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Enforcing Competition Law in the Digital Era: Addressing Algorithmic Opacity and Market Power

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Abstract

This research examines the role of algorithms in determining competition in digital markets. It concentrates on the effects of algorithmic systems on the setting of prices, ranking of search engine results, allocation of resources, and consumer behavior. It examines the issues affecting digital competition due to the lack of transparency. Algorithmic systems can facilitate coordination among firms, this may include implicit collusion, often without leaving any direct evidence, which complicates regulatory oversight. Additionally, these systems are complex, constantly evolving and protected by legal mechanisms such as intellectual property rights. Egypt provides a compelling case study as regulators noticed that the Egyptian Competition Authority faces major challenges. These include a weak mandate, lack of technical expertise, and an inappropriate legal system. The research examines how the EU and UK have addressed the challenges of algorithmic systems. It then seeks to draw a proposal for Egypt. It is believed that by adopting the proposed measures, Egypt can improve regulatory effectiveness in digital markets, reduce the risks of anti-competitive behavior, and ensure fair competition for both firms and consumers. This can be achieved without undermining the right to confidentiality of business.

Keywords: competition law, digital markets, algorithmic opacity, enforcement challenges, transparency, Egyptian Competition Authority

JEL Classification: L40, L41, L86, K21, D43

يتناول هذا البحث دور الخوارزميات في تحديد المنافسة في الأسواق الرقمية، مع التركيز على تأثير النظم الخوارزمية في تحديد الأسعار، وترتيب نتائج محركات البحث، وتخصيص الموارد، وسلوك المستهلكين. كما يبحث في الإشكالات التي تواجه المنافسة الرقمية نتيجة نقص الشفافية. ويمكن للنظم الخوارزمية أن تيسر التنسيق بين المنشآت، بما في ذلك التواطؤ الضمني، غالبًا دون ترك دليل مباشر، مما يعقد الرقابة التنظيمية. وبالإضافة إلى ذلك، تتسم هذه النظم بالتعقيد والتطور المستمر، وتحظى بالحماية بموجب آليات قانونية، مثل حقوق الملكية الفكرية. وتقدم مصر حالة دراسية مهمة، إذ يواجه جهاز حماية المنافسة ومنع الممارسات الاحتكارية تحديات رئيسية، تشمل ضعف الاختصاصات، ونقص الخبرة الفنية، وعدم ملاءمة النظام القانوني. ويدرس البحث كيفية معالجة الاتحاد الأوروبي والمملكة المتحدة للتحديات المرتبطة بالنظم الخوارزمية، ثم يسعى إلى تقديم مقترح لمصر. ومن شأن اعتماد التدابير المقترحة تحسين فعالية الرقابة في الأسواق الرقمية، والحد من مخاطر السلوك المنافي للمنافسة، وضمان المنافسة العادلة للمنشآت والمستهلكين، دون المساس بحق سرية المعلومات التجارية.

الكلمات المفتاحية: قانون المنافسة، الأسواق الرقمية، غموض الخوارزميات، تحديات الإنفاذ، الشفافية، جهاز حماية المنافسة ومنع الممارسات الاحتكارية المصري

تصنيف الأدبيات الاقتصادية: L40, L41, L86, K21, D43

. Introduction

Algorithmic systems have come to play a crucial role in a wide array of digital markets they have an important role to play in terms of competition dynamics and price setting for firms. Therefore, a major challenge for competition regulators is posed by the growing use of algorithmic systems. This challenge is mainly because of a lack of transparency in algorithmic systems that operate behind closed doors.

Lack of transparency is at the heart of the challenge facing competition regulators. In fact, algorithmic systems have come to be viewed as black boxes that take inputs and produce outputs without there being transparency over the process that occurs between these inputs and outputs. As a result, it is often unclear what process is being used. It is also often unclear whether a firm's price is a result of independent decision-making or clandestine activities that violate competition laws. Indeed, long-held standards for assessing competition rules seem to have outlived their usefulness when algorithmic systems play a role rather than direct interfirm communication.

This research aims to address the issue of algorithmic collusion in digital markets. Scholars have noted that most of the discourse surrounding the issue has been based on theoretical arguments and empirical studies that have primarily focused on developed economies. In emerging markets like Egypt, there has been a lack of consideration of the difficulties in implementing such regulations due to a lack of supporting empirical evidence. In fact, the current regulatory environment in Egyptian markets was established without sufficient consideration of the requirements and risks associated with algorithmic trading.

This research assesses the role of the obscurity associated with algorithmic systems in the implementation of competition regulations. It evaluates whether regulations based on intent are relevant in markets where algorithmic systems are used to determine prices and

make business decisions. Additionally, there will be an evaluation of the implications that the EU and the UK have for Egypt in the development or implementation of competition regulation in relation to algorithmic systems.

This research uses a qualitative legal method that combines doctrinal legal analysis with comparative law. It examines current laws and regulations and identifies enforcement problems that arise when algorithmic information is not available. The research identifies the points at which these mechanisms break down and to clarify the conditions under which this occurs. It makes clear structural binderies of intent-based enforcement in algorithm-driven markets in emerging economies

The research composed of many sections progresses from conceptual foundations of algorithmic opacity to examining theories of harm and enforcement challenges. It analyzes evidentiary gaps and legal tools while drawing on comparative regulatory experiences. Finally, the research evaluates Egypt's legal framework to provide policy-oriented recommendations for strengthening enforcement

II. Literature Review

In this section we will discuss how the scholars discussed the opacity as an enforcement challenge in traditional competition law. The ongoing debate regarding the conflict between intellectual property and regulatory transparency. And gaps exist in enforcement tools. In addition to, the Egyptian scholarship.

Algorithmic Opacity as a Fundamental Enforcement Barrier

Algorithmic opacity as a fundamental enforcement challenge that entails a substantial evidence gap, which complicates the formula-

tion of competition policy¹². Machine learning algorithms, which are not traceable, are a fundamental part of algorithmic opacity³. At this point the application of traditional antitrust policies is not adequate in dealing with the emerging algorithmic strategies due to their complexity⁴⁵. According to the literature, algorithmic opacity is not just an inconvenience but a challenge that may lead to the dominance of large corporations. In addition to trade secret laws that may exclude the code from public or regulatory scrutiny. Thus, the principal challenge is the difficulty to identify, investigate, and prove collusion due to the lack of access to the algorithmic mechanisms⁶.

The Conflict Between Intellectual Property and Regulatory Transparency

The discourse, therefore, goes beyond merely recognizing the problem; it entails striking a balance between regulation and the safeguarding of vital business-related information. Competition scholars argue that transparency is not optional. Without transparency it becomes difficult to assess whether a company is promoting innovation or, on the contrary, excluding competition, thus breaching

1 Mark R Patterson, 'Algorithmic Opacity and Exclusion in Antitrust Law' (2018) 5(1) *Italian Antitrust Review* 23 <https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3400208>. accessed 1 September 2026

2 OECD, *Algorithmic Competition* (OECD Competition Policy Roundtable Background Note No 296, OECD Publishing 2023) <<https://doi.org/10.1787/cb3b2075-en>>.

3 Jenna Burrell, 'How the Machine "Thinks": Understanding Opacity in Machine Learning Algorithms' (2016) 3(1) *Big Data & Society* 1 <<https://doi.org/10.1177/2053951715622512>>.

4 Sylvia Lu, 'Algorithmic Opacity, Private Accountability, and Corporate Social Disclosure in the Age of Artificial Intelligence' (2021) 23(1) *Vanderbilt Journal of Entertainment & Technology Law* 99 <<https://scholarship.law.vanderbilt.edu/jetlaw/vol23/iss1/3>>. accessed 1 September 2026

5 Bundeskartellamt and Autorité de la concurrence, *Algorithms and Competition* (2019) <https://www.autoritedelaconcurrence.fr/sites/default/files/2019-11/2019-11-04_algorithms_and_competition.pdf>. accessed 1 September 2026.

6 Matías Valderrama, María Paz Hermosilla and Romina Garrido, *State of the Evidence: Algorithmic Transparency* (Open Government Partnership and GobLab UAI 2023) <<https://www.opengov-partnership.org/wp-content/uploads/2023/05/State-of-the-Evidence-Algorithmic-Transparency.pdf>>. accessed 1 September 2026.

regulations⁷⁸.

However, IP scholars, as well as stakeholders, disagree with this argument. They argue that secrecy is not only permissible but also necessary. Algorithms, especially those related to pricing or ranking, are not mere technical details; they are vital assets that promote competition. The mandatory disclosure of such information may limit innovation, so that restricting competition rather than developing it⁹.

In this regard, there is a challenging task ahead of regulators, which entails striking a balance between rendering the “black box” sufficiently transparent while ensuring confidentiality, thus avoiding the disclosure of vital business-related information. While there is a consensus on the need for transparency, there are no definitive prescriptions in the literature on its actual implementation¹⁰.

The concept of algorithmic transparency remains a debatable issue in scholarly literature. Some scholars regard it as a vital factor in ensuring corporate accountability¹¹. On the other hand, there are arguments that over-transparency may undermine trade secrets, which can potentially hinder innovation¹². The persistence of this debate does not diminish, and it poses certain challenges, especially for those nations that are in the process of developing regulations.

7 Richard Whish, *New Competition Tool: Legal Comparative Study of Existing Competition Tools* (European Commission 2020) <<https://doi.org/10.2763/528171>>.

8 Valderrama and others (n 7) 16.

9 Lucas Costa dos Anjos, ‘Rethinking Algorithmic Explainability Through the Lenses of Intellectual Property and Competition’ in Kostina Prifti, Esra Demir, Julia Krämer, Klaus Heine and Evert Stamhuis (eds), *Digital Governance: Confronting the Challenges Posed by Artificial Intelligence* (Information Technology and Law Series, vol 39, TMC Asser Press 2024) 273 <https://doi.org/10.1007/978-94-6265-639-0_13>.

10 dos Anjos (n 10) 10.

11 Burrell (n 4).

12 Valderrama and others (n 7) 5.

The Gap in Enforcement Tools and Egyptian Scholarship

It has been noted that¹³ the literature on the topic of algorithmic opacity often does not provide precise details, for instance, the authors have found that few scholars have provided specific details on the steps necessary for filling the gap in the proof and have not provided specific details on the implementation, particularly on the balancing of disclosure and the preservation of confidentiality. In addition, have noted that few authors have taken into consideration the possible modifications of the laws due to the introduction of black-box technologies¹⁴.

In the Egyptian literature, the focus of the discussion has been on the implications of parallel pricing and data concentration, the advantages of algorithms, and the expertise required for the application of algorithms. Although regulators noted the difficulties of AI systems, yet few authors have addressed the issue of algorithmic opacity as an enforcement problem. Thus, the regulators have not been provided with the necessary tools and guidelines on how they can obtain the necessary information without breaching confidentiality¹⁵.

The study takes a detailed approach in the analysis of the topic and the provision of the necessary tools for the application of the structured transparency, secure auditing, and the standards of proof for the protection of trade secrets and the actual authority of the Egyptian Competition Authority. The purpose of the study is clear: It is meant for the provision of the necessary tools and instruments for the application of the laws on competition in the Egyptian market.

13 Joshua A Kroll, Joanna Huey, Solon Barocas, Edward W Felten, Joel R Reidenberg, David G Robinson and Harlan Yu, 'Accountable Algorithms' (2017) 165(3) *University of Pennsylvania Law Review* 633 <https://scholarship.law.upenn.edu/penn_law_review/vol165/iss3/3>.

14 Solon Barocas and Andrew D Selbst, 'Big Data's Disparate Impact' (2016) 104 *California Law Review* 671 <<https://doi.org/10.15779/Z38BG31>>.

15 Egyptian Competition Authority, *ECA Research Awards in Competition Policy* (Working Paper No 2025-002, Egyptian Competition Authority 2025) 124 <<https://eca.org.eg/getattachment/db6f5e22-cfc7-4cd0-9f64-0b08da9502e2/الاوراق-البحثية-لعام-2025-الإصدار-الثاني.pdf>> accessed 1 September 2026.

Conceptual Framework: Algorithms, Opacity, and Market Functioning

a) Meaning of Algorithms, Types, and How they Function in the Market

Although it is difficult to precisely identify an algorithm, it is still legitimate to regard it as a precise mathematical object. An algorithm is defined as a definite and sequential plan of executing a task, which may be used in hardware-related operations and software development¹⁶. Algorithms are most commonly procedural instructions, where a process occurs from a given input to a given output through a series of actions. Although it is an easy metaphor to understand, it is a precise conceptual definition of an algorithm, which is commonly used in the literature¹⁷.

Algorithms are developed and used for different purposes and can usefully be classified using the following functional typology¹⁸:

Recommendation. They predict consumer preferences based on behavioral data, they do this by looking at what you have done, they also look at what's popular. Sometimes they use a bit of both.

Allocation. It primarily involves matching between what people want and what's available. This happens quickly, for example, Uber finds a driver for you. Allocation is important because it helps people get what they want when they want it.

Surveillance tools. These tools help to find out if someone is doing something like cheating. These tools can be used to keep an eye on what our competitors doing like with Wiser Solutions or Intelligence Node.

Many algorithms influence how firms compete, but here, the em-

16 Alexander S Gillis, 'What Is an Algorithm?' (TechTarget, 29 July 2024) <https://www.techtarget.com/whatis/definition/algorithm> accessed 1 September 2026.

17 Bundeskartellamt and Autorité de la concurrence (n 6).

18 OECD (n 3) 8–9.

phasis remains on search, recommendation, allocation, monitoring, and pricing. These are the domains that most attract the scrutiny of competition authorities.

b) Algorithmic Opacity and its Sources

It has been noted that the Problems arise in algorithms when it is not possible to clearly articulate the steps taken in order to arrive at a particular outcome. If the reasoning behind input data and outcome cannot be clarified¹⁹. The system is said to be opaque. This is used when the logic in an algorithm is unable to be realized and involved in it left with no other option but to speculate. The users cannot see the in-between process; they only see the input and the output²⁰¹.

The opacity of algorithms is referred to three sources, as follows:

Technical Complexity. Algorithms operate much variables and employ sophisticated mathematical models, making its function unable to be understood even for specialists. Technical complexity is a problem because algorithms, like these are difficult to follow²².

Machine Learning. Machine learning systems keep learning and changing as they go. The path from input, to output gets even harder to figure out²³.

Legal Protections. It has been noted that organizations keep their secrets well protected and outsiders simply do not have access to see how those algorithms actually function. As long as intellectual property law shield code, they obscure evidence of collusion²⁴.

19 Pragma Paudyal and BL William Wong, 'Algorithmic Opacity: Making Algorithmic Processes Transparent through Abstraction Hierarchy' (2018) 62(1) *Proceedings of the Human Factors and Ergonomics Society Annual Meeting* 192 <<https://doi.org/10.1177/1541931218621046>>.

20 Chunhong Guo, Huifang Liu, Fangbai Song and Jingfu Guo, 'The Double-Edged Sword Effects of Algorithmic Opacity: The Self-Determination Theory Perspective' (2025) 260 *Acta Psychologica* 105600 <<https://doi.org/10.1016/j.actpsy.2025.105600>>.

21 Frank Pasquale, *The Black Box Society: The Secret Algorithms That Control Money and Information* (Harvard University Press 2015) <<https://doi.org/10.4159/harvard.9780674736061>>.

22 Valderrama and others (n 7) 3.

23 Lu (n 5) 115.

.Lu (n 5) 116

From Opacity to Competitive Harm: Are Algorithmic Theories of Harm a Result of Algorithmic Opacity?

Algorithms hold a key place in online markets. They make markets more efficient while simultaneously making them operate in ways that are not easily discernible. When it is not clear how raw data is transformed into decisions by algorithms, they operate as black boxes, keeping regulators, competitors, and consumers out of the loop. Such opacity creates black box effect and opens doors for anticompetitive practices that regulators struggle to penetrate²⁵.

Algorithms operate in the background. They collude, preferring and coordinate prices automatically, without human intervention. Detecting this type of conduct is difficult due to the absence of the essential elements of competition laws. Such anticompetitive practices may go unnoticed and unchecked.

Based on the above, the anticompetitive practices that occur by algorithmic systems are linked to algorithmic opacity. Because the operations and processes of these algorithms are very difficult to observe or measured. Opacity creates an environment in which firms can engage in anti-competitive behavior with minimal detection. The relationship between algorithmic anticompetitive practices and opacity highlights the importance of examining how these systems affect markets' outcome. All of these practices are discussed in the following sections.

III. Methodology

This research employs a **qualitative legal methodology** to investigate the intersection of algorithmic opacity and competition law enforcement.

Justification for the Qualitative Approach

This study employs a qualitative approach because the research problem—algorithmic opacity—is complex and multi-dimensional which requiring an interpretive analysis of legal texts, regulatory behavior, and technical concepts. Rather than a purely quantitative or statistical measurement. It is necessary to bridge the world of technical algorithms with the requirements of legal standards of proof. A qualitative analysis of case law and regulatory reports provide the necessary depth to understand the evolving theories of harm. This method allows us to assess whether existing laws truly address the challenges of our digital era.

Suitability of Egypt as a Case Study

Egypt is a compelling case to explore in this research, and it is not for any single reason.

- Digital market in Egypt is growing significantly and has a fundamental role in doing business. Egypt is facing regulatory challenges similar to those faced by any other developing country, and the pressure on the traditional regulatory systems is visible.
- The ECA itself is in the process of a major transformation and wants to take a proactive rather than a reactive role.
- The role of the legal framework is also an important dimension. Law no. 3 of 2005 was not enacted with the digital

economy in mind and almost inapplicable when it has to deal with the complexities it is supposed to address like algorithmic collusion.

Research Approaches

This research relies on four primary qualitative methods. **Doctrinal analysis.** Studying the Egyptian Competition Law and its Executive Regulations to see whether they address and deal with algorithmic conduct.

Comparative legal approach. Review enforcement mechanisms and judicial decisions from the EU, UK and USA to identify practical strategies that Egypt could adopt. The research examines the effective measures that have been observed and implemented within the EU and UK, all the while ensuring that they are contextualized within the unique legal and institutional setting of Egypt.

Technology-informed legal analysis. Aiming to connect the technical aspects—such as how algorithms use reinforcement learning or track prices—with legal definitions of harm.

Problem-oriented and normative approach. Identifying enforcement gaps created by algorithmic opacity and developing context-specific legal and institutional recommendations suited to the Egyptian competition framework.

Limitations of the Methodology

The qualitative method seeks to explore beyond the surface and uncover insights that might not be obtained by using only the numerical data. However, it is also subject to some limitations. **First**, since the algorithms being examined are highly opaque, this research does not provide direct audits of proprietary systems in Egypt. Instead, the analysis relies on legal and theoretical frameworks. **Second**, while the study draws on international examples, the recommendations are designed for Egypt's specific legal and institutional context

Results

Algorithmic Theories of Harm and Enforcement Challenges

It has been noted that algorithmic theories of harm include two behaviors, *coordinated behavior* (algorithmic collusion) and *unilateral behavior* (algorithmic exclusionary and exploitative behavior). this section clearly distinguishes between price algorithms, which can encourage both kinds of behavior²⁶.

Algorithmic Coordinated Conduct (Algorithmic Collusion)

The term “collusion” commonly refers to any form of co-ordination or agreement among competing firms with the objective of raising profits to a higher level than the non-cooperative equilibrium, resulting in a deadweight loss that might harm consumers. The use of algorithmic systems to encourage cooperation and maintain higher prices is covered in this section. There are two types of collusion, explicit and tacit:

Explicit collusion. Refers to anti-competitive conducts that are maintained with explicit agreements, whether they are written or oral. The most direct way for firms to achieve an explicit collusive outcome is to interact directly and agree on the optimal level of price or output.

Tacit collusion. Refers to forms of anti-competitive co-ordination which can be achieved without any need for an explicit agreement, but which competitors are able to maintain by recognizing their mutual interdependence²⁷.

It has been noted that the concerns around algorithmic collusion to encourage cooperation and maintain higher prices fall into three

26 OECD (n 3) 13–15.

27 OECD, *Algorithms and Collusion: Competition Policy in the Digital Age* (OECD Roundtables on Competition Policy Papers No 206, OECD Publishing 2017) 19–20 <<https://doi.org/10.1787/258dcb14-en>>.

categories²⁸.

First, **facilitate explicit coordination**, by making it easier to detect and respond to deviations and reducing the chance of errors or accidental deviations for instance, in the *David Topkins* case, the use of pricing algorithms to implement illegal resale price maintenance demonstrated that software can effectively replace human communication in executing explicit cartels.

Secondly, A **hub and spoke** model may arise if competing companies use the same algorithmic pricing system, which might be the same software or the same third-party provider. However, in *Gibson v. Cendyn Group*, the court specified that, the use of the same software is not enough to impose liability. There must be concrete evidence of a collusive agreement that the shared algorithm helped facilitate.

Sometimes, pricing algorithms independently learn to collude, they don't require anyone to provide extra information, coordinate them, or direct their actions. They simply figure it out on their own constitute a **tacit collusion**. In case like *Air Tours v. European Commission*, courts may presume tacit collusion; However, legal standards remain inadequate for prosecuting autonomous algorithmic coordination.

Algorithmic Unilateral Conduct

This section is organized to discuss all the algorithmic forms, whether they pertain to algorithmic exclusionary or exploitative conduct as follow:

Self-preferencing, in situation where a firm favors its own products or services over those of its competitors, it has been observed that the firm often uses its power to dominate the market. For instance, the

²⁸ Competition and Markets Authority, *Algorithms: How they can reduce competition and harm consumers* (2021) 30–34 <<https://www.gov.uk/government/publications/algorithms-how-they-can-reduce-competition-and-harm-consumers>> accessed 1 September 2026.

Kakao Mobility case, firms were found to be manipulating ranking algorithms to eliminate competitors, regulatory authorities stepped in to impose penalties on them²⁹³⁰.

predatory pricing, it composed of two steps, targeting the achievement of monopoly powers. The first involves the act of *predation*, in which the firm sets prices below the average cost to drive the competing firms out of the market. Once the competition suffers, the firm begins *recoupment*. At this stage, they raise prices to monopoly levels in order to recover all the losses incurred during the price war³¹. The *Qualcomm* case illustrates this, where predatory pricing of chipsets resulted in significant fines, demonstrating how algorithms can be weaponized for market foreclosure³².

Exclusionary Rebates, algorithmic targeting allows dominant firms to combine the coverage of standardized rebates with the precision of personalized ones, this actually can cause a form of anti-competitive foreclosure³³. The *European Commission vs. Intel Corp* case serves as a precedent, where such fidelity rebates were found to foreclose competitors with high efficiency.

Tying and bundling, Tying involves the conditionality of the sale of a particular product on the purchase of a second product, thereby limiting the choice of the consumer. On the other hand, bundling involves the sale of multiple products, often at a discounted rate. The use of algorithms makes these practices more effective by helping firms identify those customers who have a lesser likelihood of switching brands and offering them a bundle of products at a more

29 OECD (n 3) 18.

30 Kate Park, 'Kakao Mobility Hit with \$10.5M Antitrust Fine for Limiting Rivals' Access' (TechCrunch, 17 December 2024) <<https://techcrunch.com/2024/12/17/kakao-mobility-hit-with-10-5m-antitrust-fine-for-limiting-rivals-access/>> accessed 1 September 2026.

31 Christopher R Leslie, 'Predatory Pricing and Recoupment' (2013) 113(7) *Columbia Law Review* 1695, 1695 <<https://columbialawreview.org/content/predatory-pricing-and-recoupment/>> accessed 1 September 2026.

32 Jan Truijens Martinez and Shila Kobakiwal, 'Qualcomm Falls Prey to EU Court's Predatory Pricing Ruling' (Stibbe, 2 October 2024) <<https://www.stibbe.com/publications-and-insights/qualcomm-falls-prey-to-eu-courts-predatory-pricing-ruling>> accessed 1 September 2026.

33 OECD (n 3) 22.

attractive rate than their competitors, without the need for lowering prices for the entire customer base³⁴. A well-known example of tying comes from *Microsoft v. European Commission* case. In 2009, the European Commission took strong action against the company, imposing strict penalties for engaging in tying practices.

Excessive pricing and unfair trading condition, algorithmic exploitation in digital marketplaces can take both monetary and non-monetary forms, which can be interpreted as charging exorbitant non-monetary pricing. Dominant platforms may also impose unfair contractual terms on third-party sellers that impact welfare and transfer value to the platform³⁵.

Price discrimination, Price discrimination is the term used to describe the sale of identical goods to different people at different prices. This may be unfair to certain customers, especially when firms are imposing differential conditions in similar deals. In *CNDC v. YPF* case, it was found by the court that algorithmic price discrimination is abusive practice. The ruling emphasized the unfairness of algorithmic pricing, which offers differential prices to individuals for the same product.

Evidentiary Limitations in Algorithm-Driven Markets

OECD reports highlight that when algorithms function as black boxes, it becomes much more difficult to understand what's actually happening in the market. In situations where it is difficult to establish a direct link between action and outcome it becomes difficult to attribute accountability³⁶.

Difficulty distinguishing lawful parallel conduct from collusion. Algorithms may lead to parallel pricing outcomes without explicit communication, making it difficult to determine whether firms are coordinating or acting independently. So, the parallel practices may

34 OECD (n 3) 22.

35 OECD (n 3) 23.

36 OECD (n 28) 33–42.

be observed but the collusive conduct not be identified³⁷.

Absence of traditional evidence (communication, intent). This led to lack of direct proof under traditional competition law standards; autonomous algorithms do not require human communication to reach coordinated outcomes³⁸.

Trade secrecy and IP protection blocking evidence collection. This includes the inability for authorities to access evidence needed to measure design, intent, or effects. This opacity hinders regulators from examining how decisions are made³⁹.

Lack of access to data and models obstructs evidence gathering. When external stakeholders are denied access to data, validation, or results that are used by algorithms, they are left in a position of epistemic impasse. This means that they cannot determine whether there is a presence of bias, errors, or even tampering⁴⁰.

Complexity and reduces auditability of machine-learning systems. Deep learning models also present challenges to interpretation, even if the inner workings of these models are closely examined. Because of their layered structure and constantly shifting data patterns, it is still difficult to acquire a thorough understanding of what is going on⁴¹.

Institutional capacity and expertise constraints. To Audit these technologies, especially deep learning, there is a need to technical expertise. Currently, most organizations are not in a position to do so, which creates a definitive boundary on how much they can audit these systems⁴².

37 OECD (n 28) 19–20.

38 OECD (n 28) 19.

39 Lu (n 5) 116–117.

40 Sylvia Lu, ‘Data Privacy, Human Rights, and Algorithmic Opacity’ (2022) 110(6) *California Law Review* 2087, 2099 <<https://doi.org/10.15779/Z38804XM07>>.

41 OECD (n 28) 10–11.

42 OECD (n 3) 25.

Effective investigatory powers. Authorities need more effective investigative tools to identify collusion in algorithms, like surprise audits and access to source code and data⁴³. Similarly, improvements in detection tools are also important. This is essential for detecting algorithmic collusion as it happens⁴⁴.

Acceptance of outcome-based evidence. Since the traditional evidence is not sufficient so, enforcement must adapt. It was recognized by China's Supreme People's Court the capability use of circumstantial evidence in these cases accepting the outcome-based evidence to establish liability. This shift in burden of proof demonstrates the practical application of outcome-based evidence⁴⁵.

Audit, disclosure, and documentation obligations (algorithmic transparency)

- **Auditing.** Algorithmic audits involve assessing the output generated by an algorithm and determining whether there are signs of bias and whether there is regulatory compliance. However, it is not always necessary for the authorities to have access to the algorithms, as there are auditing tools that can be employed without having access to the code and data⁴⁶, and sometimes authority may audit with access to data and algorithms.
- **Disclosure.** Disclosure of algorithm means to make information about the operating algorithms and models available and known for the objective of audit, accountability and transparency. In this context, scholars advocate pro-

43 OECD (n 3) 29-30.

44 Bundeskartellamt and Autorité de la concurrence (n 6) 65.

45 Yu Du, 'Burden of Proof in AI-related Trade Secret Disputes: Chinese SPC Practice' (MMLC Group, 29 December 2025) <<https://mmlcgroup.com/china-spc-proof-ai/>> accessed 1 September 2026.

46 OECD (n 3) 28-31.

active disclosure tools⁴⁷⁴⁸, If you want genuine algorithmic transparency, you need more than a single approach. Audits are important. So is thorough, standardized documentation. And clear, understandable disclosures that users can actually make sense of are essential. Depending on just one of these isn't enough⁴⁹.

- **Documentation obligation.** It has been noted that proper documentation should be able to identify human intervention in the development of the system without the disclosure of IP protected trade secrets⁵⁰.
- **Coordination and collaboration.** Due to the rise in the usage of artificial intelligence in almost all industries including competition law. Governments and competition authorities decided that it is important to work together on an international and cross-sector basis to share knowledge, expertise, and practices to ensure that they can effectively regulate risks posed by artificial intelligence⁵¹.

Comparative Enforcement Approaches

This section examines the tools that other countries employ to address algorithmic opacity and the anticompetitive conduct it fosters. In this part, we compare these enforcement mechanisms, highlight their primary areas of focus, and outline the various regulatory strategies.

47 Enrique Bonsón, Michaela Bednárová and David Perea, 'Disclosures about Algorithmic Decision Making in the Corporate Reports of Western European Companies' (2023) 48 *International Journal of Accounting Information Systems* 100596 <<https://doi.org/10.1016/j.accinf.2022.100596>>.

48 Michael W Monterossi, 'Algorithmic Decisions and Transparency: Designing Remedies in View of the Principle of Accountability' (2019) 5(2) *The Italian Law Journal* 711 <<https://hdl.handle.net/2318/1743218>>

49 Valderrama and others (n 7) 12.

50 Valderrama and others (n 7) 5-8.

51 OECD (n 3) 33-34.

Table 1

Comparison of Enforcement Approaches in the EU and UK

Jurisdiction	Legal Instrument	Regulatory Logic	Instrumental Focus	Enforcement Insight
European Union European Commission, 2022 Arts. 6(2), 6(5), 6(8), 13, 15, 17; (Recital 58)	Digital Markets Act (DMA)	Ex ante digital regulation	Firms are not allowed to take advantage of non-public information collected from their business users. Firms are also required to reveal their methods of ranking and advertising algorithms—no more hidden mechanisms	Graduated regulatory access and structural requirements address algorithmic opacity directly. By concentrating on a very clear standard, whether rules were violated
European Union Whish et al., (2020, p. 2)	Market Investigation Tool (proposed)	Forward-looking / preventive	It is no longer a requirement for authorities to present concrete evidence of actual violations. When algorithms guide firms to engage in anti-competitive conduct, regulatory intervention is required	enforcement now examines the construction of systems—this enables authorities to intervene even when coordination via algorithms is suspected but difficult to prove
United Kingdom United Kingdom (Parliament, 2024)	Digital Markets, Competition and Consumers Act (2024) (DMCC)	Hybrid digital competition framework	The goal is to prevent anti-competitive conduct facilitated by algorithms and protect consumers as well as competition	Output-based analysis, supported by the CMA's Data, Technology and Analytics (DaTA) Unit, helps clarify situations, providing real technical expertise (Competition & Markets Authority, 2021, pp. 50-51)

Note. This table compares selected enforcement instruments developed in EU and UK to address algorithmic opacity in digital markets. The focus is on regulatory logic and evidentiary tools rather than substantive competition rules.

The EU, as well as UK, has adopted different approaches to the regulation of algorithmic opacity, which are dissimilar to the Egyptian framework. The following section discusses the regulation of algorithmic opacity within the current framework of competition law in Egypt.

Egyptian Jurisdiction: National Case Study

Legal and Institutional Framework

Law No. 3 of 2005 on protection of competition and the prohibition of monopolistic practices (“ECL”), which seeks to ensure free and fair competition, either through prohibiting anti-competitive agreements, the misuse of a dominant market position, and monopolies⁵².

Executive regulation No. 1316 of 2005 (“ER”), which clarifies the application of rules, identifies important terms such as the applicable market and dominance, in addition to the **ministerial and prime-ministerial decrees (“Ministerial Decrees”)** that target issues in the implementation process, such as economic concentration⁵³.

Egyptian competition authority (“ECA”), which is an independent public entity that falls under the Prime Minister. The ECA in-

52 Law No 3 of 2005 on the Protection of Competition and the Prohibition of Monopolistic Practices (Egypt) <<https://www.wipo.int/wipolex/en/legislation/details/7409>> accessed 1 September 2026.

53 Prime Ministerial Decree No 1316 of 2005 issuing the Executive Regulations of Law No 3 of 2005 on the Protection of Competition and Prohibition of Monopolistic Practices (Egypt) <<https://www.wipo.int/wipolex/en/legislation/details/7410>> accessed 1 September 2026.

investigates any violations, provides advice on policies that refer to competition, and creates awareness to ensure that the law is applied uniformly⁵⁴.

Guidelines and compliance materials (“Explanatory Guidelines”) that assist firms and the public sector in the understanding and application of the rules⁵⁵.

Institutional Enforcement Capacity of the Egyptian Competition Authority

Investigation & inspection. ECA has wide investigation powers includes obtaining evidence, seeking information, as well as conducting searches in line with the law⁵⁶.

Criminal sanctions and judicial enforcement. The ECA may declare any violation of the competition law, then referred to the Public Prosecution, the later may take the case to the Economic Criminal Courts. The Court alone has the power to impose any criminal sanctions; there are many court decisions imposing fines⁵⁷.

Cooperation, coordination and Sectoral interfaces. The ECA collaborates with other sectoral regulators in order to enhance the competition law enforcement efforts. This cooperation has actually been called for in article (11) of the ECL, since many competition issues often raise sectoral concerns in certain regulated industries, the Central Bank and Financial Regulatory Authority collaborate, often adhering closely to the ECA’s framework, to manage aspects

54 ELDIB & CO, ‘Introducing the Egyptian Competition Authority’ (17 May 2021) <<https://eldib.com/introducing-the-egyptian-competition-authority>> accessed 1 September 2026.

55 Egyptian Competition Authority, ‘Guidelines’ <<https://eca.org.eg/en-us/جهاز-حماية-المنافسة>> accessed 1 September 2026.

56 Mourad Greiss, ‘Investigative Powers of the Egyptian Competition Authority: A Guide for Companies in the Egyptian Market’ (2010) 31(11) *European Competition Law Review* 459 <https://papers.ssrn.com/sol3/papers.cfm?abstract_id=1688278> accessed 1 September 2026.

57 Shams Elmallah, ‘The Impact of the Egyptian Competition Law on Price Fixing Agreements and Consumer Welfare in Egypt’ (2021) 26(1) *Coventry Law Journal* 79 <<https://publications.coventry.ac.uk/index.php/clj/article/view/853/913>> accessed 1 September 2026.

of the ECL⁵⁸⁵⁹.

Algorithmic Opacity as a Structural Enforcement Barrier in Egypt

The ECL explicitly mandates demonstrating intent or a definite agreement to establish any violations of Article 6 (abuse of dominance) or Article 4 (restrictive agreements), as a requirement complicated by algorithmic opacity previously defined in section four⁶⁰.

The opacity of algorithms in Egypt is manifested on three major levels, which are problematic.

1. **Difficulty of demonstrating the existence of the agreement.** The provisions of the ECL are broad and have not been supplemented by any specialized instruments specifically address the challenges of the digital era. When the operations of an entity are primarily controlled through an algorithmic system it becomes difficult to make any tangible agreements only data sharing⁶¹.
2. **Proof of intent.** ECA must make a distinction between innovation and anti-competitive behavior. Showing that an algorithm was designed to limit competition, rather than improve efficiency, creates a high burden of proof⁶².
3. **Detection of conduct.** There is an absence of an effective market monitoring system⁶³. The ECA under the

58 United Nations Conference on Trade and Development, *Voluntary Peer Review of Competition Law and Policy of Egypt* (United Nations 2024) 26–31 <https://unctad.org/system/files/official-document/ditcclp2024d1_en.pdf> accessed 1 September 2026.

59 Amr Abbas and Mohamed Samy, 'Competition Litigation Comparative Guide – Egypt' (Mondaq, 8 January 2025) <<https://www.mondaq.com/antitrustcompetition-law/1272336/competition-litigation-comparative-guide>> accessed 1 September 2026

60 Karam Shehat Hassan, 'The Effectiveness of the Competition Protection Law in Facing the Challenges of the Digital Sharing Economy in Egypt' (2025) 37(2) *Journal of Legal and Economic Research* 381, 390–391 <https://journals.ekb.eg/article_456761_39b429eafdec4ad2ab13c7f8fbbf5fd2.pdf> accessed 1 September 2026.

61 OECD (n 3) 15.

62 Hassan (n 61) 389.

63 OECD, 'Recommendation of the Council concerning Effective Action against Hard Core Cartels' (OECD/LEGAL/0452, 2 July 2019) <<https://legalinstruments.oecd.org/en/instruments/>>

ECL is limited to requesting documents and conducting dawn raids on physical premises. Without a specific legal provision to compel algorithmic auditing, the Authority cannot verify if price parallelism is the result of collusion or coincidence.

Illustrative Enforcement Scenarios (Analytical Use Only)

Since there are no direct decisions address algorithmic conduct and how they affect competition framework within Egypt, the below section relies on analogous reasoning drawn from established jurisprudence on pricing and dominance, while employing hypothetical scenarios as a justified analytical tool to assess enforcement challenges arising from algorithmic opacity.

Hub-and-spoke Coordination

Restaurants using the same delivery platform tend to change their prices simultaneously, even without explicit coordination between them. Article 6 of the ECL demands that the regulator identify whether this is actually happening due to the algorithms or if they are simply increasing the efficiency of individual restaurants. This demands empirical assessment by the regulators about the functioning of the algorithms⁶⁴.

Self-preferencing in E-commerce

In Egyptian E-commerce context a scenario arises when large on-line platforms use pricing algorithms to feature their own products as top recommendations for searches. Article 8 of the ECL requires that the regulators identify this phenomenon, but this proves to be quite challenging for them. In most cases, the regulator does not have access to the algorithm but rather has to observe the results and

[OECD-LEGAL-0452](#)>.

64 Competition and Markets Authority (n 29) 31.

identify unfair practices based on this⁶⁵⁶⁶.

Comparative Insights and Transferability Limits

Based on the instruments and enforcement mechanisms examined in the preceding sections, this comparison highlights the key similarities and divergences between the EU, UK, and Egyptian approaches.

Table 2
Comparative Analysis of Enforcement Mechanisms in the EU, UK, and Egypt

Dimension	EU & UK	Egypt
Regulatory Approach to Opacity	Opacity acknowledged as an enforcement obstacle and addressed through adapted evidentiary techniques	Opacity operates as a structural barrier due to reliance on traditional proof standards
Access to Algorithmic Systems	Graduated, safeguarded access through audits, structured disclosure, and technical assessment	No algorithm-specific access mechanisms; investigatory powers lack digital adaptation
Evidentiary Logic	Relying on output data of the market and price algorithms substitutes the lack of internal communication records	Demonstrating agreement and intent remains principal, which opacity makes difficult to establish
Investigatory Tools	Data scraping, algorithmic audits, and systematic monitoring of outcomes	Limited monitoring capacity and absence of algorithm-focused investigative tools
Transferability Insight	Tools are functionally adaptable without requiring full transparency or code disclosure	Requires context-sensitive adaptation rather than direct legal transplantation

Note. The table above presents how the European Union, the United Kingdom, and Egypt deal with the challenge of algorithmic opacity. It focuses on the regulatory tools employed and the type of evidence used, rather than specific rules. It is important to note that this does not reflect an evaluation of the actual practices of Egypt; instead, it is only being used as a framework.

In a comparative analysis of how EU and UK regions deal with al-

65 Competition and Markets Authority (n 29) 25-28.

66 Commission Decision C(2017) 4444 final of 27 June 2017 relating to proceedings under Article 102 TFEU and Article 54 of the EEA Agreement (Case AT.39740 – Google Search (Shopping)) <https://ec.europa.eu/competition/antitrust/cases/dec_docs/39740/39740_14996_3.pdf>.

gorithmic opacity, it is evident that different regions take different approaches. However, there are some challenges associated with applying this approach to Egypt. After the formulation of a new international standard, it is then imperative that the focus be shifted to Egypt. It is essential to examine the compatibility of these approaches with the institutions of Egypt and its capabilities.

Addressing the Barriers of Opacity in Egypt

Having discussed the issue of opacity, difficulties of enforcement and the impact of market forces in Egypt we have to move into practice. The next section introduces some steps that directly follow from all of these insights provided so far. The following policy and enforcement strategies are suggested for the case of Egypt:

Introduce digital-specific legal standards. Egypt could overcome these challenges by modernizing its competition laws and developing clear and transparent regulations in the digital market.

Develop digital and algorithmic expertise. The ECA has to strengthen its enforcement abilities by establishing a specialized digital competition team composed of legal, economic, and technical expertise like many other jurisdictions⁶⁷.

Enhance direct enforcement powers. ECA could be effective in its role by having the powers to impose penalties in the form of fines when there are violations. Minor cases could be dealt with expeditiously by using simpler procedures. This could be effective in terms of efficiency and avoiding delays.

Strike a balance between innovation and competition. However, determining the right balance in promoting innovation and competition is not an easy task. The ECA should carry out an impact assessment to determine whether new business models are promoting

67 Digital Markets, Competition and Consumers Act 2024, c 13 <<https://www.legislation.gov.uk/ukpga/2024/13>>.

or limiting competition.

Improving transparency to better support digital competition enforcement. In order to improve enforcement and increase transparency, it's recommended that Egypt make dominant online platforms more transparent with regard to algorithms and data practices in such a way as to avoid uncovering trade secrets⁶⁸.

IV. Discussion

This section includes the findings of analysis. It focuses on how algorithmic opacity affects the traditional competition practices particularly agreement, intent and causation withing the Egyptian context.

Algorithmic opacity also affects the enforcement of competition law. The difficulty of distinguishing between what constitutes an agreement arises in autonomous algorithm interactions. Where no human coordination exists. It has been noted that⁶⁹ this raises the importance of market results rather than corporate intent. This is both pragmatically and conceptually appealing. However, it also brings with it considerable challenges. The sole emphasis on results can see firms penalized for being efficient. While an emphasis on intent can see such behavior ignored⁷⁰. The difficulty in both cases is that of assessing and dealing with an underlying uncertainty.

The use of an effects-based enforcement strategy is a realistic approach to address the problem of algorithmic opacity, while at the same time creating identifiable risks that need to be evaluated. There is a tangible danger that over-reliance on outcome-based inferences could lead to the penalization of efficient and innovative actions., which could be a barrier to further technological development. The

68 European Commission, 'Overview' (2022) <https://competition-policy.ec.europa.eu/anti-trust-and-cartels/overview_en> accessed 1 September 2026.

69 OECD (n 3) 15.

70 OECD (n 28) 19-32.

use of outcome-based inferences must be accompanied by appropriate safeguards and evidence-based approaches to avoid overreach in the application of the law.

Algorithmic anti-competitive practices may provide short-term gains, but ultimately, they harm consumers. They limit innovation and reduce new entrants to the market. When new firms want to gain entry into the market, these hurdles force them to compete with low odds, resulting in a less dynamic and equitable market. Eventually, the costs are borne by everyone. Over time, this results in unfair prices, manipulated choices, over-collection of data, and over-dependence on dominant firms. Algorithmic opacity constitutes many obstacles in detection and investigation, as it leads to the same result without any human interference.

In this regards there is a crucial question: Are the existing rules of competition strong enough to deal with the new challenges posed by algorithms, or should they be abolished and new rules created from scratch? It has been noted that⁷¹, current competition law already addresses cases where algorithms help humans make explicit collusive agreements. However, when it comes to tacit collusion the law often falls short.

In the context of Egypt, the institutional gap in Egypt—specifically the absence of a unit analogous to the UK's DaTA—prevents the direct adoption of Western models that are present in the European Union and the UK makes it difficult to implement these models in their entirety. The fact of the matter is that digital economies need to be assessed in an empirical context. It is argued that transparency is an essential part of an effective regulatory regime and should not be dismissed as mere rhetoric. Firms should be held accountable for their algorithmic behavior without the need to disclose their trade secrets.

V. Conclusion

Opacity changes the manner in which competition law works, the way to capture violations, assess intent, and allocate responsibility. In countries that face resource challenges like Egypt, the expectation of full transparency or direct evidence is not practicable. Rather, Adjusting the burden of proof is logically and legally sound in this environment. This approach is beneficial for Egypt, as it enables the regulation of digital markets while staying within the bounds of what is legally and institutionally feasible.

The research highlights the key issue, which is the possibility of algorithms being used to facilitate collusion or exclusion, even without the existence of any agreement among companies. The EU and the UK focus more on the actual market impact. They use advanced tools and techniques, and they are highly committed to the development of innovations.

The case of Egypt is a good example of the problem. If the enforcement mechanisms are not aligned with the actual market, then the legal system may be unable to fulfill its purposes. On paper, competition rules in Egypt seem adequate and promise equality of treatment for all forms of technology. However, in practice, it all depends on how individuals interpret these rules and the evidence they use. The manner in which algorithms work is less transparent, and the actual nature of algorithmic wrongdoing cannot be captured properly.

This research also contributes to the global discourse on the use of competition law in a world where algorithms are ubiquitous. Consequently, the legal framework has to evolve beyond simple intent-based systems to address algorithmic opacity. It confirms the need for the objectives of competition law to remain relevant: free market access, consumer protection, and the prevention of abuse. What needs to change is the way we analyze these objectives and prove them.

VI. Recommendations

The recommendations provided below are presented as an integrated policy strategy to address the challenges of algorithmic competition in Egypt.

Legal and Policy Reform

Issue practical guidance on digital markets. ECA should issue guidelines to enlighten on the applicability of antitrust laws to algorithms, hence promoting awareness before the commission of any antitrust law infringement.

Introduce basic documentation requirements. It would be necessary for leading companies operating in the digital world to maintain a system of records, to explain their main algorithms together with their modifications.

Allow faster and more flexible enforcement. The ECA should be accorded limited administrative powers of sanctioning, which will expedite the enforcement process, as the current court process takes a long time.

Strengthen cooperation with data protection authorities. A greater degree of coordination on the part of the data protection authorities may aid in dealing with market power via data.

Institutional Capacity and Awareness

Creating a dedicated digital competition unit. The ECA should also create a specialized unit with expertise in digital markets and algorithms. This specialized unit can be composed of legal experts, economists, and technical and data science experts to support particular cases related to algorithms and AI systems.

Public and Business Awareness. Such an awareness program and

training should not only be implemented within corporate environments but also within judicial environments and legal professionals themselves. Such understanding regarding algorithms may help in avoiding any violation and efficient enforcement.

Collaborate with international regulators as well. To depend on enforcing frameworks developed by UNCITRAL and the OECD for the aim of exchange technical audit tools and expertise between the EU and the UK. Given that many Egyptian platforms already operate globally and are subject to foreign regulation, this step is logical.

Enforcement, Monitoring and Innovation

Use outcome-based evidence more actively. The enforcement should be focused on what is actually happening in the market, scrutinizing the trend of the prices, the impact of the market, and the algorithms. This is what reveals the actual nature of the digital market, as opposed to the intention of the company.

Establish a digital sandbox. where technology companies can securely share their algorithm information with the ECA, maintaining full confidentiality. This approach enables firms to obtain pre-clearance for new pricing models before they are implemented.

Develop simple digital monitoring tools. The ECA must make investments in screening and monitoring systems. Such systems can identify unusual pricing or evidence of coordination among firms.

Encourage innovation through regulatory dialogue. Using Sandboxing and the dialogue between regulators and tech companies are fundamental, as they facilitate innovation through the creation of new business models. in addition to, separating illegal behavior from innovation

References

1. Abbas A, 'Competition Litigation Comparative Guide – Egypt' (Mondaq, 8 January 2025) <https://www.mondaq.com/antitrustcompetition-law/1272336/competition-litigation-comparative-guide>
2. Anjos LCD, 'Rethinking Algorithmic Explainability through the Lenses of Intellectual Property and Competition' in Kostina Prifti, Esra Demir, Julia Krämer, Klaus Heine and Evert Stamhuis (eds), *Digital Governance: Confronting the Challenges Posed by Artificial Intelligence* (Information Technology and Law Series, vol 39, TMC Asser Press 2024) 273–295 https://doi.org/10.1007/978-94-6265-639-0_13
3. Barocas S and Selbst AD, 'Big Data's Disparate Impact' (2016) 104 *California Law Review* 671–732 https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2477899
4. Bonsón E, Bednárová M and Perea D, 'Disclosures about Algorithmic Decision Making in the Corporate Reports of Western European Companies' (2022) 48 *International Journal of Accounting Information Systems* 100596 <https://doi.org/10.1016/j.accinf.2022.100596>
5. Bundeskartellamt and Autorité de la concurrence, *Algorithms and Competition* (2019) <https://www.autoritedela-concurrence.fr/sites/default/files/algorithms-and-competition.pdf>
6. Burrell J, 'How the Machine “Thinks”: Understanding Opacity in Machine Learning Algorithms' (2016) 3(1) *Big Data & Society* 1–12 <https://doi.org/10.1177/2053951715622512>
7. Competition Commission, 'Competition and Anti-competitive Practices' (2015) https://www.compcomm.hk/en/practices/what_is_comp/tying_bundling.html
8. Competition and Markets Authority, *Algorithms: How they can reduce competition and harm consumers* (2021) https://assets.publishing.service.gov.uk/media/60085ff4d3bf7f2aa8d9704c/Algorithms_++.pdf

9. Du Y, 'Burden of Proof in AI-related Trade Secret Disputes: Chinese SPC Practice' (MMLC Group, 29 December 2025) <https://mmlcgroup.com/china-spc-proof-ai/>
10. Eldib & Co, 'Introducing the Egyptian Competition Authority' (2021) <https://eldib.com/introducing-the-egyptian-competition-authority/>
11. Elmallah S, 'View of the Impact of the Egyptian Competition Law on Price Fixing Agreements and Consumer Welfare in Egypt' (2021) <https://publications.coventry.ac.uk/index.php/clj/article/view/853/913>
12. Egyptian Competition Authority, 'Guidelines' (2024) <https://eca.org.eg/en-us/دعوى اوقل الانون اقل/اقتسافان مل-ا-قايامح-زاهج/ةي دأش رال>
13. Egyptian Competition Authority, Aboul-Ella O Jr, Rabie M, El Masry A, Ezzat RA, Al Fiqr NEDM, Hamdy H and Ehab N, *ECA Research Awards in Competition Policy* (Working Paper No 2025–002, Egyptian Competition Authority 2025) <https://eca.org.eg/getattachment/db6f5e22-cfc7-4cd0-9f64-0b08da9502e2/ا-قاروال-ةي ثح بل-ا-م اعل-2025-رادص إل-ا-ي ن اثل>
14. European Commission, 'Overview' (2022) https://competition-policy.ec.europa.eu/antitrust-and-cartels/overview_en
15. European Commission, *Commission Decision of 27 June 2017 Relating to Proceedings under Article 102 of the Treaty on the Functioning of the European Union and Article 54 of the EEA Agreement (AT.39740 – Google Search (Shopping))* https://ec.europa.eu/competition/antitrust/cases/dec_docs/39740/39740_14996_3.pdf
16. Gillis AS, 'What Is an Algorithm?' (TechTarget, 29 July 2024) <https://www.techtarget.com/whatis/definition/algorithm>
17. Greiss M, 'Investigative Powers of the Egyptian Competition Authority: A Guide for Companies in the Egyptian

Market' (2010) https://papers.ssrn.com/sol3/papers.cfm?abstract_id=1688278

18. Guo C, Liu H, Song F and Guo J, 'The Double-Edged Sword Effects of Algorithmic Opacity: The Self-Determination Theory Perspective' (2025) 260 *Acta Psychologica* 105600 <https://doi.org/10.1016/j.actpsy.2025.105600>

19. Hassan K, 'The Effectiveness of the Competition Protection Law in Facing the Challenges of the Digital Sharing Economy in Egypt' (2025) 37(2) *Journal of Legal and Economic Research* 381–386 https://journals.ekb.eg/article_456761_39b429eafdee4ad2ab13c7f8fbbf5fd2.pdf

20. Kroll JA, Barocas S, Felten EW, Venkatasubramanian S, Reidenberg JR, Robinson DG and Yu H, 'Accountable Algorithms' (2017) 165(3) *University of Pennsylvania Law Review* 633–695 https://scholarship.law.upenn.edu/penn_law_review/vol165/iss3/3

21. Leslie CR, 'Predatory Pricing and Recoupment' (2013) 113(7) *Columbia Law Review* 1695–1771 <https://www.law.uci.edu/faculty/full-time/leslie/PredatoryPricing.pdf>

22. Lu S, 'Algorithmic Opacity, Private Accountability, and Corporate Social Disclosure in the Age of Artificial Intelligence' (2021) 23(1) *Vanderbilt Journal of Entertainment & Technology Law* 99–146 <https://scholarship.law.vanderbilt.edu/jetlaw/vol23/iss1/3>

23. Lu S, 'Data Privacy, Human Rights, and Algorithmic Opacity' (2022) 110 *California Law Review* 2087–2089 <https://doi.org/10.15779/Z38804XM07>

24. Martinez JT and Kobakiwal S, 'Qualcomm Falls Prey to EU Court's Predatory Pricing Ruling' (Stibbe, 2 October 2024) <https://www.stibbe.com/publications-and-insights/qualcomm-falls-prey-to-eu-courts-predatory-pricing-ruling>

25. Monterossi M, 'Algorithmic Decisions and Transparency: Designing Remedies in View of the Principle of Accountability' (2019) 5(2) *The Italian Law Journal* 711–733 <https://>

theitalianlawjournal.it/data/uploads/5-italj-2-2019/711-monterossi.pdf

26. OECD, *Algorithms and Collusion: Competition Policy in the Digital Age* (OECD Roundtables on Competition Policy Papers No 206, OECD Publishing 2017) <https://www.oecd.org/competition/algorithms-collusion-competition-policy-in-the-digital-age.htm>

27. OECD, *Algorithmic Competition: OECD Competition Policy Roundtable Background Note* (OECD 2023) <https://www.oecd.org/daf/competition/algorithmic-competition-2023.pdf>

28. OECD, *Legal Instruments* (2019) <https://legalinstruments.oecd.org/en/instruments/OECD-LEGAL-0452>

29. Patterson MR, ‘Algorithmic Opacity and Exclusion in Antitrust Law’ (2018) 5(1) *Italian Antitrust Review* https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3400208

30. Paudyal P and Wong BLW, ‘Algorithmic Opacity: Making Algorithmic Processes Transparent through Abstraction Hierarchy’ (2018) 62(1) *Proceedings of the Human Factors and Ergonomics Society Annual Meeting* 192–196 <https://doi.org/10.1177/1541931218621046>

31. Park K, ‘Kakao Mobility Hit with \$10.5M Antitrust Fine for Limiting Rivals’ Access’ (TechCrunch, 17 December 2024) <https://techcrunch.com/2024/12/17/kakao-mobility-hit-with-10-5m-antitrust-fine-for-limiting-rivals-access/>

32. Pasquale F, *The Black Box Society: The Secret Algorithms That Control Money and Information* (Harvard University Press 2015)

33. United Kingdom Parliament, *Digital Markets, Competition and Consumers Act 2024* (2024 c 13) <https://www.legislation.gov.uk/ukpga/2024/13/data.pdf>

34. United Nations Conference on Trade and Development, *Voluntary Peer Review of Competition Law and Policy: Egypt* (United Nations 2024) <https://unctad.org/system/>

[files/official-document/ditccpl2024d1_en.pdf](#)

35. Valderrama M, Hermosilla MP and Garrido R, *State of the Evidence: Algorithmic Transparency* (2023) <https://www.opengovpartnership.org/wp-content/uploads/2023/05/State-of-the-Evidence-Algorithmic-Transparency.pdf>
36. Whish R, *New Competition Tool: Legal Comparative Study of Existing Competition Tools* (European Commission 2020) <https://doi.org/10.2763/528171>