and Yihan Wang, "Examining the First Amendment of China's Anti-Monopoly Law: Suggestions to Improve the Regulation on Monopoly Agreements," *China-EU Law Journal* 9, no. 1–4 (October 12, 2023): 3–23.

resources such as data and AI technology, ensuring that new business actors can compete fairly. In Indonesia, Law No. 5 of 1999, with Article 17, also regulates the prohibition of practices that hinder healthy competition, particularly preventing dominant actors from using their positions to create barriers to entry for new competitors.

This paper generally regulates business actors to prevent them from arbitrarily exploiting market dominance, which can endanger the competitive business process. Meanwhile, the UK, with the Competition Act 1998 Article 18, prohibits the abuse of dominant positions that hinder the entry of new competitors and create disproportionate barriers in the market. These countries are increasingly updating and adapting regulations to face new challenges in the digital age. The dominance of expensive data and AI technologies is a key tool capable of creating high barriers to entry, reducing market plurality, and increasing the risk of innovation stagnation. Strong and adaptive regulations are essential to maintain a healthy and dynamic business competition ecosystem.

2) Price Manipulation

The algorithm's ability to automatically collude with prices (algorithmic collusion) can cause the price of a product or service to be unreasonable, higher than the competitive price it should be.[44] This practice is detrimental to consumers because consumers must pay a higher price than the healthy market price. In addition, small business actors who lack the power to determine prices suffer losses because they cannot compete with prices distorted by this algorithmic collusion. Price manipulation through algorithms is a significant challenge for supervisory authorities because of the complexity of algorithmic interactions occurring in real-time without human intervention. This makes tracking and proving the existence of algorithmic collusion very difficult.[45]

Business competition authorities must develop new methods and high-tech analysis tools to detect algorithmic behaviour patterns that potentially violate competition laws. In Indonesia, this aspect is regulated by Law No. 5 of 1999, particularly Article 19, which prohibits business actors from engaging in activities that may lead to monopolies or unfair business competition, including through electronic systems that can harm competition and consumers. The government also addresses this in Government Regulation No. 80 of 2019 (GR-

[44] Lea Bernhardt and Ralf Dewenter, "Collusion by Code or Algorithmic Collusion? When Pricing Algorithms Take Over," *European Competition Journal* 16, no. 2–3 (September 1, 2020): 312–342.

[45] Axel Gautier, Ashwin Ittoo, and Pieter Van Cleynenbreugel, "AI Algorithms, Price Discrimination and Collusion: A Technological, Economic and Legal Perspective," *European Journal of Law and Economics* 50, no. 3 (December 14, 2020): 405–435.

No. 80 of 2019), which mandates the supervision of business competition practices in electronic systems.

The algorithm's ability to automatically collude with prices (algorithmic collusion) can cause the price of a product or service to be unreasonable, higher than the competitive price it should be.[46] This practice is detrimental to consumers because consumers must pay a higher price than the healthy market price. In addition, small business actors who lack the power to determine prices suffer losses because they cannot compete with prices distorted by this algorithmic collusion. Price manipulation through algorithms is a significant challenge for supervisory authorities because of the complexity of algorithmic interactions occurring in real-time without human intervention. This makes tracking and proving the existence of algorithmic collusion very difficult.[47]

Business competition authorities must develop new methods and high-tech analysis tools to detect algorithmic behaviour patterns that potentially violate competition laws. In Indonesia, this aspect is regulated by Law No. 5 of 1999, particularly Article 19, which prohibits business actors from engaging in activities that may lead to monopolies or unfair business competition, including through electronic systems that can harm competition and consumers. The government also addresses this in GR-No. 80 of 2019, which mandates supervising business competition practices in electronic systems.

3) Inequality of Access to Technology and Data

Inequality of access to technology and data is a crucial problem in today's digital economy.[48] Large business players who master advanced technology and large data sets tend to accumulate significant market power. Meanwhile, small businesses and newcomers are increasingly marginalised due to limited access to technology and data, the main capital needed to compete. This widens economic disparities and strengthens unbreakable monopolies, thereby hindering market plurality and economic justice in the pursuit of healthy market access. This inequality also affects the distribution of benefits in the digital economy, where business groups that have not fully adopted digital technology struggle to expand market reach and increase competitiveness.

This has caused a widening disparity between large and small business actors and between developed and disadvantaged regions, especially in

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[46] Salil K Mehra, "Price Discrimination-Driven Algorithmic Collusion: Platforms for Durable Cartels," *Stanford Journal of Law, Business, and Finance* 26 (2021): 171.

[47] Antonio Gomes, and Pedro Gonzaga "Pricing Algorithms: The Risk of Collusion and Personalised Pricing," in *Killer Acquisitions? Evidence and Potential Theories of Harm* (Cheltenham, UK: Edward Elgar Publishing, 2022), 64–75.

[48] Yi Huang, "Monopoly and Anti-Monopoly in China Today," *The American Journal of Economics and Sociology* 78, no. 5 (November 26, 2019): 1101–1134.

developing countries such as Indonesia.[49] Technological inequality also impacts access to information, innovation, and productivity capabilities, which vary significantly among business actors. The government and related institutions must address this inequality problem by developing equitable digital infrastructure, increasing digital literacy, and implementing inclusive regulations. Developing a fast and equitable internet network, digital skills training, and providing technology access to small businesses are the keys to reducing the digital gap and creating fairer business competition.

Thus, the growth of the digital economy can be felt by all levels of society and reduces the risk of market dominance by a handful of large business actors.[50] The problem of inequality in access to technology and data is highly relevant to the supervision of business competition, where market dominance must be prevented from becoming an adverse monopoly practice. This inequality needs to be anticipated with regulations that prohibit the practice of monopolies and abuse of dominant positions, as stipulated in Law No. 5 of 1999 Article 17 in Indonesia, Sherman Act Article 2 and Clayton Act Article 7 in the US, Article 102 TFEU in the EU, as well as Article 46 of the Competition and Consumer Act 2010 in Australia and Article 17 of China's Anti-Monopoly Law. This regulation aims to encourage more inclusive market access and ensure that business competition continues healthily amid rapid digital technology developments.

Traditional regulations on business competition, which refer to the supervision of human behaviour, have become ineffective in overseeing the interaction of autonomous agents in machine-opoly. It is necessary to apply a new approach that uses information technology and data analysis to monitor algorithmic behaviour patterns and develop adaptive, risk-based AI regulations.[51] These regulations must prevent anti-competitive practices without hindering innovation and technological development.

The machine-opoly phenomenon has become a significant concern for regulators in various countries. The EU, for example, through the EU AI Act, which came into effect in August 2024, establishes regulations governing the

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[49] David Mhlanga, "Industry 4.0 in Finance: The Impact of Artificial Intelligence (AI) on Digital Financial Inclusion," *International Journal of Financial Studies* 8, no. 3 (July 28, 2020): 45.

[50] Abdullah Taufik, "Dominant Position in the Aviation Industry: Case Analysis of Appointment of Strategic Business Partners (Wholesaler) By PT.Garuda Perspective UU No. 5 of 1999," *Khazanah Sosial* 5, no. 3 (October 12, 2023): 418–427.

[51] Jerzy Niemczyk et al., "The Dominant Motives of Mergers and Acquisitions in the Energy Sector in Western Europe from the Perspective of Green Economy," *Energies* 15, no. 3 (January 31, 2022): 1065.

use of AI with a risk-based approach, emphasising transparency, auditability, and non-discrimination.[52] The regulation also integrates the competition law provisions under Articles 101 and 102 TFEU, which require the supervision of algorithmic interactions to prevent collusion and abuse of dominant positions.

In the US, authorities such as the FTC and DOJ are tightening antitrust oversight, especially in large tech industries that rely on AI and big data. Oversight approaches include merger analysis, algorithmic pricing controversies, and algorithmic transparency to prevent market abuse. Meanwhile, Indonesia refers to Law No. 5 of 1999 as the central legal umbrella, with Articles 17, 18, and 25 as the basis for intervention against AI-based and digital-based monopoly practices. The Circular Letter of the Minister of Communication and Information Technology No. 9 of 2023 on Artificial Intelligence Ethics also provides an ethical framework for AI's sustainable and responsible development in Indonesia.

Machineopoly is a concept that introduces a new dimension to monopoly in the digital age. It is shaped by the automatic interaction of algorithms, the mastery of big data, and the network effects of digital platforms.[53] This phenomenon indicates a shift from traditional monopolies, which are physical in nature, to monopolies based on advanced technologies that require a more adaptive and innovative approach to regulation and supervision. The impact on competition and consumers is widespread, ranging from high barriers to entry and price manipulation to inequality of access to technology.

Philosophical and Theoretical Challenges to the Principle of Market Justice

Amid this massive wave of technological innovation, there is an irreconcilable tension between the need to encourage innovation and maintain economic fairness and the principles of fair competition. This is mainly related to how market fairness, a fundamental concept in economic theory and competition law, must be reinterpreted when market actors are no longer direct human entities, but autonomous and algorithmic systems. The authors provide three major issues: whether algorithms can be considered economic actors in the legal sense, the ethical and moral implications of AI autonomous decisions in the market, and how responsibility shifts from human corporations to algorithmic systems.

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[52] Hannah van Kolfschooten and Janneke van Oirschot, "The EU Artificial Intelligence Act (2024): Implications for Healthcare," *Health Policy* 149 (November 2024): 105152.

[53] Andrea Coveri, Claudio Cozza, and Dario Guarascio, "Monopoly Capitalism in the Digital Era" (LEM Working Paper Series, 2021).

1. Can Algorithms Be Considered Economic Actors in the Legal Sense?

In the conventional legal system, "economic actors" are entities that have legal capacity and are capable of being held accountable for their actions, hold rights and obligations, and are subject to legal and civil liability.[54] These perpetrators are usually individuals, groups/organisations, or legal entities such as companies that can enter into contracts, file lawsuits, and be subject to sanctions. However, with the advancement of AI, decision-making functions that were once entirely performed by humans are now starting to be shifted to intelligent algorithms and autonomous agents. These algorithms have no legal awareness or moral capacity, so their status in the legal and economic realms becomes vague and complex.

A big question arises that needs to be underlined: can AI systems and algorithms be considered economic actors? If so, the demands for legal and ethical responsibility should be reframed to include non-human actors. Some classical legal theories argue that AI is a tool human actors or corporations use, so it cannot legally stand as a subject. However, thanks to AI's increasingly independent ability to make business decisions, such as setting prices, negotiating automatically, or managing digital markets, some argue that AI should be treated as an independent economic agent and potentially have limited legal status (legal personhood) or be governed based on the principle of special obligations and responsibilities.

An alternative approach sees AI as an "extension" of human actors, so the AI system's creator, manager, or owner remains responsible for algorithmic decisions.[55] This approach is currently more commonly accepted in legal frameworks in various jurisdictions as a temporary solution, given the technical and philosophical complexities of recognising legal subjectivity for AI. However, this model poses major challenges in practice, especially in the case of autonomously generated algorithmic errors, which are difficult to attribute directly to specific human actions. These questions are still debated in academia and the evolving legal order, both nationally and internationally, demanding in-depth reflection on whether and how non-human decision-making capabilities can be recognised and regulated effectively and fairly.

In Article 5 of Law No. 5 of 1999, business actors are prohibited from agreeing with competitors to determine the price of goods or services that

[54] Ahmed Mohammed Awwad, "Contractual Freedom and Restrictions Included Therein in The Saudi Civil Transactions Law," *International Journal of Religion* 5, no. 5 (April 5, 2024): 210–222.

[55] Nevejans, "European Union's Regulation on the Placing on the Market and Use of AI Systems: A Critical Overview of the AI Act."

consumers pay. Meanwhile, Article 11 prohibits agreements that influence prices, production, or marketing that could lead to monopolies or unfair business competition. In the practice of automated pricing algorithms, even in the absence of written agreements or direct communication between the perpetrators, algorithmic systems that result in collusive behaviour may be considered to violate these articles because the impact is similar to traditional cartel (price fixing) practices.[56] In addition, KPPU, as a regulatory institution and supervisor of business competition in Indonesia, has issued guidelines and suggestions related to algorithm regulation and the role of technology in the digital economy. KPPU understands the challenges in overseeing algorithmic collusion practices and continues to develop oversight strategies, including regulatory advocacy and technology engagement, to detect unfair competition practices generated by automated systems.

In the United States, algorithmic collusion violates Article 1 of the Sherman Act, prohibiting agreements, conspiracies, or coalitions that restrict trade, including unlawful price fixing.[57] Although algorithms move automatically, the law in the US considers human control over algorithms as a basis for demanding legal liability against business actors who use the system. Article 101 TFEU prohibits agreements that directly or indirectly set prices or regulate trade conditions between competing parties in the European Union. With algorithmic collusion, where algorithms monitor and adjust prices in parallel without direct human intervention, this mode can still be considered a violation as long as there is coordination that reduces the risk of competition. This legal approach in the EU is also a reference for other countries responding to technological challenges in business competition.

2. Ethical and Moral Implications of AI Autonomous Decisions in the Market

When algorithms take a central role in driving markets through autonomous functions such as automated pricing, resource allocation, and supply chain management, several ethical and moral issues arise that need serious attention. Unsupervised AI decisions can reinforce price-discriminatory practices, algorithmic monopolies, or harm certain social groups due to veiled

[56] Haiqal Riski Ramadhan, Darminto Hartono Paulus, and Giovanni Marcello, "Prohibition of Monopolistic Practices in Business Trials in Indonesia: Reforming on Business Competition Supervisory Commission," *Journal of Law and Legal Reform* 4, no. 2 (April 30, 2023): 163–182.

[57] Yichen Yang, "Price-Related Cartels under the Chinese Anti-Monopoly Law Regime: The Need to Clarify Four Substantive and Procedural Issues," *World Competition* 39, no. Issue 3 (September 1, 2016): 479–512.

biases in the datasets used for algorithm training. This can be seen from AI-based pricing that adjusts prices differently between consumers based on personal data analysis, which can trigger distributive injustices contrary to the principles of fair competition and consumer protection.[58]

Transparency and explainability are key issues in dealing with AI-related market justice. It is common for algorithmic decisions to be difficult to understand even by the developers themselves (black-box problem). This ambiguity can fail to ensure the resulting decision is free from bias, discrimination, and other injustices. International organisations such as the United Nations Educational, Scientific, and Cultural Organisation (UNESCO) and the Organisation for Economic Co-operation and Development (OECD) have established ethical principles of AI that challenge developers and users of technology to ensure accountability, inclusivity, and fairness as the foundation of AI development and implementation.[59]

In fact, decision automation in the digital market shows the incompatibility between the fast and changing machine learning process and traditional justice norms that demand fair, transparent, and participatory methods. As a result, a new concept of justice is needed to accommodate the dynamics of automation and the use of big data, while also paying attention to the socio-economic impact on all market participants and the wider community. Focus not only on the final market or price results, but also on the decision-making process, data governance, and algorithmic oversight to maintain ethics and fairness.

The ethical and moral implications of AI's autonomous decisions in the marketplace are becoming increasingly important as AI's use in various aspects of business and social life develops.[60] Ethics in AI decisions demand transparency, accountability, fairness, and privacy protection, as AI decisions often directly impact the lives of consumers and business actors. For example, algorithms that automatically determine prices must be non-discriminatory and not lead to unhealthy practices such as price collusion or market exclusion.

From an ethical perspective, AI-generated automated decisions must be explainable and accountable. Complex AI systems need to be designed so that humans can understand the decision-making process and study the impact and

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[58] Jiayi Hou, "The Influence of Administrative Anti-Monopoly Measures on the Innovation Enthusiasm of Digital Economy Enterprises and Countermeasures," ed. B. Wang, *SHS Web of Conferences* 208 (December 12, 2024): 01002.

[59] Andy Nguyen et al., "Ethical Principles for Artificial Intelligence in Education," *Education and Information Technologies* 28, no. 4 (April 13, 2023): 4221–4241.

[60] Shubh Shukla, "Principles Governing Ethical Development and Deployment of AI," *International Journal of Engineering, Business and Management* 8, no. 2 (2024): 26–46.

risks of those decisions transparently. This is important for building public trust in AI technology and ensuring the protection of the rights of consumers and small businesses vulnerable to technology abuse.[61] Morality also demands that the data used in algorithm training be processed ethically while maintaining the privacy and security of personal data. Unethical data collection and use can lead to violations of individual rights and create bias and discrimination in AI decisions.

3. Shifting Responsibility from Corporations to Algorithmic Systems

One of the biggest paradigmatic shifts due to the widespread use of AI in the economy is the shift in legal and moral responsibilities from human entities, especially corporations, to algorithmic systems that govern daily business operations. Previously, responsibility for monopolistic business practices, collusion, fraud, or other law violations lay clearly with the human actors or corporate entities who directly made the decisions. But now, many of those decisions are made by highly complex and autonomous AI systems, making it difficult to determine who should be held accountable in case of a violation or legal loss.

Legal theory gives rise to a paradigm of layered responsibility, which involves several actors according to their respective functions and positions in the AI ecosystem: AI makers, operators, end-users, and regulators.[62] Regulations require each layer to have its legal contribution and obligations to ensure the continuation of safe, fair, and lawful AI operations. In practice, however, legal accountability is complicated because AI operates autonomously and highly complexly, sometimes resulting in decisions humans cannot fully predict or audit.[63]

Corporate responsibility is now not limited only to business outcomes and market decisions. Still, it extends to moral and ethical responsibilities, such as auditability, system security, and risk mitigation for the negative impacts of AI. Corporations face pressure to improve the algorithms' transparency, facilitate independent oversight mechanisms, and comply with increasingly stringent national and international ethical and regulatory frameworks. This shows that

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[61] Ajay Verma and Nisha Singhal, "Integrating Artificial Intelligence for Adaptive Decision-Making in Complex System," 2024, 95–105.

[62] Ioannis Lianos, Klaas Hendrik Eller, and Tobias Kleinschmitt, "Towards a Legal Theory of Digital Ecosystems," *Faculty of Laws University College London Law Research Paper* No. 16, 2024.

[63] Tomasz Braun, "Liability for Artificial Intelligence Reasoning Technologies – a Cognitive Autonomy That Does Not Help," *Corporate Governance: The International Journal of Business in Society*, April 16, 2025.

corporate legal responsibility in an AI-based economy must be active in prevention and accountability when violations occur.

In Indonesia, corporate responsibility is legally regulated in Law No. 40 of 2007 concerning Limited Liability Companies, especially Article 74, which regulates corporate social responsibility (CSR). Article 74, paragraph (2) stipulates that social and environmental responsibility costs must be budgeted and implemented reasonably and fairly. These regulations are relevant in the context of high-tech businesses, including AI, which require corporations to pay attention to their operations' social and environmental impacts, including the risk of violating the laws and ethics of technology. Government Regulation Number 47 of 2012 strengthens the implementation of Article 74 by requiring supervision and reporting of the implementation of social responsibility in the annual report to the general meeting of shareholders.

Corporate responsibility for using AI and similar technologies is also receiving increasing attention. For example, in the United States, legal responsibilities are regulated by various corporate and competition law provisions that demand transparency and accountability, including the oversight of algorithms to avoid monopolies and abuse of dominant positions, such as in the Sherman Act and the Clayton Act.[64] The European Union, through the Artificial Intelligence Act, suggests a framework for the development and use of AI that can be audited and accountable, including applying the principles of fairness, transparency, and risk reduction.[65]

In the UK, companies are required to comply with the Companies Act 2006, which regulates the responsibilities of directors to conduct business properly, including taking into account the social impact and new technologies.[66] Australia, through the Competition and Consumer Act 2010, also regulates corporate business practices so as not to abuse its dominant position, especially related to digital technology.[67] Meanwhile, the latest Anti-Monopoly Law in China requires companies to conduct corporate risk

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[64] Hammad Raza, "Regulating Digital Markets: Antitrust Strategies for Tackling Data Monopolies and AI Oversight," 2024.

[65] Alice Witt et al., "Encoding Legislation: A Methodology for Enhancing Technical Validation, Legal Alignment and Interdisciplinarity," *Artificial Intelligence and Law* 32, no. 2 (June 3, 2024): 293–324.

[66] Ceyhun Emre Babacan, "Directors' Conflict of Interest Duties Under the Companies Act 2006: Compliance Measures and Consequences of Non-Compliance," *İbn Haldun Üniversitesi Hukuk Fakültesi Dergisi* 3, no. 1 (2025): 49–86.

[67] Julie Clarke et al., "Competition and Consumer Law in Australia: Principles, Enforcement, and Comparative Perspectives," in *Competition Law and Economics in Australia, Volume II* (London: Routledge, 2025), 1–18.

management in market dominance, including AI technology, with strict oversight mechanisms. These regulations reflect global legal awareness of the moral and legal challenges autonomous AI systems pose. In corporate responsibility theory, AI is positioned as a tool, not a legal subject. Still, using AI gives rise to legal obligations inherent in corporations as economic actors. This new paradigm emphasizes the need for strong internal control mechanisms, adaptive regulation, and multi-actor cooperation so that the development and deployment of AI does not abdicate moral and legal responsibilities, but rather becomes an integral part of sustainable and ethical corporate governance.

4. Synergy between Technology, Law, and Ethics for Modern Market Justice

Understanding and responding to the philosophical and theoretical challenges of market fairness in the age of AI demands a multidisciplinary approach that harmoniously integrates technological, legal, and ethical aspects. AI systems and big data network infrastructure are not separate entities, but rather an integral part of the modern economic ecosystem that requires specific accountability, transparency, and consumer protection arrangements. Traditional regulatory frameworks focusing on human actors and explicit transactions are now insufficient to guard and guarantee market fairness in a complex and autonomous digital economy environment. Several international institutions have designed AI ethical guidelines and standards that serve as universal guidelines for the development and implementation of AI that is fair, bias-free, and responsible. The OECD AI Principles, for example, emphasise the importance of distributive justice, transparency in data processing, and respect for human rights and privacy protection.[68]

UNESCO's Recommendation on the Ethics of Artificial Intelligence also prioritises social justice and the empowerment of AI users so that the digital revolution does not create new gaps or discrimination.[69] This standard contains fundamental moral principles that should be used as a foundation for AI regulation worldwide. From a legal perspective, challenges in the AI era force a complete reinterpretation of market fairness principles and compliance with competition laws. This includes the redefinition of economic actors, which now

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[68] Petar Radanliev, "AI Ethics: Integrating Transparency, Fairness, and Privacy in AI Development," *Applied Artificial Intelligence* 39, no. 1 (December 31, 2025).

[69] Sahan Bulathwela et al., "Artificial Intelligence Alone Will Not Democratise Education: On Educational Inequality, Techno-Solutionism and Inclusive Tools," *Sustainability* 16, no. 2 (January 16, 2024): 781.

also involve algorithmic systems, law enforcement against algorithmic collusion practices, and the implementation of technological audit and supervision mechanisms that are responsive to rapid technological changes. In Indonesia, for example, the principle of corporate accountability for the impact of AI is contained in Law No. 40 of 2007 on Limited Liability Companies, especially Article 74, which requires companies to carry out social and environmental responsibilities fairly and transparently.

This article supports companies' obligations to audit and manage the risks of using AI so as not to harm the social and economic interests of the community. Globally, developed countries have also adopted advanced regulations related to AI. The European Union, for example, implements the Artificial Intelligence Act, which requires strict oversight and auditability of AI, upholds the principles of fairness and transparency, and reduces algorithmic bias and discrimination. In the United States, while there is no centralised regulation of AI, existing legal principles such as the Sherman Act and the Clayton Act allow room for enforcement against the risk of algorithmic collusion and abuse of market dominance. The UK, with the Companies Act 2006, requires the company's directors to conduct business ethically and sustainably, including in technology management. Australia and China have also updated their competition laws, such as section 46 of Australia's Competition and Consumer Act 2010 and section 17 of China's Anti-Monopoly Law, which explicitly regulate business practices that use advanced technologies such as AI, thereby inhibiting competition and creating high barriers to market entry.

If you look at the legal philosophy side, this issue is rooted in John Rawls's concept of distributive and restorative justice.[70] This emphasises the need for a just social and economic structure and provides equal opportunities for all market participants, including in the digital context. Legal justice must accommodate the rights of consumers and business actors, adjust to technological developments so that the law remains relevant, and provide substantive justice, not just procedural.[71] In this case, the role of regulation is to ensure that AI as a decision-making tool does not become a tool of oppression or exclusivity that harms certain groups. Transparency and accountability are ethical principles that demand that AI algorithms be auditable and accountable

[70] M.Yasir Said and Yati Nurhayati, "A Review on Rawls Theory of Justice," *International Journal of Law, Environment, and Natural Resources* 1, no. 1 (April 28, 2021): 29–36.

[71] Bagus Hermanto, I Gede Yusa, and Nyoman Mas Aryani, "Constitutional Court of the Republic of Indonesia: Does the Ultra Petita Principle Reflect the Truth of Law?," *Fiat Justisia: Jurnal Ilmu Hukum* 14, no. 3 (May 15, 2020): 261–286.

so that humans can understand and supervise the resulting decisions. This relates to the liability law theory, which states that the actors using the instrument, in this case, the corporation operating the AI, must have a legal obligation for the impact caused by the instrument.[72]

The precautionary principle supports the implementation of preventive regulations in the use of AI so that negative impacts can be minimised. In addition, the concept of layers of responsibility is also relevant in the AI era, involving all actors ranging from software makers, system operators, end-users, to regulators who regulate and supervise. This paradigm emphasises the importance of cooperation between various stakeholders to ensure AI operates with fairness, security, and legal compliance. In the Indonesian legal system, as stipulated in Law No. 40 of 2007 Article 74, corporate responsibility for social and environmental impacts, including technology risk management, is an integrative part of good corporate governance.

Normative-Comparative Analysis of the Competition Law Framework

Machine-opoly, as a monopoly built based on algorithmic interaction and machine autonomy, poses new challenges that cannot be fully answered with traditional competition legal frameworks. In this section, this paper discusses in detail the effectiveness and limitations of existing competition law, particularly through a review of Articles 101 and 102 of the Treaty on the TFEU and Law No. 5 of 1999.

1. European Union: An Approach to Articles 101 and 102 TFEU in the Context of Artificial Intelligence

The EU has long been a pioneer in developing and enforcing strict and comprehensive competition law, with Articles 101 and 102 TFEU as the main foothold. Article 101 TFEU prohibits agreements, arrangements, or joint practices between business actors that may impede market competition, including cartel practices and price coordination to the detriment of consumers.[73] In the digital age and AI-driven markets, the main challenge is to interpret "collusion" behaviour when interacting with an automated algorithm capable of compiling and adjusting prices without human intervention. The European Commission has been actively investigating the use of dynamic

[72] Oliver Budzinski and Juliane Mendelsohn, "Regulating Big Tech: From Competition Policy to Sector Regulation?," *ORDO* 72–73, no. 1 (November 1, 2023): 215–255.

[73] David Bailey, "Restrictions of Competition by Object under Article 101 TFEU," *Common Market Law Review* 49, no. Issue 2 (April 1, 2012): 559–599.

pricing algorithms and asserted that algorithmic collusion can still be processed as an infringement if it is proven that there is non-competitive coordination of market regulation, even in the absence of explicit communication between human actors.

Article 102 TFEU, which prohibits the abuse of dominant positions by market participants, is also being applied dynamically to address the risk of market dominance amplified by AI and big data. Examples are monopolistic digital platforms that control consumer data as well as superior algorithms, which can use their influence to suppress competitors or set unfair conditions in the market ecosystem. EU authorities demand algorithmic transparency and fairness of data access so that dominant positions are not abused. Law enforcement in Europe is increasingly paying attention to the digital context and characteristics of AI to integrate algorithmic surveillance into traditional competition law frameworks.

The European Union introduced the EU AI Act, an AI-specific regulation that provides a new legal basis that complements Articles 101 and 102 TFEU with AI risk regulation, algorithm auditability obligations, and transparency as prerequisites for competition law compliance. The EU AI Act divides AI systems into risk categories (e.g., high risk) and requires companies that manufacture or use AI to meet strict security and ethical standards. This approach makes the EU a proactive and adaptive regulatory model in dealing with machine-opoly that has the potential to give rise to algorithmic monopolies and automatic collusion in the digital market.[74]

The European Union and other countries have also developed legal frameworks to regulate AI, especially in the context of business competition. In the United States, business competition law is governed by the Sherman Act and the Clayton Act, which prohibit monopolies and anti-competitive practices, including those involving new technologies such as AI algorithms. Authorities such as the FTC and DOJ are increasingly actively monitoring and cracking down on technology monopoly practices, including algorithmic collusion and data misuse by large digital platforms. While there is no centralised AI regulation yet, sector-specific approaches and executive orders at the federal level indicate the development of increasingly stringent AI regulation.

The UK uses the Competition Act 1998, which prohibits the abuse of dominant positions and cartel practices, and by 2024, applies "pro-innovation" principles in AI regulation. The UK's Competition and Markets Authority

[74] Maren Tamke, "Big Data and Competition Law," *Zeitschrift Für Wettbewerbsrecht* 15, no. 4 (December 7, 2017): 358–385.

(CMA) issued guidelines that prioritise interoperability, consumer choice, and strict oversight of the use of AI in digital marketplaces.[75] Australia, through the Competition and Consumer Act 2010, regulates the prohibition of abuse of market power as specifically set out in Article 46, stating that companies with substantial market power must not engage in actions that have the purpose or effect of significantly reducing competition. This prohibition includes a variety of behaviours, including setting unfair conditions, pressuring competitors, or inhibiting the entry of new business actors into the market. This article does not prohibit the acquisition of market power itself, but anyone who has controlled the market must avoid arbitrary behaviour that is detrimental to competition. Enforcement of Article 46 is the main task of the Australian Competition and Consumer Commission (ACCC), which is authorised to oversee and crack down on anti-competitive practices. The ACCC can take legal action, including taking cases to court to prove a breach of Article 46. Sanctions for violations can be severe for both the company and the executives involved, including significant fines and restrictions on functions within the company.[76]

China has also strengthened anti-monopoly regulations with the revised Anti-Monopoly Law in 2022, specifically Article 17.[77] This article prohibits companies that hold dominant positions from committing acts that abuse market power so as to impede unfair competition. Some of the prohibited actions include suppressing competitors, imposing unfair conditions, inhibiting the entry of other business actors, and other practices that can be detrimental to market competition. The content of Article 17 emphasises that it does not mean that having a dominant position itself is against the law, but the abuse of that dominant position is strictly prohibited. A company is considered to have a dominant position if it controls a certain market share in a significant amount and can determine market conditions. Prohibited abusive practices include setting prices too high or too low, restricting sales to competitors, and controls that inhibit other competitive activities.

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75 Dirk Auer, Matthew Lesh, and Lazar Radic, "Digital Overload: How the Digital Markets, Competition and Consumers Bill's Sweeping New Powers Threaten Britain's Economy," *SSRN Electronic Journal*, 2024.

76 Allan Fels and Luke Woodward, "50 Years of the Australian Competition and Consumer Commission," in *Competition Law and Economics in Australia, Volume I* (London: Routledge, 2025), 45–75.

77 Jing Wang, "Competition Neutrality in Courts: Can China's Anti-Monopoly Law 2022 Ensure the Supremacy of Competition Law in Antitrust Private Litigation Involving State-Owned Enterprises," *Global Competition Litigation Review* 15, no. 4 (2022): 132-138.

In the context of technology and AI, because large digital platforms that control data and advanced algorithms can unfairly strengthen their dominance by using these market forces to deter new competitors, impose self-advantageous contractual provisions, and utilise algorithms to set prices that are not in accordance with the dynamics of healthy competition, Article 17 can be used as a reference in regulating AI in market power. Strict oversight and enforcement of Article 17 can prevent algorithmic monopolies and keep the market open and competitive. The State Administration enforces Article 17 for Market Regulation (SAMR), which has the authority to supervise and crack down on monopoly practices in China.[78] Heavy fines and administrative sanctions can be imposed on violating companies. The strengthening of regulations in Article 17 is accompanied by operational guidelines that facilitate the interpretation and implementation of penalties for abuse of dominant positions in the era of rapid digital transformation, so efforts to maintain healthy business competition also adapt to the challenges of evolving AI technology.

2. Indonesia: The Relevance and Limitations of Law No. 5 of 1999 in the Era of AI-Based Markets

On the other hand, Law No. 5 of 1999 is the foundation of competition law in Indonesia. Law No. 5 of 1999 regulates the prohibition of monopolies, unfair market domination, agreements that hinder competition, and abuse of dominant positions. Important articles such as Article 17 on the prohibition of monopolies, Article 18 on unfair market domination, and Article 25 on the abuse of dominant position are the main instruments of competition law enforcement.[79]

However, these regulations are substantially based on the traditional market paradigm that emphasizes human business actors' dominant behavior and position and explicit transactions. In digital and AI-driven markets, this law shows several substantial limitations. First, there are no specific arrangements that accommodate automated algorithmic behaviours, such as algorithmic collusion, that are difficult to monitor and prove without explicit human communication. Second, there are no explicit provisions regarding data management and control as a key aspect in the dominance of the digital market,

[78] Adrian Emch and David Stallibrass, *China's Anti-Monopoly Law: The First Five Years* (Alphen aan den Rijn, The Netherlands: Kluwer Law International BV, 2013).

[79] Anna Maria Tri Anggraini, Ahmad Sabirin, and Yoel Nixon A Rumahorbo, "The Form and Pattern of Business Actors Requirements in Exclusive Dealing: A Rule of Reason Approach," *Yustisia Jurnal Hukum* 12, no. 2 (August 1, 2023): 107.

even though data mastery is the main factor in the formation of machine-opoly. Third, the existing legal framework has not comprehensively regulated the transparency and auditing of autonomous AI systems as part of business competition governance.

Indonesia, in recent years, has begun to adapt the issue of digital regulation through technology policies, such as the Circular Letter of the Minister of Communication and Information No. 9 of 2023 on Artificial Intelligence Ethics. Still, this document is more of a technology ethics guideline and has not yet become a binding rule in business competition law. Therefore, there is an increasingly urgent need to integrate business competition norms with information technology and AI regulations so that Indonesia's competition law can handle the machine-opoly phenomenon effectively. Therefore, the effectiveness of Law No. 5 of 1999 in dealing with machine-opoly is still limited. These regulations are not yet fully adaptive to the development of machine autonomy technology and algorithmic interactions that cause new monopolies.[80] Existing regulations need to be strengthened and expanded to address algorithms, data mastery, and AI governance. The principles of transparency and accountability are sufficient to prevent violations of business competition in the digital era.

3. Regulation and Implementation Gaps: Identifying Unreached Areas

From the analysis above regarding the legal framework of business competition between the European Union and Indonesia, it can be seen that there is a significant gap, especially in the context of facing the machine-opoly phenomenon that is increasingly spreading in the digital era. The European Union, with Articles 101 and 102 TFEU as its foundation, not only maintains the basic principles of competition law but also adopts an innovative approach that guarantees legal relevance in the face of the challenges of autonomous algorithms and technologies. Article 101 TFEU explicitly prohibits anti-competitive agreements, including cartels and price coordination, which now includes the interpretation of collusion behavior when the interaction is an automated algorithm that sets prices without human intervention. The European Commission is aggressively investigating the practice of algorithmic

[80] Dandan Ning and Hongyang Zhao, "The Influence of Monopoly Capitalism on Economic Globalization," *Highlights in Business, Economics and Management* 23 (December 29, 2023): 674–680.

collusion and data misuse as a form of dominant force, demonstrating adaptive and innovative law enforcement.[81]

Article 102 TFEU prohibits the abuse of dominant positions reinforced by AI and the mastery of big data, such as monopolistic digital platforms that oppress competitors and impose unfair conditions in the market. Algorithm transparency and fairness of data access are key demands of EU regulators to prevent abuse of dominant positions. With the introduction of the EU AI Act in 2024, the EU strengthens the legal framework that complements Articles 101 and 102 TFEU. These regulations regulate AI risk, algorithmic auditability, and transparency obligations as prerequisites for competition law compliance, making the EU an effective, proactive, and adaptive regulatory model in mitigating the risks of algorithmic monopolies and automated collusion in digital markets.[82]

Indonesia's Law No. 5 of 1999 still does not accommodate complex issues related to AI and algorithms. These regulations were drafted before the digital revolution, and algorithmic automation developed rapidly, making them inadequate in dealing with the influence of machines that involve algorithmic interaction and data mastery as dominant assets.[83] Indonesia's competition law supervision and enforcement system is also still limited in terms of technology and a deep understanding of complex machine interactions, making violation detection and enforcement less effective. The lack of a specific legal framework regarding AI increases the risk of regulatory loopholes that large business actors can exploit to maintain market dominance.

The problem of cross-sector coordination between competition authorities, information technology supervisors, and policymakers is an obstacle. The fragmentation of technology and AI regulations that have not been maximised hinders effective supervision of market competition in the digital era. Therefore, efforts to strengthen competition regulation in Indonesia must involve increasing the technical capacity of regulators, debriefing judges and legal practitioners on technological understanding, and establishing adaptive and collaborative legal frameworks to effectively deal with the challenges of collusion and algorithmic domination. The synergy of

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[81] Sharda Abrianti et al., "The Rule of Reason Approach in Discriminatory Practices: Airlines and Telecommunications Industry Sector," *Jurnal Dinamika Hukum* 24, no. 2 (August 27, 2024): 292.

[82] Konstantinos Pantelidis, "The DMA Procedure: Areas to Improve," *World Competition* 47, no. Issue 2 (June 1, 2024): 157–192.

[83] Zulvia Makka, "Bentuk Perlindungan Hukum Pelaku Usaha Pesaing Terhadap Posisi Dominan Dalam Penerapan Rule of Reason," *Jurnal Persaingan Usaha* 1, no. 2 (December 31, 2021): 5–14.

competition law and technology policies at the national and global levels is essential to create a competitive and fair digital market amid a rapid technological revolution.

The European Union and other countries also have approaches that can be compared. The United States, through the Sherman Act and the Clayton Act, enforced competition laws that strictly apply to monopolies and unfair practices, including algorithmic practices that have the potential to give rise to automatic collusion and algorithmic dominance. The FTC and the U.S. Department of Justice increasingly use these regulations to oversee and crack down on big tech companies.[84] With the Competition Act 1998, the UK began to integrate "pro-innovation" principles in AI-related regulations, ensuring innovation continues to thrive while maintaining competition.[85] Australia relies on the Competition and Consumer Act 2010, specifically Article 46, to prohibit the abuse of market power that digital platforms with AI technology can amplify.

China, through the revised Anti-Monopoly Law in 2022 and Article 17 in particular, establishes a ban on abuse of dominant positions that utilize AI technology and data mastery to deter healthy competition. The SAMR also strengthens law enforcement against algorithmic monopoly practices by imposing algorithmic audits and strict controls on large tech companies.[86]

In fact, the paradigm shift from traditional human law actors to algorithmic systems poses challenges in defining market justice. John Rawls's theory of distributive justice and Aristotle's concept of justice put forward the need to create fair opportunities and protect the rights of all market participants. AI regulation must accommodate this principle by ensuring fair market access, algorithmic transparency, and accountability of AI users and providers as economic actors. The theory of corporate responsibility and the principle of prudence are the basis for implementing regulations that prevent the risk of market dominance and algorithmic monopolies without hindering technological innovation.

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[84] Debra A. Valentine, "The Evolution of U.S. Merger Law," FTC, 1996, https://www.ftc.gov/news-events/news/speeches/evolution-us-merger-law,.

[85] Satya Marar, "Artificial Intelligence and Antitrust Law: A Primer," *SSRN Electronic Journal*, 2024.

[86] Jingmeng Cai, *China's Anti-Monopoly Law in the Digital Era: How China Tames the Digital Behemoth* (Oxford, UK: Taylor & Francis, 2025).

Towards an Adaptive Regulatory Framework: Transparency, Collaboration, and Accountability

Traditional regulatory frameworks are no longer adequate in the face of the machine-opoly phenomenon, where monopolies are built and maintained through algorithmic interaction and artificial intelligence AI. Effective competition regulations must be adapted to accommodate digital technology's rapidly changing complexity and dynamics. Therefore, developing a more adaptive future regulatory framework, balanced between innovation and market fairness, is critical. The framework must include three main elements: algorithmic transparency, regulatory collaboration, and supervisory capacity. In this section, the principles and policies related to the three elements are discussed as the foundation of regulations that can answer the challenges of machine-opoly comprehensively and fairly.

1. Algorithmic Transparency

Algorithmic transparency is a prerequisite for creating fairness and accountability in an AI-driven digital marketplace.[87] This transparency refers to the obligation of business actors or technology developers to disclose the logic, data used, and algorithmic decision-making processes that impact users and the market. In the context of machine-opoly and business competition, transparency of market and consumer watchers understand how algorithms operate, predict price behavior, resource allocation, and their influence on competition.

Algorithmic disclosure is important to reduce the risk of algorithmic collusion, price discrimination, and abuse of dominant positions.[88] Collusion practices carried out through algorithmic interactions are often difficult to detect because they are automated and complex. They can only be analyzed if there is access to code, parameters, and AI training data. This is where the importance of independent agencies' regular ethical and technical audits of algorithms lies. This audit aims to ensure that algorithms comply with the

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87 Husna Maulidah Ramadhani, Elisatris Gultom, and Sudaryat, "Penggunaan Produk Goto Group Dalam Rangkaian Operasi Marketplace Tokopedia Berdasarkan Undang-Undang Larangan Praktek Monopoli Dan Persaingan Usaha Tidak Sehat," *Reformasi Hukum* 26, no. 2 (December 31, 2022): 189–208.

88 Ahmad Sabirin and Raafid Haidar Herfian, "Keterlambatan Pelaporan Pengambilalihan Saham Perusahaan Dalam Sistem Post Merger Notification Menurut Undang-Undang Persaingan Usaha Di Indonesia," *Jurnal Persaingan Usaha* 1, no. 2 (December 31, 2021): 55–63.

principles of fairness, non-discrimination, and distributive justice and detect biases or prediction errors that could harm the market and consumers.

Several countries and international organizations have already adopted algorithmic transparency policies as part of the AI regulatory framework. The EU AI Act requires risk evaluation and disclosure for high-risk AI systems.[89] The OECD also establishes AI policy principles emphasizing transparency as key to building trust and accountability. Although still in the early stages of managing this issue, Indonesia can learn from this practice by including similar provisions in the competition regulations and information technology that regulate algorithm transparency, ethical audits, and consumer protection in the digital ecosystem. Applying algorithmic transparency must be balanced with protecting trade secrets and intellectual property rights, so regulations must establish a proportionate scope of disclosure and appropriate protection of information access restrictions.[90] Thus, business actors can still innovate without losing intellectual property, while regulators and the public still have access to enough information to monitor and assess algorithms' impact on competition.

2. Regulatory Collaboration

The phenomenon of machines and digital markets is complex, cross-sectoral, and jurisdictional. Therefore, an effective regulatory framework must be built on the principle of regulatory collaboration involving various national and international authorities in a coordinated manner. At the national level, the competition authority or KPPU must work closely with information technology supervisory institutions such as the Ministry of Communication and Information Technology and the State Cyber and Cryptography Agency to integrate business competition supervision with technology and data security. This coordination is important to combine competition law, AI technical, and digital policy expertise to make supervision more effective and responsive. For example, exchanging intelligence data related to algorithmic activities, exchanging technical resources for market data analysis, and creating mutual algorithmic audit standards can be a vehicle for collaboration.

At the international level, as digital and AI market players typically operate globally, individual country regulations do not adequately address the risks of

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[89] Gerhard Wagner, "Liability Rules for the Digital Age," *Journal of European Tort Law* 13, no. 3 (February 6, 2023): 191–243.

[90] Chen, "Systematic Reconstruction of Labour Rights Mechanisms under the Threshold of Hierarchical Classification: An Integrated Path Based on Legal Empowerment and Procedural Synergy."

monopoly and algorithmic collusion.[91] Therefore, participation in collaborative mechanisms such as the OECD AI Policy Observatory, the International Competition Network (ICN), and G20 forums is very relevant for countries, including Indonesia. International collaboration can support policy harmonization, shared risk mapping, and effective exchange of best practice experiences to address cross-border machine policy. Regulatory collaboration must also anticipate conflicts and legal overlaps by building a mechanism for harmonizing rules between sectors and countries.[92] For example, regulations on personal data protection, intellectual property rights, and competition law need to be integrated with AI policies so that the regulations made are not in conflict with each other but are mutually supportive.

3. Supervisory Capacity

The success of implementing adaptive regulatory frameworks depends not only on legal norms and collaboration mechanisms but also on the capacity of supervisory institutions. Supervisory capacity is important in understanding, monitoring, and assessing algorithmic behavior in an increasingly complex and digitized market. One of the main obstacles in AI-based market surveillance is the technical limitations, human resources, and knowledge related to artificial intelligence and big data technologies.

Strengthening the capacity of supervisory institutions can be done through several strategies. First, the development of human resource competencies that master AI technology, data science, and algorithmic analysis in the context of economics and competition law.[93] This includes technical training, professional certifications, and cooperation with academia and the technology sector. Second, modern surveillance technologies, such as algorithmic audit automation tools and big data analysis, must be procured and utilised to identify real-time monopolistic and collusion risk patterns. Third, a special unit within the competition authority that focuses on technological and digital supervision should be created to combine legal, economic, and technical perspectives.

The internal aspect of capacity building, supervisory institutions also need to strengthen cooperation with research institutions and technology

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[91] Toshiaki Takigawa, "Super Platforms, Big Data, and Competition Law: The Japanese Approach in Contrast with the USA and EU," *Journal of Antitrust Enforcement* 9, no. 2 (September 14, 2021): 289–312.

[92] Jenifer Sunrise Winter and Elizabeth Davidson, "Harmonizing Regulatory Regimes for the Governance of Patient-Generated Health Data," *Telecommunications Policy* 46, no. 5 (June 2022): 102285.

[93] Hawkes, *A Market Investigation Tool to Tackle Algorithmic Tacit Collusion: An Approach for the (near) Future*.

practitioners to update supervisory methodologies according to the latest technological developments. For example, collaborations with universities and AI research centres can be a source of knowledge and the development of valid algorithmic audit methods.[94] Institutional capacity must also include periodic regulatory evaluation and adjustment mechanisms to maintain the legal framework's relevance to technology dynamics and the rapidly changing digital market. In the Indonesian context, strengthening the capacity of KPPU and the Ministry of Communication and Information Technology is a top priority in responding to the machine-opoly phenomenon. The synergy between the two institutions is still not optimal and requires systematic improvements so that AI regulations and business competition can run effectively.

The three elements, algorithmic transparency, regulatory collaboration, and supervisory capacity, must be formulated and implemented in an integrated manner within the future regulatory framework. Mandatory disclosure of algorithmic logic and ethical audits will encourage transparency, while cross-authority collaboration mechanisms ensure holistic oversight coverage and policy harmonisation. At the same time, strengthening the capacity of supervisory institutions ensures the enforcement of the law and the effectiveness of supervision and enforcement of competition laws in the face of AI market dynamics.[95]

Thus, this future regulation is an important foundation for developing countries such as Indonesia to take an active role in the global digital economy while maintaining the sovereignty and fairness of the domestic market. A regulatory framework that is adaptive to machines must form a strong foundation through three main pillars: algorithmic transparency that requires disclosure and auditing of algorithmic ethics, regulatory collaboration across jurisdictions and countries to address the complexity of global and digital markets, and strengthening the capacity of supervisory institutions to understand and supervise algorithm interactions effectively. These three elements complement each other and must be integrated into policy designs and regulatory practices that balance innovation and market fairness.

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[94] Jacqui-Lyn McIntyre, Duane Aslett, and Nico Buitendag. "Lifestyle audits in South Africa–overrated or X-factor?." *Journal of Financial Crime* 30, no. 4 (2023): 1078-1095.

[95] Shuya Hayashi and Koki Arai, "How Competition Law Should React in the Age of Big Data and Artificial Intelligence," *The Antitrust Bulletin* 64, no. 3 (September 15, 2019): 447–56.

Conclusion

The machine-opoly phenomenon marks a fundamental shift from traditional monopolies to new market dominance built through algorithmic interaction and autonomous artificial intelligence. Data- and algorithmic-based dominance creates high barriers to entry, the risk of automated collusion, and inequality of access to technology and information. This condition poses a major challenge for business competition law, which is still oriented towards human behaviour and explicit transactions. The EU regulation in Articles 101 and 102 TFEU and the EU AI Act successfully integrate the principles of algorithmic transparency, auditability, and risk-based supervision in competition law. The United States, through the Sherman Act and the Clayton Act, affirmed strict scrutiny of the abuse of algorithms and the power of digital markets by authorities such as the FTC and DOJ.

Through the Competition Act 1998 and its "pro-innovation regulation" policy, the UK balances innovation with consumer protection. Through the Competition and Consumer Act 2010 (Section 46), Australia expands the definition of market power abuse to digital and algorithmic behavior. Meanwhile, through the Anti-Monopoly Law 2022 in Article 17, China explicitly prohibits the abuse of dominant positions through data mastery and AI. On the other hand, through Law Number 5 of 1999, Indonesia still faces limitations in regulating algorithmic behaviour, data control, and legal responsibility for automated decisions. This shows that a regulatory gap needs to be bridged with legal reforms emphasising the integration between AI regulations, technology ethics, and business competition norms so that supervision of the digital market can be carried out effectively.

Indonesia actually needs to amend Law Number 5 of 1999 immediately. In addition, it is necessary to pay attention to the three main pillars in adopting and implementing them: algorithmic transparency, regulatory collaboration across sectors and countries, and strengthening the capacity of supervisory institutions. This approach maintains a balance between innovation and market fairness, strengthens corporate accountability, and encourages an inclusive and sustainable digital ecosystem. Through these steps, Indonesia and other countries can build a legal order responsive to technological developments while ensuring that AI advances contribute to the values of justice, fair competition, and public welfare.

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Acknowledgment

We would like to deliver our gratitude to the Faculty of Law, Universitas Trisakti and all parties that have supported this research.

Funding Information

None

Conflicting Interest Statement

The authors state that there is no conflict of interest in the publication of this article.

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Cite this article as:

Anggraini, Anna Maria Tri, Ahmad Sabirin, and Jimi Rambo Arranchado. "From Monopoly to Machine-opoly: Rethinking Market Regulations for Autonomous AI Agents." *Journal of Indonesian Legal Studies* 11, no. 1 (2026): 33-80. https://doi.org/10.15294/jils.v11i1.38477