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Legal Challenges and Reform Proposals for Algorithmic Contracts under Indonesia's Information and Electronic Transactions Law

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Abstract

The emergence of algorithmic contracts, made or carried out by independent systems, creates difficult legal problems, especially in Indonesia's regulatory environment. This study examines whether Indonesia's Information and Electronic Transactions Law is adequate to deal with new problems with algorithmic pricing, EAs, and automated contract creation. The article also examines the different types of algorithmic contracts and how black-box algorithms are used in dynamic pricing in business competition. It shows how unclear the law is about agency, consent, and accountability. Using doctrinal legal research combined with conceptual, comparative, and interdisciplinary approaches, the study finds that Indonesia's Information and Electronic Transactions Law and Competition Law have become inadequate in responding to developments in AI-driven transactions. It suggests a legal framework that does not favour any one technology and recognises algorithms as helpful agents. It also calls for changes to the law to clarify how electronic agents can work together and negotiate. This method ensures that businesses are held accountable and that the law is clear in the age of self-driving digital contracts.

1. Introduction

The term "pricing strategies algorithm," or APS, refers to firms' methods and tactics to determine the pricing frameworks for their products or services. This process involves numerous factors, including production expenses, market demand, competitive dynamics, profit goals, and consumer preference [1]. The pricing strategies algorithm is essential for helping firms identify the most beneficial pricing structures to achieve their business pursuits.[2] Its application spans various business domains with the primary aim of achieving several favorable business outcomes. Firstly, APS enables businesses to enhance their profits significantly. It is employed in a variety of industry sectors with the primary objective of attaining numerous advantageous business results. Firstly, APS facilitates substantial profit enhancement for businesses. Utilizing pricing algorithms, firms can optimize the pricing of their products or services to enhance revenue maximization. These algorithms enable the computation of production costs, demand analysis, and assessment of client preferences, allowing enterprises to provide competitive and equitable pricing options[3].

Moreover, APS allows organizations to evaluate market competitiveness and establish pricing plans that maximize profitability.[4] Secondly, in competitive market conditions, APS assists enterprises in adjusting their pricing to maintain competitiveness. Companies can leverage insights regarding competitors' pricing tactics, market data, and sophisticated pricing methodologies to determine price points that enable them to sustain a competitive advantage and secure a significant market share.[5] Thirdly, pricing

[1] Sungwoo Choi et al., "Let Your Algorithm Shine: The Impact of Algorithmic Cues on Consumer Perceptions of Price Discrimination," *Tourism Management* 99 (December 2023): 104792, https://doi.org/10.1016/j.tourman.2023.104792.
[2] Haiyan Song and Gang Li, "Tourism Demand Modelling and Forecasting—A Review of Recent Research," *Tourism Management* 29, no. 2 (2008): 203–20, https://doi.org/10.1016/j.tourman.2007.07.016.
[3] Choi et al., "Let Your Algorithm Shine: The Impact of Algorithmic Cues on Consumer Perceptions of Price Discrimination."
[4] Wenjia Han and Billy Bai, "Pricing Research in Hospitality and Tourism and Marketing Literature: A Systematic Review and Research Agenda," *International Journal of Contemporary Hospitality Management* 34, no. 5 (2022): 1717–38, https://doi.org/10.1108/IJCHM-08-2021-0963; Isabel P. Riquelme et al., "Does It Matter Who Gets a Better Price? Antecedents and Consequences of Online Price Unfairness for Advantaged and Disadvantaged Consumers," *Tourism Management Perspectives* 40 (October 2021): 100902, https://doi.org/10.1016/j.tmp.2021.100902.
[5] So Young Sohn et al., "Optimal Pricing for Mobile Manufacturers in Competitive Market Using Genetic Algorithm," *Expert Systems with Applications* 36, no. 2 (2009): 3448–53, https://doi.org/10.1016/j.eswa.2008.02.051.

strategy algorithms are essential for maximizing capacity utilization in sectors with constrained capacity, such as transportation and hospitality. Companies can alter prices dynamically according to actual demand, optimizing revenue while reducing the risk of capacity gaps or underutilization.[6]

The existence of Algorithmic Contracts is closely associated with APS. Algorithmic Contracts are agreements that rely on algorithmic decision-making, often in conjunction with human decision-makers. Any heuristic that an individual employ to facilitate a selection is included in the most comprehensive definition of the term algorithm. The most effective approach to understanding the innovations and distinctions of algorithmic contracts is to look at their formation process, in which computer programs undertake decision-making responsibilities that humans previously performed.[7] Several organizations are transitioning from the decision-making process that was previously conducted by humans who executed an algorithm to the decision-making process that is conducted by a computer program.[8,9] The extraordinary processing speed and sophistication that machine learning enables are causing modern firms to delegate responsibility for algorithmic decision-making to an increasing extent.

Numerous characteristics of the algorithmic contract economy are comparable to those of the form contract economy. The primary distinction is the actor who selects standard terms and/or clients for a company. A computer program customizes the terms of a contract in certain algorithmic contracts based on the real-time availability of the product or the client's characteristics. The algorithm replaces the expertise of a human actor in this scenario. Instead of a small shop owner relying on her understanding of her expenses and business conditions in her town to determine prices or a major company employing a team of human researchers to achieve the same result, a company can now

[6] Zvi Schwartz et al., "Hotel Daily Occupancy Forecasting with Competitive Sets: A Recursive Algorithm," *International Journal of Contemporary Hospitality Management* 28, no. 2 (2016): 267–85, https://doi.org/10.1108/IJCHM-10-2014-0507.
[7] Lauren Henry Scholz, "Algorithmic Contracts," *Stanford Technology Law Review* 20, no. 2 (2017): 128–69.
[8] Ronald J. Gilson et al., "Contract, Uncertainty and Innovation," *SSRN Electronic Journal*, ahead of print, 2010, https://doi.org/10.2139/ssrn.1711435.
[9] Scholz, "Algorithmic Contracts."

utilize an algorithm to consider all pertinent information to establish a price for the goods or services it sells.

Dynamic Pricing is one approach that can be effectively implemented using APS. This pricing method employs variable pricing rather than fixed pricing, where the price of a certain product varies according to the current supply and demand situations that consumers perceive. Dynamic pricing is evident when the listed price markedly diverges from the consumer's internal or external reference price.[10] APS enables firms to effortlessly and adaptively execute dynamic pricing plans by utilizing insights derived from customer data, including purchase preferences, transaction history, demographic details, and brand interactions.[11]

Big data comprises extensive and complex datasets derived from many sources, such as sales transactions, customer records, market data, and other data points.[12] Big data allows firms to gather extensive and deep insights into customer behaviors, market trends, and numerous factors influencing price.[13] Furthermore, it enables enterprises to perform more accurate and comprehensive statistical studies that include historical and current data.[14] Pricing algorithms can harness the knowledge derived from extensive historical big data, enabling predictive analyses to discern pertinent patterns.[15] This circumstance enables firms to optimize the pricing of their products or services by considering real-time market dynamics, competitive landscapes, consumer profiles, and

[10] Ellen Garbarino and Olivia F. Lee, "Dynamic Pricing in Internet Retail: Effects on Consumer Trust," *Psychology & Marketing* 20, no. 6 (2003): 495–513, https://doi.org/10.1002/mar.10084.
[11] Peter Seele et al., "Mapping the Ethicality of Algorithmic Pricing: A Review of Dynamic and Personalized Pricing," *Journal of Business Ethics* 170, no. 4 (2021): 697–719, https://doi.org/10.1007/s10551-019-04371-w.
[12] Kyle Manley et al., "A Review of Machine Learning and Big Data Applications in Addressing Ecosystem Service Research Gaps," *Ecosystem Services* 57 (October 2022): 101478, https://doi.org/10.1016/j.ecoser.2022.101478.
[13] Juan-Pedro Cabrera-Sánchez and Ángel F. Villarejo-Ramos, "Acceptance and Use of Big Data Techniques in Services Companies," *Journal of Retailing and Consumer Services* 52 (January 2020): 101888, https://doi.org/10.1016/j.jretconser.2019.101888.
[14] Martin Mullins et al., "Creating Ethics Guidelines for Artificial Intelligence and Big Data Analytics Customers: The Case of the Consumer European Insurance Market," *Patterns* 2, no. 10 (2021): 100362, https://doi.org/10.1016/j.patter.2021.100362; Sunil Erevelles et al., "Big Data Consumer Analytics and the Transformation of Marketing," *Journal of Business Research* 69, no. 2 (2016): 897–904, https://doi.org/10.1016/j.jbusres.2015.07.001.
[15] Winky K.O. Ho et al., "Predicting Property Prices with Machine Learning Algorithms," *Journal of Property Research* 38, no. 1 (2021): 48–70, https://doi.org/10.1080/09599916.2020.1832558.

other significant pricing influences.[16]According to research by McKinsey & Company, the telecommunications, retail, transportation, finance, and education sectors have the greatest levels of AI deployment. AI-driven automation technologies are crucial to governments' digital transformation efforts, considerably aiding the advancement of digital economies.[17] In recent years, economies have undergone digitization due to advancements in Information and Communication Technologies (ICTs), significantly impacting the economic landscape of nations.[18,19]

The emergence of algorithmic contracts—agreements made or carried out by electronic agents (EAs) utilising AI and machine learning—has changed how organisations do business.[20] These contracts can set their terms, such as prices, through dynamic and data-driven systems that don't always need direct human supervision. This change raises many complicated legal issues, especially regarding the validity of consent, the creation of intent, and the assignment of culpability in contracts made by autonomous systems.

The Information and Electronic Transactions Law (In Indonesian Context: ITE Law) and the Business Competition Law (Law No. 5 of 1999) in Indonesia do not deal well with these problems. The ITE Law says that electronic contracts and agents are valid, but it doesn't say anything about what happens when agents work together independently.[21]The Competition Law, conversely, doesn't have any rules that deal with

[16] Alexander Kastius and Rainer Schlosser, "Dynamic Pricing under Competition Using Reinforcement Learning," *Journal of Revenue and Pricing Management* 21, no. 1 (2022): 50–63, https://doi.org/10.1057/s41272-021-00285-3; Valeh Moghaddam et al., "An Online Reinforcement Learning Approach for Dynamic Pricing of Electric Vehicle Charging Stations," *IEEE Access* 8 (2020): 130305–13, https://doi.org/10.1109/ACCESS.2020.3009419; Eduardo J. Salazar et al., "Dynamic Customer Demand Management: A Reinforcement Learning Model Based on Real-Time Pricing and Incentives," *Renewable Energy Focus* 46 (September 2023): 39–56, https://doi.org/10.1016/j.ref.2023.05.004.
[17] Seele et al., "Mapping the Ethicality of Algorithmic Pricing."
[18] Seele et al., "Mapping the Ethicality of Algorithmic Pricing."
[19] Alex Pollock and Eivind Berge, "How to Do a Systematic Review," *International Journal of Stroke* 13, no. 2 (2018): 138–56, https://doi.org/10.1177/1747493017743796.
[20] Dina Berliana et al., "Can Smart Contracts Have a Legality Valid in Indonesia?," *International Journal of Business, Law, and Education* 6, no. 1 (2025): 895–911, https://doi.org/10.56442/ijble.v6i1.1079.
[21] Cassey Lee, "Competition Policy in the Age of Algorithms: Challenges for Indonesia," *Bulletin of Indonesian Economic Studies* 58, no. 3 (2022): 297–312, https://doi.org/10.1080/00074918.2022.2125488.

algorithmic coordination or collusion, even though algorithm-driven pricing techniques are becoming more common in the market.

As algorithmic technologies improve, the lack of clear laws puts legal certainty and commercial fairness at risk. Legal questions need to be answered, like whether a black-box algorithm can be held responsible for contract outcomes or if electronic agents can lawfully work together to set prices. Thus, legal reform is necessary to ensure Indonesian law keeps up with new technologies. This circumstance is especially important when making digital and autonomous contracts, where agency, consent, and liability must be clarified.

2. Problem Statement

The rapid development of algorithmic contracts, particularly those formed and executed by autonomous systems, poses significant legal challenges in Indonesia, especially in the context of the Information and Electronic Transactions Law and Competition Law. Current legal frameworks do not adequately address issues of agency, consent, and accountability in AI-driven transactions, particularly those involving black-box algorithms and dynamic pricing. This legal uncertainty hampers effective regulation and undermines accountability in digital business practices. There is an urgent need to develop a neutral and adaptive legal framework that accommodates the evolving nature of algorithmic agents and ensures clarity in contract formation and enforcement in the digital age.

3. Methods

The article uses doctrinal legal research with a conceptual, comparative, and interdisciplinary approach. The conceptual approach provides that the study begins by recognising algorithmic contracts as a growing legal phenomenon. Indonesia's ITE Law acknowledges "electronic contracts" and "electronic agents", yet fails to clarify the implications of autonomous interaction, coordination, and pricing conducted independently by EAs. The Comparative Legal Analysis provides the international legal instruments, most notably:

a. United States (UETA): Section 14 of UETA allows contracts to be formed by interactions between electronic agents without human intervention;

b. Courts (US v. Topkins), which began examining the intent and design behind algorithmic tools to assess antitrust violations, even in the absence of human-to-human communication;
c. An interdisciplinary approach provides that the research uses computer study, namely ITE, and Indonesia's competition law, which faces significant challenges in addressing the complexities introduced by algorithmic contracts. While the ITE Law recognises the concept of electronic contracts and defines electronic agents (EAs) in Article 1, point 8 of ITE's Law, it lacks clear provisions on the legal consequences of autonomous actions by such agents, especially when EAs interact or negotiate independently. This legal ambiguity raises serious concerns about the validity of consent, the existence of intent, and the attribution of liability in contracts generated or executed by AI systems, particularly in environments involving dynamic pricing and automated decision-making

4. The Adequacy of the Legal Instrument and Approach to Deal with The Current Feature Developments in The Algorithm Contracts

As the conventional economy shifts to the digital domain, the Business Competition Supervisory Commission encounters a substantial legal challenge regarding the differentiation between independent parallel actions and intentionally coordinated actions (concerted actions) enabled by Reinforcement Learning (RL) algorithms. In 2015, the United States Department of Justice brought a significant case against David Topkins, who was said to have conspired with other online poster vendors to manipulate prices. This investigation uncovered a "deal" in which *Topkins* and his accomplices developed and disseminated a dynamic pricing "algorithm" designed to perform activities in alignment with their agreement. Complex scenarios arise when market participants autonomously develop algorithms, incorporating decision criteria that react to the choices of others in manners that reinforce or maintain coordinated results. Moreover, difficulties emerge when algorithms, albeit not explicitly intended for coordination, autonomously attain comparable outcomes. Periodically, the algorithm is tasked with an objective, such as "maximizing profits," and independently establishes decision parameters via machine learning methodologies.

Initially, it is important to highlight that as early as 1992, the Federal District Court recognized that an algorithm might surpass its role as a mere "tool" when evaluating multiple elements to directly ascertain a motorboat safety rating.[22] Reinforcement Learning (RL) techniques have facilitated the creation of algorithms that more closely resemble human labourers rather than simple "tools." Substantial layoffs in industries such as banking and investing illustrate this transition In 2015, eleven banks terminated 100,000 banking workers together.[23] In 2017, investing giant Blackrock diminished its personnel by 40 stock pickers, replacing human employees with technology. Resolving this legal issue requires thoroughly comprehending the Taxonomy of Algorithmic Agreements and the Application of Algorithms in Price Determination. [24]

5. Taxonomy of Algorithmic Contracts

An algorithmic contract refers to a deal wherein one or more parties employ an algorithm to establish the contract's terms and conditions. Algorithmic contracts integrate clauses and provisions established by computers rather than human decision-makers. In this context, an algorithm denotes a systematic procedure or a collection of rules employed for performing computations or solving problems using computer processes. The primary difference between algorithms and human decision-makers is that computers, governed by algorithms, demonstrate greater simplicity and speed than human intellect. By employing Reinforcement Learning (RL), which is instructed on diverse patterns and data, algorithms can assess several factors across various scenarios, a capability that surpasses human ability. The existence and operations of algorithms in various activities frequently present difficulties for developers in anticipating their behavior.[25]

To understand the intricacies of algorithmic contracts, examining the potential functions of algorithms in contract construction is crucial. Multiple methods exist for parties to utilize algorithms in the contract formation process. Algorithms can operate as simple

[22] Scholz, "Algorithmic Contracts."
[23] Oscar Williams-Grut, "Banking's 'Uber Moment' Is Already Happening— 100,000 Bankers Lost Their Jobs in 2015," Business Insider, 2015, http://www.businessinsider.de/banks-uber-moment-100000-bankers-fired-in2015-2015-12.
[24] Lucinda Shen, "Robots Are Replacing Humans at All These Wall Street Firms," Fortune, 2017, http://fortune.com/2017/03/30/blackrockrobots-layoffs-artificial-intelligence-ai-hedge-fund/%0A.
[25] Ryan Calo, "Robotics and the Lessons of Cyberlaw," *California Law Review* 103 (2015).

tools or autonomous agents, depending on the complexity and predictability of the decision-making tasks. The transparency of the artificial agent can be categorized into two types: clear box, where the internal components or logic of the algorithm are understandable to humans, and black box, where the algorithm's functioning is complex and difficult to interpret. [26] Contracts in which algorithms function as instruments alongside the parties do not present new challenges to contract law, as they are comparable to situations where parties employ calculators or spreadsheet software to ascertain their offers or acceptances.[27] Contrarily, when contract algorithm agents function as artificial agents engaged in "negotiating or coordinating," they necessitate a more explicit consideration under contract law.

When computers assume the role of negotiators, there is an increased necessity for interpretative diligence to guarantee compliance with contract law. Black box algorithmic contracts reveal a divergence between the stated goals of the parties utilizing the algorithm and the intentions of the artificial agent. Unlike traditional contracts, which often presume that a "sophisticated party" has the requisite knowledge for effective binding, black box algorithms incorporate an element of emergent behavior that remains unpredictable for a principal.

6. Black Box Algorithmic Contract Status

To improve the enforceable nature of Black Box Algorithmic Contracts, the current contract law framework should integrate one of two legal notions. It can be argued that Black Box Algorithmic Contracts serve solely as instruments. Secondly, an alternative approach may entail acknowledging that advanced organizations can understand the functioning of Black Box Algorithmic Contracts from an agency-based viewpoint. The latter approach would more accurately reflect the operational dynamics of Black Box Algorithmic Contracts rather than intentionally disregarding their intrinsic characteristics. This method may effectively reduce the likelihood of irresponsible usage and deliberate abuse of algorithms in contract negotiation and creation.

[26] Lauren Henry Scholz, "Algorithmic Contract," *Standford Technology Law Review* 128 (2017): 134.
[27] Scholz, "Algorithmic Contract."

The binary classification of sophistication—differentiating between those who possess sophistication in contract matters and those who do not—cannot be universally justified within general contract law, as it creates separate contract regulations for corporations and individuals.[28] This idea is extended to its extremes in black box algorithmic contracts. Black box algorithms can function outside the understanding and intents of their authorizing bodies, yet private law has not yet evolved to address the developing reality of artificial intelligence.[29] Persuasive arguments have been presented regarding the unenforceability of algorithmic contracts. A contract often represents a mutual agreement between two or more parties intending to alter their legal rights. Competent persons, free from pressure regardless of their perceived sophistication, have the authority to establish the terms to which they consent to be legally bound. An informed and objectively articulated consent to the terms is an essential contract component.[30] Obscure mechanism Algorithmic contracts present a distinct problem in contrast to traditional contracts. The algorithm's actions may stay undisclosed to both parties involved. A consensus to negotiate or to seek a goal dependent on its profitability is typically not considered a contract. Although algorithms render intricate conclusions, automated choices possess a distinct legal position in contrast to deliberate decisions made by persons, similar to the restrictions controlling autonomous weaponry.[31] Similar to agents, algorithms need not to be regarded as mere extensions of the intentions of humans or corporations. Legal expert in robotics, Ryan Calo, defines emergence as "unpredictable behavior," which pertains to actions that appear to fulfill a purpose in a way that the algorithm's designer cannot foresee, resulting from learning and self-modification based on previous behavior. [32] If the principal's instructions to the

[28] Meredith Miller, "Contract Law, Party Sophistication and the New Formalism," *Missouri Law Review* 75, no. 2 (2010), https://scholarship.law.missouri.edu/mlr/vol75/iss2/7.
[29] F. Patrick Hubbard, "'Sophisticated Robots': Balancing Liability, Regulation, and Innovation," *Florida Law Review* 66, no. 5 (2014): 1803.
[30] Priscilla J. Smith, "When Machines Are Watching: How Warrantless Use of GPS Surveillance Technology Violates the Fourth Amendment Right Against Unreasonable Searches," *Yale Law Journal Online* 121 (2011); Wendy Netter Epstein, "'Facilitating Incomplete Contracts' by Wendy Netter Epstein," *Case Western Reserve Law Review* 65, no. 2 (2014): 297–300.
[31] A. Michael Froomkin and Zak Colangelo, "Self-Defense Against Robots," *SSRN Electronic Journal*, ahead of print, 2014, https://doi.org/10.2139/ssrn.2504325.
[32] Calo, Ryan. "Robotics and the Lessons of Cyberlaw." *California Law Review* 103 (2015)

algorithmic agent are ambiguous, they may not represent a clearly expressed intent upon which a contractual obligation can be established.

Agents representing the offeror create offers that the offeror may or may not consciously consider. The core inquiry is whether a party's stated purpose of employing an algorithm for determining prices and contract terms aligns with the real intent reflected in the contract terms selected by the algorithm. This is not inherently true. Algorithms operate as agents, acting as middlemen between the creator's objectives and the algorithm's behaviours. When the algorithm functions within the parameters of the offeror's explicit intentions, it serves as a medium for effectively communicating the offeror's objective intent. Stating that the offeror consents to a black box algorithmic contract constitutes an illusory commitment. If an illusory promise constitutes the only basis of a contract, devoid of any associated duties, then the contract is not genuinely valid.[33] Innovative technologies must not enable contractual parties to circumvent the essential tenets of contract law. Individuals' limited understanding of algorithms in society is predicated on the assumption that those employing the algorithms are aware of the acts taken on their behalf. This misconception stems from the belief that algorithms are supplementary "tools" similar to calculators. In agency law, principals are not always obligated by their agents' activities; an agent may directly oppose the principal's goals and interests. The principal is generally accountable for the mistakes made by the agent, given these risks were accepted upon the decision to engage the agent.

Algorithms, functioning similarly to human agents, raise the relevance of agency law, while it is characterized as "constructive" because algorithms do not possess human qualities. Agency law allows the legal system to acknowledge the intentions of principals who are not directly involved in the contract formation process. Principals may explicitly empower their agents, indicating that they gain advantages from the actions performed by these agents. This method is consistent with modern contract law while slightly broadening its formal parameters. The Uniform Electronic Transactions Act (UETA)

[33] Melvin Eisenberg, "Donative Promises," *University of Chicago Law Review* 47, no. 1 (1979), https://chicagounbound.uchicago.edu/uclrev/vol47/iss1/2; Robert A. Prentice, "Law & Gratuitous Promises," *SSRN Electronic Journal*, ahead of print, 2006, https://doi.org/10.2139/ssrn.908929.

includes the notion of algorithms as agents.[34] The UETA enables the creation of algorithmic contracts by acknowledging these contracts as established by algorithms known as "electronic agents." Thus, electronic records and signatures enabled by electronic agents possess equivalent legal validity to manual records and signatures.[35] An "electronic agent" is a computer program or automated mechanism utilized autonomously to initiate or respond to electronic actions, wholly or partially, without requiring human participation. Moreover, Section 14 of UETA on Automated Transactions stipulates, "A contract may be established through the interaction of the parties' electronic agents, even in the absence of an individual review of the electronic agent's actions." The next point concerns the legal culpability arising when an "electronic agent" acts contrary to the principal's objectives. [36]

Electronic agents can be classified into two distinct categories to analyze their operational modes: stationary and mobile. Like a "calculator," stationary agents are restricted to their initial environment and lack mobility. Conversely, mobile agents are software applications that autonomously navigate diverse computer networks. Upon receiving an assignment, mobile agents transfer to different platforms to collect data and achieve their goals. They function autonomously and proactively, capable of independent internet navigation, conducting transactions, and retrieving information.[37] Mobile agents are anticipated to operate independently, with minimum user oversight. They function on an agent platform, enabling communication with several agents online and interaction with diverse objects and services. The primary concern pertains to the legal status of electronic agents, particularly on the applicability of established legal principles governing principal-agent relationships to these entities.

Three main thoughts exist about the legal status of electronic agents. The initial perspective, known as the 'conventional approach,' regards electronic agents exclusively as instruments utilized by humans. The second perspective, known as the "modern

[34] Uniform Electronic Transactions Act (1999).
[35] Patricia Brumfield Fry, "Introduction to the Uniform Electronic Transactions," *Idaho Law Reviiew* 37, no. 3 (2000).
[36] Uniform Electronic Transactions Act.
[37] Larry Korba, "Towards an Agent Middleware Framework for E-Commerce," *Netnomics* 2, no. 2 (2000): 171–89, https://doi.org/10.1023/A:1019138813642.

approach," regards electronic agents as legal entities or individuals. Nonetheless, no legal system has thus far acknowledged electronic agents as autonomous legal entities independent of their users. This circumstance prompts the inquiry of whether a program can achieve independent legal entity status. If the legal personality of an electronic agent is recognized, it would introduce certain challenges, such as establishing the commencement of this legal personality and defining the corresponding rights and obligations. Another perspective asserts that electronic agents have restricted personhood, granting them contractual capacity while denying them complete legal capacity. The third perspective, called the "progressive approach," contests the concept of an autonomous 'electronic person.' It proposes that electronic agents may be more accurately described as "registered agents."[38] Through this method, an agent's proprietor can allocate a specified amount of capital by registering it, establishing an agency with restricted responsibility.

The "progressive method" is the most pragmatic solution, given that electronic agents exhibit autonomy and are not simply instruments of their users. Electronic agents, operating as agents, may demonstrate independent objectives and, therefore, should assume specific legal duties. At present, bestowing complete legal personhood seems unsuitable; nevertheless, enabling them to assume responsibility via registration may be a feasible alternative. The incorporation of electronic agents undoubtedly poses several potential hazards. Imposing registration requirements that include a financial investment can effectively reduce these hazards. Should a possible danger manifest, the money designated for registration may be employed to indemnify any resultant harms.

7. Readiness of Indonesian Business Competition Law to Respond to Contracts between Electronic Agents

The Indonesian legal system hasn't yet clearly allowed algorithms to be seen as legal entities or helpful tools in making contracts. Article 1 point 8 of the Electronic Information and Transactions Law (UU ITE) recognises the existence of an "electronic agent" as a device in an electronic system that works on its own. However, this provision is still too broad and doesn't consider the advanced algorithms that can negotiate and

[38] Sachin Mishra, *The Legal Status of Electronic Agents* (2022).

make contracts without human help. Because of this lack of clarity, there is no clear law about who is responsible for and what makes contracts made by autonomous algorithms lawful.

Wahyuni's (2021) research shows that Indonesian law does not recognize algorithms or artificial intelligence systems as legal beings yet. This circumstance means these entities cannot have rights and responsibilities independently. The Electronic Information and Transactions Law (UU ITE) recognises "tools" in electronic systems. It doesn't think about times when these tools make legal judgments independently, like when they are used in contracts.[39] This contrasts with the international discourse, such as in the EU Commission report (2020), which has begun to consider electronic personhood within the framework of civil law.

Lee's (2022) research, which was published in the Bulletin of Indonesian Economic Studies, says that algorithmic contracts could make responsibility unclear because it's hard to tell who is to blame when an algorithm makes a choice that hurts one of the parties. Many modern algorithms are "black boxes," which makes it hard for people to comprehend how they make decisions completely. This circumstance makes the problem much worse.[40] He concludes that the Indonesian legal system does not yet have clear mechanisms for traceability and liability attribution in this context.

Fry (2000) and Calo (2015) both say that the UETA in the United States has made it easier for electronic agents to be recognised as capable of engaging and making contracts on their own, without any help from people. This circumstance is where the idea of constructive agency comes from: the belief that an algorithm's actions can be seen as an extension of the user's (the principal's) will.[41] This approach has no equivalent in Indonesia, where the principles of contract law remain highly anthropocentric (human-centered).

[39] Wahyuni, Sri. *Kecerdasan Buatan dan Tantangannya terhadap Sistem Hukum Nasional*. Yogyakarta: Genta Publishing, 2021.
[40] Lee, "Competition Policy in the Age of Algorithms."
[41] Fry, Patricia Brumfield. "Introduction to the Uniform Electronic Transactions Act." Idaho Law Review 37, no. 3 (2000): 237. https://heinonline.org/HOL/LandingPage?handle=hein.journals/idlr37&div=14&id=&page=

Scholz's (2017) research in the Stanford Technology Law Review shows that the Indonesian Civil Code (KUH Perdata) and other conventional legal systems still require a meeting of minds (consensualism) for a contract to be valid. But when it comes to autonomous algorithms, it's no longer possible to explicitly assign contractual intent to a human party.[42] He refers to this condition as "illusory consent," a form of apparent agreement that becomes legally problematic if it continues to be enforced within the framework of classical contract law.

Indonesian legislation still adheres to the principle of consensus ad idem in contract law, as stipulated in Article 1320 of the Civil Code (KUH Perdata).[43] When it comes to algorithmic systems, the main challenge is how the law can prove that there is mutual consent (consensus) when an electronic agent makes an agreement but does not have any legal awareness. This idea is very important since black-box-based algorithmic contracts can make terms that the people who utilize the system don't even fully understand.

Law Number 5 of 1999 has not yet acknowledged that algorithms could be used to collude. The KPPU (Indonesia's Competition Commission) may not consider algorithmic conduct that leads to parallel pricing because of machine learning to constitute collusion if there is no proof that business people talked to one other directly.[44,45] Therefore, an update to Article 5 must include non-traditional forms of coordination through electronic agents or algorithms that interact with each other in the digital market.

Given the ability of "electronic agents" (referred to as EAs) to facilitate the coordination of agreement transactions, it is imperative to reevaluate the reformulation of Article 5 of Law Number 5 of 1999 and Business Competition Supervisory Commission Regulation (Perkom KPPU) Number 4 of 2011, particularly concerning the classification of price-fixing agreements, to ensure that they are consistent with current trends. It is

[42] Scholz, "Algorithmic Contracts."
[43] Indonesia, Kitab Undang-Undang Hukum Perdata (Burgerlijk Wetboek voor Indonesië), Art. 1320.
[44] Julienna Hartono, Julianda Rosyadi, dan Xavier Nugraha, "Analisis Penggunaan Algoritma Harga sebagai Bentuk Perjanjian Penetapan Harga," Jurnal Hukum Bisnis Bonum Commune 4, no. 1 (Februari 2021): 41–62.
[45] Ahmad Sabirin dan Anna Maria Tri Anggraini, "Competition Law and Artificial Intelligence: Solution or Threat," Jurnal Persaingan Usaha 4, no. 1 (2024): 77–102.

instructive to analyze legal developments, such as Law Number 19 of 2016, which amended Law Number 11 of 2008, referred to as the Information and Electronic Transactions Law (ITE Law). ITE Law defines an "Electronic Contract" (EC) as an agreement between parties established through an electronic system. It is important to note that interactions involving EAs can establish ECs within the ITE Law framework. A comprehensive definition of an "electronic agent" is provided in Article 1, point 8 of the ITE Law. This definition includes a device within an electronic system designed to automate the execution of specific actions on electronic information, all under the direction of a human operator. The party responsible for all legal ramifications associated with electronic transactions, particularly in cases where errors are attributed to EAs, is also specified in ITE Law. In such instances, the registered electronic agent operator becomes accountable.

The ITE Law's definition of Electronic Agents (EAs) is relatively straightforward, as it does not contain any specific provisions delineating whether or not an EA may engage in coordinated interactions with other EAs. The interactions of two electronic agents can result in algorithmic contracts, as noted by Hubbard and Epstein.[46] Moreover, Stigler's stipulation regarding the establishment of comprehension, one of the prerequisites for an oligopoly, emphasizes the role of "algorithms" in facilitating "coordination" among business actors. "Gap-filling negotiators" are frequently the term used to describe EAs. On the other hand, the Uniform Electronic Transactions Act (UETA) notably more progressive definition of EAs, which defines them as "a computer program or an electronic or other automated means used independently to initiate an action or response to electronic records or performances in whole or in part, without review or action by an individual" (Sec. 2(6) of the Uniform Electronic Transactions Act, 1999). This definition implies that EAs can operate independently without human supervision.

The ITE Law's definition of Electronic Agents (EAs) is relatively straightforward, as it does not contain any specific provisions delineating whether or not an EA may engage in coordinated interactions with other EAs. The interactions of two electronic agents can

[46] F. Patrick Hubbard, "'Sophisticated Robots': Balancing Liability, Regulation, and Innovation," *Florida Law Review* 66, no. 5 (2014).

result in algorithmic contracts, as noted by Hubbard and Epstein. [47] Additionally, Stigler's stipulation regarding the establishment of comprehension, one of the prerequisites for an oligopoly, emphasizes the role of "algorithms" in facilitating "coordination" among business actors.[48,49]. EAs are often viewed as "gap-filling negotiators" [50]. In contrast, the definition of EAs within the Uniform Electronic Transactions Act (UETA) is notably more progressive, characterizing EAs as "a computer program or an electronic or other automated means used independently to initiate an action or response to electronic records or performances in whole or in part, without review or action by an individual" [51]. This definition implies that EAs can operate independently without human supervision.

The commentary on the revised UETA should elucidate that, regarding machine learning and its emerging capabilities, the concept of "sophisticated agent" must encompass the understanding that there are inherent technical and temporal constraints on the knowledge that even the most advanced companies possess at the time of contract formation. Courts often afford businesses considerable deference in establishing their transactional relationships, premised on the notion that their sophistication implies an intention to be bound by certain terms, which the law should acknowledge.[52,53] The law requires mechanisms to resolve conflicts when many credible approaches exist, particularly in emerging legal possibilities.

The algorithmic contracts framework proposes a method for comprehending transactions involving algorithmic agents without depending on an improbable legal fiction. Viewing algorithms as constructive agents for corporations utilizing them in transactions offers a distinct, technology-neutral rationale for holding companies accountable to the terms established by an algorithm. It is erroneous to overlook the

[47] Hubbard, "'Sophisticated Robots': Balancing Liability, Regulation, and Innovation"; Epstein, "'Facilitating Incomplete Contracts' by Wendy Netter Epstein."
[48] George J Stigler, "A Theory of Oligopoly," *Journal of Olitical Economy* 72, no. 1 (1964).
[49] Michal S Gal, "Algorithms as Illegal Agreements on JSTOR," *Berkeley Technology Law Journal* 34, no. 1 (2019): 99.
[50] Scholz, "Algorithmic Contract."
[51] Uniform Electronic Transactions Act.
[52] Scholz, "Algorithmic Contract."
[53] Ronald J. Gilson et al., "Contract, Uncertainty and Innovation," in *SSRN Electronic Journal* (2010), https://doi.org/10.2139/ssrn.1711435.

distinctive characteristics of machine-learning algorithms by asserting that all "electronic" contracts are enforceable solely due to their electronic nature. It is erroneous to claim that machine-learning algorithms are so complex that the companies employing them cannot be held accountable for the terms the algorithm chose on their behalf. Contract law can broadly integrate new technology into the old contractual framework and the values it embodies. The initial stage in this approach is recognizing that algorithms can function as agents for corporations.

Electronic agents (EAs) can be broadly categorized into two main types, as outlined by:[54]

a. Reactive agents: These EAs react to direct stimuli from their environment and perform actions based on these stimuli. These agents may operate within either a static or dynamic environment.

b. Multi-agent systems: this kind of system is characterized by the collaboration of multiple agents to attain a shared objective. To accomplish their objectives, these agents may require coordination and communication. EAs are employed in various fields, including robotics, computing, and intelligent systems. They can be created using a variety of programming languages and techniques, such as natural language processing and machine learning.

The definition of EAs within the ITE Law is more in line with reactive agents when these electronic agent categories are considered. EAs are entities that "... act on certain electronic information which is held by a person automatically," as defined in Article 1 point 8 of the ITE Law. According to the ITE Law, EAs function when they receive instructions from their environment, predominantly composed of "individuals or people."

8. Doctrinal Approach and Juridical Reinterpretation in Contracts under Indonesian Law

To clear up the legal grey areas of algorithmic contracts in Indonesia, doctrinal remedies must start with a new look at Article 1320 of the Civil Code (KUH Perdata) about

[54] Geeks for Geeks, *Agents in Artificial Intelligence* (2021); Michael S. Harré, "Information Theory for Agents in Artificial Intelligence, Psychology, and Economics," *Entropy* 23, no. 3 (2021): 310, https://doi.org/10.3390/e23030310.

consensus. This new interpretation should recognise that electronic agents (EAs) acting on behalf of human principals can meet the criterion for mutual consent. A constructive agency gives EAs the same legal status as the principal's intent, as companies operate through human agents. This circumstance makes contracts made by algorithmic procedures legitimate.

Changes to the ITE Law are also necessary. Change Article 1 point 8 to distinguish between reactive and autonomous EAs. The latter can make judgments without real-time input from humans. Algorithmic contracts made through these agents should also be legally recognised, especially when judgments are based on dynamic pricing models. Section 14 of the U.S. Uniform Electronic Transactions Act (UETA) says that Indonesian law should recognise contracts made by electronic agents, even if no one was there to see or review them when they were made.

The article need another set of rules to help us deal with the threats that black box algorithms represent. Companies that use machine learning to set prices should have to make their models public and have them checked to ensure that the contract conditions are clear and not random. To fix the differences in how people comprehend algorithms, the law should likewise set distinct legal criteria for different levels of intelligence in contracting parties. Lastly, there should be a registration system for autonomous EAs requiring a certain amount of capital set aside. This circumstance would ensure there are ways to hold them responsible and make things right if they cause harm.

Jurisprudential reinterpretations in Indonesian contract law are urgently needed to accommodate the realities of algorithmic contracts. Courts must expand the legal notion of "intent" to include outcomes generated by algorithms, as long as those outcomes can be traced back to rational goals set by the principal, such as maximizing profit. This functional approach, inspired by cases like US v. Topkins,[55] treats the design and deployment of algorithms as evidence of underlying intent. Similarly, the classical requirement of mutual consent in Article 1320 of the Civil Code should evolve to

[55] United States v. David Topkins. Information at 5, Docket No. 3:15-CR-00201 (N.D. Cal. Apr. 6, 2015).

recognize delegated informed consent, where human parties pre-authorize AI systems to act within certain boundaries of decision-making.

Moreover, Indonesian judges should reinterpret "agreement" under Article 5 of Law No. 5 of 1999 to capture tacit collusion facilitated by electronic agents (EAs) engaging in dynamic pricing strategies. Even without explicit communication, parallel pricing behaviors produced by trained algorithms may constitute concerted practices. Additionally, the courts should adopt a technology-neutral interpretation of "means" under the ITE Law, treating algorithmic tools as valid instruments of contract formation.[56] Finally, liability rules must evolve to recognize algorithmic foreseeability, holding principals accountable when autonomous algorithmic actions are a foreseeable consequence of the instructions or goals they have defined. These shifts ensure that fundamental contract principles remain robust in the face of AI-driven transactions.

9. Conclusion

Algorithmic contracts and the rise of autonomous electronic agents (EAs) are new legal problems for Indonesia's current regulatory systems. The ITE Law and Competition Law do not do enough to deal with the fact that prices might change, machines can make decisions independently, and machine-learning algorithms can work together. When contracts are made or carried out by algorithms, especially those that work as black box algorithm, the current laws on consent, agency, and liability are unclear. This study suggests that doctrinal and jurisprudential changes are needed to ensure that the digital economy is fair and that the law is clear. Article 1320 of the Civil Code requires to be examined to include delegated intent and informed consent through technological agents. The ITE Law requires to be changed so that it is clear that contracts made without human involvement are legitimate and that there is a difference between reactive and autonomous EAs. Also, Indonesian competition law should be changed to include algorithmic coordination as a type of collusion, even if there is no direct contact, especially under Article 5 of Law Number 5 of 1999. Treating algorithms as constructive agents, like human mediators, and taking a functional, technology-neutral approach will align Indonesian law more with international standards and the changing digital reality.

[56] Ningrum. N. Sirait, "Overview of the Indonesia Competition Law Law Number 5/1999," Working Paper on Competition Law: Indonesia (UNCTAD Secretariat, 2009).

Setting up a registration system for self-driving EAs and requiring algorithmic pricing models to be open makes accountability and consumer protection even stronger.

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