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The regulator's dilemma in proving algorithmic cartels against the principle of fair competition in the digital economy era

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ABSTRACT

The rapid development of the digital economy, marked by the adoption of pricing algorithms, has introduced new dynamics to Indonesia's competition law landscape. Algorithmic systems enable autonomous price setting based on market data learning without direct human intervention. This condition potentially gives rise to algorithmic cartels, a form of market coordination occurring without explicit agreement, yet producing anti-competitive effects similar to conventional cartels. The national legal framework, specifically Law No. 5 of 1999 and KPPU Regulation No. 4 of 2010, remains inadequate to address this phenomenon, as it is still anchored to a traditional paradigm requiring the element of "agreement" as a prerequisite for proving violation. This study aims to analyze the dilemma faced by the regulator (KPPU) in proving the existence of algorithmic cartels against the principle of fair competition in the digital era. Employing a normative juridical approach, this study examines relevant legislation, academic literature, and international policies from the OECD and European Commission. The findings indicate a regulatory gap in Indonesia's competition law regarding proof involving autonomous systems. Furthermore, the KPPU faces conceptual and technical obstacles in determining legal intent (legal intent) and the validity of digital evidence derived from algorithmic systems. The study concludes that proving algorithmic cartels must shift from an intent-based approach to an effects-based approach, which focuses on assessing the economic impact on market structure and consumer welfare. Therefore, strategic recommendations include reinterpreting the element of "agreement" in Article 1, paragraph 7, and Article 11 of Law No. 5 of 1999 to encompass algorithmic coordination that generates anti-competitive effects. Additionally, the KPPU is mandated to develop digital evidence guidelines and strengthen the multidisciplinary institutional capacity to effectively oversee algorithmic behavior. These steps are crucial for Indonesian competition law to adapt to the realities of the digital economy while ensuring justice and legal certainty.

Keywords: competition law, algorithms, digital cartels, legal evidence, digital economy.

1. INTRODUCTION

The rise of the digital economy has changed Indonesia's competition structure and dynamics. Tasks that were once performed solely by human beings are now performed by algorithmic systems that can autonomously make economic decisions using big data and are adjusted to real-time economic activities. In e-commerce, online transportation, and other digital platforms, the application of pricing algorithms has become the norm to improve the efficiency of business plans. These algorithms respond to changes in the market instantaneously and with a high degree of accuracy without human involvement. However, this adaptability tends to undermine the foundational principles of competition. Such is the case where the algorithms of a number of business players cause parallel pricing and cartel like coordination of the market.(OECD, 2017a)

In a competitive market structure, the quality, efficiency, and innovation of business actors improve because of market forces. In turn, healthy competition gives consumers the benefit of having many different products and/or services to choose from while also providing better prices. This, along with the ability of companies to differentiate themselves and improve upon existing technologies, is the very definition of a market. However, in the digital economy, these principles face challenges when competition is ultimately no longer rooted in humans but in algorithms that can generate similar behaviors and lead to collusive pricing.

As an institution authorized to oversee business competition, the KPPU plays a crucial role in ensuring fair and transparent market mechanisms. This role is increasingly relevant as the digital economy evolves, introducing new algorithm-based competitive patterns. Under these conditions, the KPPU's ability to assess and supervise business behavior is crucial for maintaining a healthy market structure. The importance of this function is reflected in the KPPU's emphasis on maintaining market balance and fairness through its supervisory mandate.(Mariyam.S, 2023)

Algorithmic collusion is the case where competing business actors' algorithmic systems "learn to adapt their pricing to each other and achieve collusion with no tacit human communication." In reality, algorithms make it possible to exploit established patterns in a market's data and its competitors' pricing to maintain elevated prices. This artificially harms the market's consumers and disables the inherent competition of the market. This case has existed on the periphery of academia for a long time. Mehra already pointed out in 2015 the fundamental conundrum that "antitrust law will regulate what is not human decision making, but rather the decision making of a machine." Based on this inquiry, Mehra is suggesting that algorithmic pricing should make it easier and more stable cartel formation.(Mehra, 2016) According to the Organisation for Economic Cooperation and Development (OECD), this form of collusion is difficult to prove because it lacks the direct communication trails common in conventional cartels. Consequently, law enforcement against algorithmic cartels presents a dilemma for competition authorities, including the Business Competition Supervisory Commission (KPPU) in Indonesia.(Ezrachi & Stucke, 2016)

The national legal framework, regulated by Law Number 5 of 1999 concerning the Prohibition of Monopolistic Practices and Unfair Business Competition, is normatively designed to regulate the behavior of human business actors, not algorithmic systems. Article 1, number 7, defines an agreement as an agreement between business actors that can influence the market positively or negatively. This definition implies the need for evidence of an agreement (whether written or unwritten) to determine whether a violation of competition law exists. In the digital context, this becomes problematic because the coordination that occurs is not the result of a "common intention" of humans but rather the result of system automation. Thus, the element of "agreement" as defined in positive law, becomes difficult to prove, even though its economic impact is equivalent to that of conventional cartel practices.

Furthermore, KPPU Regulation No. 4 of 2010, concerning Guidelines for the Examination of Alleged Cartels, does not address the phenomenon of algorithmic collusion. These guidelines still focus on proving it through explicit communication, such as meetings, emails, or other forms of direct communication between business actors and the government. However, in algorithmic cases, collusive

behavior can occur without any human communication. Consequently, a regulatory gap exists that leaves Indonesian competition law lagging behind the complexities of modern market technologies.

The primary concern is that the KPPU's assessment of legally guaranteed market behavior is contradictory. If an identical pricing policy is construed as illegal without a case-by-case analysis of the potential causes, there is a danger of entrepreneurs' losses. On the other hand, there is a danger of regulators' protective inertia leading to the consequences of pricing algorithm coordination to consumers. This case has shown the necessity of a fundamental reform of the legal methodology proving cartel behaviour in the digital context.(KPPU, 2010)

This problem has been the focus of numerous studies worldwide. Ezrachi and Stucke discuss, in their work Virtual Competition, the possibility of market coordination that mimics collusive behaviour being formed by algorithms through machine learning, out of the reach of human participation.(Ezrachi & Stucke, 2016) Calvano et al. show that collusive behaviour in a rationally constructed algorithm market may be obtained endogenously. (Calvano et al., 2020) This research demonstrates that classical competition law which relies on "intent" has become grossly inadequate in dealing with the phenomena surrounding the automated and adaptive digital market. In such circumstances, different bodies like the European Commission and the OECD have proposed a shift from the classical form to a form where behaviour is assessed solely for its economic impact, with no requirement of a formal agreement. (Ezrachi & Stucke, 2016)

The research pertaining to proving algorithmic cartels is still rather scant in the national legal literature. In Indonesia, most legal studies concentrate on the digitalisation of trade or on the issues of market dominance, without considering the evidentiary problems of competition law in the algorithmic realm. Therefore, this work seeks to fill this gap by analysing the dilemma of the algorithmic cartel in Indonesia's current law and providing conceptual changes to strengthen the enforcement of law in the digital age. The regulators' dilemma is the difficulty in discovering and proving the role of an algorithm in collusive price fixing. This problem also complicates and constrains the application of competition law which, by design, is premised on the existence of tangible proof of an agreement of several parties in a concerted action.

National regulators have begun to express concerns about the issue of algorithmic collusion. The KPPU states that "automatic pricing systems collude algorithmically without an explicit agreement between economic actors." In a hearing with the Indonesian House of Representatives Commission VI, KPPU Chairman M. Fanshurullah Asa (Ifan) views this update of regulations as a strategic step to address the challenges of the digital economy era in preventing and dealing with algorithmic collusion.(Saputra, 2025)

This statement demonstrates that the issue of algorithmic cartels is no longer hypothetical but has become part of the national competition policy discourse. Therefore, this study aims to provide a theoretical foundation and conceptual recommendations for the KPPU in developing evidentiary instruments that adapt to the development of algorithmic technology in the digital market.

This study seeks to answer the main question: How does Indonesian competition law respond to the regulator's dilemma in proving algorithmic cartels against the principle of fair competition in the digital economy era? More specifically, this study aims to: (1) analyze the normative gaps in competition law regulations related to algorithms; (2) assess the limitations of the "agreement" element in the context of automated collusion; (3) identify the challenges of proof by the KPPU; and (4) formulate a direction for regulatory reform that is in accordance with the principle of fair competition.

Theoretically, this research is expected to contribute to the development of economic law, particularly by broadening the interpretation of the element of "agreement" to include algorithm based automated behavior. Practically, the results of this research can serve as a reference for the Commission (KPPU) in developing technical guidelines for digital evidence based verification and strengthening the effects based approach in assessing the market impact of algorithmic behavior.

2. METHOD

This study employs a normative legal research method focusing on doctrinal and policy analysis. The statutory approach is applied to examine normative gaps in Law No. 5 of 1999 and KPPU Regulation No. 4 of 2010. The conceptual approach is used to reconstruct the concept of "agreement" in the context of algorithmic coordination, while the comparative law approach is utilized to analyze policy developments from the OECD and European Commission. Research data sources consist of primary legal materials including legislation and KPPU decisions, as well as secondary legal materials comprising international journals and business competition literature. Data collection is conducted through library research, while data analysis uses qualitative methods with legal interpretation and legal construction techniques to develop legal concepts responsive to digital technology developments.

3. RESULT AND DISCUSSION

3.1 Conceptual and Theoretical Framework of Algorithmic Cartels

Competition law is built on the fundamental principle that markets must operate freely and efficiently with fair competition mechanisms. The principle of fair competition ensures that every business actor has an equal opportunity to compete based on quality, innovation, and efficiency without intervention that causes market distortion. The primary objective of competition policy is to maximize consumer welfare by increasing allocative, productive, and dynamic efficiency in the market. This objective is a fundamental core of global competition theory.(Motta, 2004)

This principle is oriented in Law Number 5 of 1999 which aims to, "safeguard the public interest and improve national economic efficiency as well as improve the welfare of the people." The principles formed the basis for governing the prohibition of monopolistic practices, collusion and the abuse of dominant positions.

The concept of fair competition is also related to the rule of reason principle, whereby a business actor's behavior is deemed unlawful if it is proven to negatively impact market structure, economic efficiency, or consumer interests. Therefore, competition law assesses not only the existence of an agreement or action but also its economic consequences. This becomes crucial as markets become increasingly complex due to the emergence of digital technology and algorithmic systems that operate automatically without direct human control.

A cartel is cooperation between two or more business entities with the intention of price manipulation or control, market division or segmentation, or restriction of market supply with the aim of garnering exorbitant returns. Within the confines of the law, Article 11 of Law No. 5 of 1999 bans business actors from making arrangements with competing counterparts on price predetermination such that it may lead to the emergence of a monopoly or acts of unfair business rivalry. Within the structure of traditional competition law, proving a cartel is usually correlated to the presence of an open or public consensus (explicit collusion) which refers to the direct interaction of the business operators, whether it be in writing or orally. (KPPU, 2010)

Concerning theory and market practice, there exists certain forms of cartel behaviour (tacit collusion) which is price coordination, as opposed to an active agreement, through observation of competitors in the market. Oligopolistic markets are characterised by a limited number of players in the market, and as such, collusion is easier to coordinate. This is the juncture where pricing algorithms come in, as these applications permit businesses to alter their pricing in an automated and simultaneous manner based on identical information. This allows for collusion to occur without the need for direct contact between the players in the market.(OECD, 2017a)

Algorithms have various meanings depending on the context in which they are applied. The concept encompasses a wide range of fields, from driverless vehicle systems and automated medical devices to pricing mechanisms on digital trading platforms. In its report, "Algorithms and Collusion," the OECD provides a general definition of an algorithm as "a set of rules executed in a specific order to

accomplish a specific task."(OECD, 2017b)Although this definition is broad, in the context of algorithmic collusion a more specific understanding is required, namely focusing on algorithms designed to set prices autonomously or according to instructions from business actors.

The development of algorithmic technology has transformed the interaction patterns of business actors in digital markets. Algorithms no longer function simply as decision making aids, but have evolved into systems capable of learning and adapting to the dynamics of market behavior. In the context of modern competition law, this demands a more thorough analysis of the role of algorithms, particularly in examining how digital mechanisms can indirectly coordinate prices without human involvement.

There are market variables like demand and supply, available inventory, prices of competing products, and consumer behaviour that can be entered into a system. Pricing algorithms are sets of instructions that allow the system to determine product prices. Digital markets are dependent on these algorithms to ensure price based competition and operational efficiency. However, the algorithms of Ezrachi and Stucke are likely to create collusion, albeit unintentionally, when competing firms employ systems with similar functions based on machine learning. (Ezrachi & Stucke, 2016)

The OECD has categorised pricing algorithms into four types based on their functions and their role in facilitating price collusion in digital markets. Such a classification fosters a better understanding of how engaged collusion in algorithmic technology might be, albeit unintentionally, it can assist in collusion in the hands of the business actors involved. (OECD, 2017a)

3.1.1 Monitoring Algorithms

It serves to oversee the enforcement of price agreements among business entities. This algorithm is meant to autonomously ascertain any company contravening the agreements made. With such a function, the algorithm not only protects price stability but also potentiates the stability of collusive practices because the system can readily detect and rectify any violations of the agreement.

3.1.2 Parallel Algorithms

A system that autonomously reconfigures prices in correlation with the available supply and demand in the market. Ideally, such an algorithm should enhance efficiency given that prices can be tailored to the market. However, the OECD points out that similar algorithms and colluding businesses with no agreement can yield price uniformity, a potential form of collusion.

3.1.3 Signaling Algorithms

The software responds to price changes as a means of inter firm rivalry. A price increase by one firm may be understood by a rival firm's system as a prompt to increase their price as well. Richard Posner views price increases as constituting an "offer" to which another firm's price increase is an "acceptance." This algorithmic collusion results in price coordination which competitors can plausibly deny.

3.1.4 Self Learning Algorithms

This form is considered to be the most advanced and carries the greatest risk of being anti competitive. This kind of algorithm, through machine learning, is capable of autonomously learning from the analysed market data and the behaviour of rival firms. This system is capable of detecting collusion without human assistance and from which market players would benefit by maximally increasing their profits. In tightly knit markets, this kind of system can easily engage in automated price collusion, which is detrimental to consumer welfare and defies competitive market principles.

This OECD classification shows that there are different technological means of price coordination that theoretically could involve no communications between the actors. In the instance of enforcement of

competition law in Indonesia, these types of algorithms are important to different evidentiary challenges in terms of the 'agreement' element contained in Article 1 number 7 and Article 11 of Law Number 5 of 1999. For instance, monitoring and signalling algorithms are still amenable to analysis by way of evidence of market behaviour or communication evidentiary less, but self learning algorithms require deeper substantive approaches, which are effects based, to evaluate the actual detriment to the market structure and consumer welfare.

In addition to the OECD classification explaining the function of algorithms in facilitating price setting, Ezrachi and Stucke's research also highlights the emergence of forms of digital collusion stemming from interactions between algorithms themselves. They explain that collusion can occur without direct communication between business actors, but rather through algorithms mutually adjusting pricing decisions based on market behavior patterns. In their view, this marks a significant shift in competition law, as price coordination no longer requires explicit agreement between humans but can instead occur autonomously through machine learning processes.

Forms of digital collusion can be divided into three main types (Ezrachi & Stucke, 2016): (1) Messenger collusion, where business actors deliberately use algorithms as an indirect communication tool; (2) Hub and spoke collusion, namely the situation when one algorithm provider controls the pricing strategies of several business actors; and (3) Self learning collusion, where the algorithm learns to adjust prices to competing algorithms without human intervention.

This latter phenomenon poses the greatest challenge for law enforcement, as there is no demonstrable malice (mens rea) or explicit agreement between individuals. Yet, its impact on prices and consumers is the same as that of a conventional cartel.

3.2 Normative Void in Competition Law Regulations Regarding Algorithms

3.2.1. Traditional Paradigm and General Gap Analysis

The foundation of Indonesia's competition law model is still stuck in a traditional perspective which is heavily focused on the intent and the agreement, as manifested by Law No. 5 of 1999 which posits the 'agreement' as the foremost important component in proving a cartel. When it comes to algorithms, this model is irrelevant, as systems can coordinate with no human intent. This research exposes the gaps in the ability of Law Number 5 of 1999 to address the reality of algorithmic cartels.

3.2.2. Specific Normative Vacancies in the KPPU Law and Regulations

3.2.2.1 Weaknesses of Agreement Elements (Article 1 number 7 and Article 11):

The provisions in Article 1, paragraph 7 of Law Number 5 of 1999, which define an agreement as "an agreement between business actors that can influence the market," are still based on the traditional paradigm, namely the existence of intent and agreement between humans. In algorithmic cartel practices, price coordination can occur without intent or direct communication between business actors. This renders the element of agreement in positive law irrelevant when automated systems make independent decisions.

The provisions of Article 11 of Law No. 5 of 1999, which is concerned with prohibiting agreements that have the effect of colluding on the price of the provisions, does not recognize technologies or digital systems as being able to assume the role of an entity in market mechanisms. This rule does not consider "non human actors" particularly algorithms which are currently able to set prices, and regulate the market activities. This means that there is a normative gap in Indonesian competition law, as there are no legal tools that can be used to evaluate or regulate the behavior of autonomous algorithms.

3.2.2.2 Weaknesses of the KPPU Evidence Guidelines

In addition, KPPU Regulation Number 4 of 2010 is silent about the use of digital evidence, system data, or algorithmic log files in the offering of evidence. These guidelines still prefer conventional evidence that consists of the communications of the business actors. However, in algorithmic cases, the data that constitutes the evidence is actually from the communications of the systems. This indicates that the legal system still cannot accommodate electronic evidence and system behavior as the basis of evidence in KPPU investigations.(KPPU, 2010)

3.2.3. Conceptual Challenges and Regulatory Capacity Limitations

During the enforcement of the competition law, the KPPU is most challenged when assessing the validity of the evidence, especially when the case no longer concerns actual contact among business actors. As Wahyu Dwi Erlangga and Arrisman (2021) noted, in conventional cartel prosecution, the primary concern is the absence of legitimacy in the positive legal theory concerning indirect evidence. Doubts about the strength of indirect evidence lead to divergent views between the KPPU and the court, especially when the use of economic data serves as the basis for inferring market collusion. The same scenario is likely to happen during the prosecution of algorithmic cartels where AI systems collusively and autonomously generate market outcomes as if the outcomes were the result of human behavior.(Erlangga & Arrisman, 2021)

The KPPU experiences challenges in the digital age that are primarily technical, as well as conceptual: positive law is still anthropocentric, whereas the current economic situation introduces non-human actors that are powerful in shaping the market.

The weakness of competitors is another issue. With regards to KPPU (Commisson of Complaints and Investigation), a people suffer from and unlawful algorithmic abuse of KPPU. Overlapping domain of investigation is is Economics and Law and Computer and Data Science, Understanding investigative process is crucial to decipher behavioral and conduct from competitions market. The KPPU has no policies on the recognition of digital evidence (such as source code, stored evidence, computer log files and program instructions or commands) as credible evidence in their investigations. This is another reason for not recognizing the use of digital evidence as credible as an explanation for the unreasonably cumbersome use of digital evidence in investigations.

According to a 2021 UNCTAD report, developing countries face significant challenges in overseeing competition practices in the digital economy. Limited institutional capacity and the lack of regulations tailored to the characteristics of digital markets make competition oversight less effective. UNCTAD emphasizes that data and network control are fundamental elements of the digital economy, yet many competition legal frameworks still follow conventional approaches that fail to address these complexities. Therefore, competition regulatory bodies, both at the national and regional levels, need to clarify applicable provisions, the scope of digital markets, and policies related to data and digital network management.(UNCTAD secretariat, 2021)

3.2.4. Normative Implications and Conceptual Solutions

From a normative legal perspective, this lack of norms indicates that Indonesian competition law still operates under an analog paradigm amidst the realities of the digital market. However, based on the principles of economic efficiency and consumer protection, the law must adapt to technological change. The absence of norms governing algorithmic behavior has the potential to weaken the KPPU's supervisory function and create legal uncertainty for businesses.

This situation demonstrates the need to reinterpret the elements of the agreement in Article 1, paragraph 7, and Article 11 of Law No. 5 of 1999. This element can be conceptually expanded to include "economic coordination that has anticompetitive effects," to ensure competition law remains relevant to technological developments. Furthermore, Indonesia could adopt international guidelines, such as those

of the OECD (2021), which emphasize the need for algorithmic oversight mechanisms and transparency in digital systems to prevent automated collusion in the market. (OECD, 2017a)

3.3. Limitations of the "Agreement" Element and Challenges to Proof by the Regulator (KPPU)

3.3.1 Evidential Basis and the Dilemma of Algorithmic Cartels

Evidence is a central element in any competition law enforcement process. In the Indonesian legal system, evidence of cartels is regulated by KPPU Regulation No. 4 of 2010, which distinguishes between direct evidence, such as communications or agreement documents, and indirect evidence, such as price patterns, market behavior, or statistical data. In practice, evidence based on indirect evidence requires in-depth economic analysis to demonstrate the link between business actors' behavior and their impact on the market.

Problems arise when direct evidence is unavailable because coordination occurs through algorithmic systems. On the one hand, the KPPU cannot simply accuse business actors of collusion without evidence of explicit communication, as this would violate the presumption of innocence. However, on the other hand, ignoring algorithmic collusive behavior could result in significant losses for consumers and hinder economic efficiency. This dilemma lies at the heart of the problem of proving competition law in the digital era.(Calvano et al., 2020)

3.3.2 Lack of "Agreement" Elements in Law no. 5 of 1999

One of the key findings of this research is that the element of "agreement" in Law No. 5 of 1999 cannot be directly applied to the phenomenon of algorithmic cartels. In traditional practice, cartel agreements require explicit communication, whether through meetings, emails, or other instruments demonstrating a shared intention to regulate the market. However, in algorithmic cartels, coordination can occur automatically because the algorithm learns competitors' behavior through market data.(Bundeskartellamt & Concurrence, 2019)

Ezrachi and Stucke recognized that algorithms are able to autonomously adapt to competitors' strategies and modify pricing behavior without human intervention. In this case, there may not be a 'meeting of the minds' among the actors, but the outcome is price fixing. (Ezrachi & Stucke, 2016) This raises a legal dilemma: can algorithmic results that lead to high stable prices be considered an "agreement" in the legal sense?. This method has been labelled as effects based as it evaluates actions based on their consequences economically, ignoring the actions of the wrongdoer. (Calvano et al., 2020)

3.3.3 Conceptual Solutions and Reinterpretation Recommendations

In a global context, institutions like the European Commission have begun using an effects based analysis approach, which assesses the economic impact of behavior without requiring evidence of an explicit agreement. This approach allows regulators to assess algorithms based on market outcomes, such as increased prices or reduced innovation, even in the absence of direct communication between business actors. This principle aligns with the rule of reason theory, which emphasizes assessing the substantive consequences of business behavior, not just the formal form of the agreement.(Madiega, 2024)

In line with this global trend, this study finds a need to reinterpret Article 1, paragraph 7, of Law No. 5 of 1999, so that it is not limited to explicit agreements but rather encompasses coordination that has anticompetitive effects. This reinterpretation can be achieved through implementing regulations from the Commission for the Competitiveness and Competition (KPPU), which emphasize that algorithmic coordination falls within the scope of prohibited agreements if proven to disrupt market mechanisms. This way, the law can maintain a balance between legal certainty and effective oversight.

3.3.4. KPPU's Practical Challenges and Evidence Guidelines

Based on the analysis of the evidentiary framework, the KPPU faces three main challenges in enforcing the law against algorithmic cartels. First, technical challenges of proof. The KPPU currently lacks a mechanism to obtain and analyze complex and confidential algorithmic data. Most algorithms are trade secrets, making them difficult for regulators to access. Without access to the algorithm's source code or training data, proving collusion stemming from system interactions is nearly impossible (Financial et al., 2023). Second, methodological challenges (Mens Rea Element). The Indonesian legal system still requires intent or deliberate action as the basis for legal accountability. However, algorithms do not possess intent in the legal sense, as their decisions are derived from statistical logic and computational processes, not human will. In such a context, an intent focused evidentiary approach is no longer relevant. Therefore, the Business Competition Supervisory Commission (KPPU) needs to adopt an effects based evidentiary approach, assessing price patterns, market behavior, and changes in market structure as indirect evidence of potential algorithmic coordination (Financial et al., 2023). Third, conceptual challenges (efficiency vs. legal certainty). Algorithms are often used to increase pricing efficiency and avoid price wars that harm businesses. If every price uniformity is perceived as collusion, innovation and market efficiency will be hampered. Therefore, regulators must be able to distinguish between "efficient price adjustment" and "anti competitive coordination." This balance is at the heart of the regulator's dilemma in the digital age.

Based on this analysis, this study recommends that the KPPU develop digital evidence based verification guidelines, which include indicators such as: (1) identical price patterns over a short period of time, (2) similarity of service provider algorithms, and (3) the relationship between changes in input data and price outcomes in the market. These guidelines should be developed with the involvement of digital economics and data science experts to have a strong technical basis.

3.4 Comparison, Implications, and Direction of Regulatory Reform

This study compares Indonesia's approach with that of other jurisdictions, such as the European Union, the United States, and the OECD. The comparison shows that competition authorities in developed countries have begun adapting the concept of proof to algorithmic practices.

In the European Union, the European Commission, in its Antitrust and Algorithms report, stated that algorithms can be a means of passive collusion that does not require explicit communication. The EU now uses an effects based approach, which assesses market behavior based on economic effects, rather than formal agreements. If price patterns exhibit unusual stability without a rational economic justification, it can be categorized as algorithmic collusion.(OECD, 2017a)Meanwhile, in the United States, the approach remains rooted in the Sherman Act, which emphasizes the existence of an "agreement." However, courts are beginning to consider the use of economic inference to prove collusion, namely by drawing legal conclusions from repeated and competitively inefficient patterns of economic behavior. Meanwhile, the OECD has suggested to its member countries to create a new standard of the countries to be able to incorporate economic analysis and digital forensics within new guidelines to be created in order to prove myths of algorithmic collusion (OECD, 2017a)

These comparisons suggest that on the global policy scale the global policy leaning more towards strengthening the effect based approach which in the case of Indonesia can be used as a benchmark in reformulating the KPPU guidelines that can preserve legal flexibility in the midst of technological progress. The findings of this study have implications for the implementation of the principle of healthy competition in Indonesia, which requires regulatory and institutional reform: (1) Algorithmic Fairness and Adaptive Principles. The principle of fair competition must be interpreted adaptively to encompass competitive fairness in the digital space. Fair competition requires not only freedom of enterprise but also algorithmic fairness, where digital systems must not create unfair advantages for certain actors; (2) Regulatory Transformation (Governance). Competition law must transform from an instrument of control to an instrument of governance, one that not only punishes violations but also guides businesses to use technology ethically. In this context, Indonesia can adopt an algorithmic transparency policy, requiring

businesses to disclose the underlying logic of pricing algorithms to regulators. This policy has been implemented to a limited extent in the European Union through the EU's explainable AI principle; (3) Normative Reform. Regulatory reform is needed in the form of drafting a KPPU Regulation on Guidelines for Algorithmic Behavior Assessment, which emphasizes that coordination of automated systems that results in anticompetitive effects can be considered a violation of the law. Such guidelines can bridge the legal gap without requiring comprehensive changes to the law.

Technological change demands an adjustment of competition law theory from an intent based approach to an effects based approach. This shift is not merely technical, but conceptual. Competition law must be able to assess the substantial economic effects generated by algorithmic systems, rather than simply relying on evidence of formal agreements between business actors. In this regard, the theories of economic efficiency and consumer welfare are key indicators in determining whether a behavior violates the principles of fair competition.

Furthermore, the theory of regulatory adaptation is also important, namely the idea that law must be flexible to technological innovation without losing its regulatory function. This means that competition law needs to adopt a hybrid approach that combines legal and technological analysis in an integrated manner. The need for this paradigm shift is urgent, especially for competition authorities in developing countries such as the KPPU because: "There is a growing understanding of the weaknesses of relying solely on competition law enforcement to address competition problems posed by digital platforms. Furthermore, there is a recognized need to regulate such platforms ex ante, to address problems before they arise, that is, to prevent certain anti competitive practices rather than waiting until they cause competition related harm in the market and trying to correct them ex post, especially since the latter approach requires a significant expenditure of time and resources."(UNCTAD secretariat, 2021)This approach is in line with Soerjono Soekanto's view that law as a system of norms must always be able to adapt to the social and economic dynamics of society.(Soekanto, 1983)

Thus, this theoretical review confirms that algorithmic cartels pose a new challenge to Indonesian competition law. This phenomenon cannot be addressed with the old paradigm focused on intent and agreement, but rather requires a new analytical framework that assesses the actual impact of algorithmic coordination on markets and consumers.

4. CONCLUSION AND SUGGESTION

4.1. Conclusion

This research confirms that the transformation of the digital economy and the use of algorithms in pricing have created new challenges for competition law enforcement in Indonesia. The legal system, built on an analog paradigm that focuses on human intent and agreement, is no longer adequate to address the complexities of automated collusion in the era of artificial intelligence. In the context of algorithmic cartels, price coordination can occur without explicit agreement, yet still have anticompetitive effects that harm consumers and hinder economic efficiency.

The main findings of this study indicate that the lack of norms in Law No. 5 of 1999 and KPPU Regulation No. 4 of 2010 is a major obstacle to legal evidence. The element of "agreement," which normatively requires an agreement between business actors, is unable to accommodate the phenomenon of autonomous algorithmic coordination. As a result, the KPPU faces a legal and technical dilemma: on the one hand, it must maintain legal certainty by adhering to formal evidence, but on the other hand, it must be able to protect the market from the anti competitive effects of algorithmic systems.

From an economic law perspective, this study finds that the effects based approach is the most relevant evidentiary model in the context of algorithmic cartels. This approach allows regulators to assess behavior based on its actual impact on market structure and consumer welfare, without relying on evidence of explicit communication. Thus, the law can be more responsive to the dynamics of technology and digital market behavior.

Normatively, this study recommends three strategic steps. First, reinterpret the elements of the agreement in Article 1 number 7 and Article 11 of Law No. 5 of 1999 to include algorithmic coordination that causes anti competitive effects. Second, the KPPU (Commission for the Commission for the Procurement of Digital Evidence) should develop digital evidence guidelines that integrate algorithmic data analysis, digital evidence, and market behavior indicators. Third, strengthen regulatory capacity through cross disciplinary collaboration between law, economics, and data science to substantively understand technological dynamics.

With these steps, Indonesian competition law can transform into a system that is adaptive, predictive, and relevant to the digital economy. The principle of fair competition will be maintained, not merely as a formal norm, but as a dynamic mechanism capable of balancing technological innovation and market fairness.

4.2. Suggestions

Based on the above conclusions, this study recommends the following three strategic steps for competition law reform in Indonesia: (1) Normative Reinterpretation: A reinterpretation of the "agreement" element in Article 1 number 7 and Article 11 of Law No. 5 of 1999 is needed. This element must be conceptually expanded to include "economic coordination with anticompetitive impacts" resulting from algorithmic systems. This reinterpretation forms the doctrinal basis for the application of the effects based approach; (2) Development of Digital Evidence Guidelines: The KPPU is required to develop comprehensive digital evidence guidelines. These guidelines must integrate algorithmic data analysis, digital evidence (source code, log files), and market behavior indicators to provide legal legitimacy to indirect evidence in the digital era; (3) Cross Disciplinary Capacity Building: The KPPU must strengthen its regulatory capacity through cross disciplinary collaboration between law, economics, and data science or digital forensics. This strengthening is essential for a substantive understanding of technological dynamics, enabling the KPPU to distinguish between legitimate efficiency and automated collusion.

Ethical Approval
Not Applicable

Informed Consent Statement
Not Applicable

Authors' Contributions
TAP contributed to the examination of the legal framework of Law No. 5 of 1999 and KPPU regulations, assisted in interpreting key legal provisions on "agreement," and provided critical input in developing the argument regarding the shift from intent-based to effects-based assessment. DB participated in revising and refining the manuscript. AR contributed to the literature review, analysis of OECD and European Commission policies, and identification of regulatory challenges in proving algorithmic collusion. He supported data interpretation and assisted in strengthening the discussion on the implications for market structure and consumer welfare. SMI contributed to the methodological design, evaluation of normative juridical sources, and development of arguments related to digital evidence and algorithmic transparency. He also reviewed the manuscript for consistency and legal coherence. ANFN contributed to finalizing the manuscript through editing, ensuring clarity, academic rigor, and alignment with competition law discourse. She assisted in structuring the strategic recommendations and validating the conclusions of the study.

Disclosure statement
The authors declare that there are no relevant conflicts of interest related to this research.

Data Availability Statement
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