Organisation for Economic Co-operation and Development

DAF/COMP/WD(2023)61

Unclassified

English - Or. English

2 June 2023

DIRECTORATE FOR FINANCIAL AND ENTERPRISE AFFAIRS
COMPETITION COMMITTEE

Algorithmic competition – Note by Germany

14 June 2023

This document reproduces a written contribution from Germany submitted for Item 5 of the 140th OECD Competition Committee meeting on 14-16 June 2023.

More documents related to this discussion can be found at https://www.oecd.org/competition/algorithmic-competition.htm

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1. Introduction

1. Algorithms provide a wide variety of beneficial opportunities for the economy and society. For example, they can facilitate innovative services, allow for the personalisation of products and services, support the optimisation of inventories and reduce search costs.

2. They may nevertheless have detrimental effects on competition, too. For example, pricing algorithms may affect strategic interactions between companies, ultimately leading to horizontal collusion.

3. This contribution briefly outlines the types of algorithms available (II) and the theories of harm related to the use of algorithms (III) The conceptual considerations in sections II and III are based on the joint paper published together with the Autorité de la Concurrence in 2019.[1] While section IV of this paper addresses the investigation of algorithms and the Bundeskartellamt's practical experiences within its case work, section V discusses whether current competition law is sufficient to address the potential harm caused by algorithms. Section VI presents some closing remarks and concludes the paper.

2. Types of algorithms (and their fields of application)

4. Algorithms can be distinguished in different ways. In the following, the paper will focus on the categorisation of algorithms by the task they perform. The joint paper published by the Bundeskartellamt and the Autorité de la Concurrence offers a more comprehensive categorisation of algorithms, including a classification based on the method of learning and a distinction between different types of machine learning.[2]

2.1. Algorithms used for monitoring and data collection

5. Algorithms can facilitate the collection of various data, such as data related to general market dynamics, competitors (for instance through the use of scraping algorithms[3]) or buyer behaviour or preferences.[4] For example, according to the e-commerce sector inquiry conducted by the European Commission (in the following: Commission) between June 2015 and March 2016, a significant proportion of online retailers used such algorithms to monitor prices set by other sellers.[5] Such monitoring

[1] https://www.bundeskartellamt.de/SharedDocs/Publikation/EN/Berichte/Algorithms_and_Competition_Working-Paper.html

[2] https://www.bundeskartellamt.de/SharedDocs/Publikation/EN/Berichte/Algorithms_and_Competition_Working-Paper.html, Section II.

[3] Scraping is a method for crawling web sites and automatically extracting structured data from them.

[4] See, for instance, ADLC, Opinion no. 18-A-03 of 6 March 2018 on data processing in the online advertising sector (https://www.autoritedelaconcurrence.fr/fr/avis/portant-sur-lexploitation-des-donnees-dans-le-secteur-de-la-publicite-sur-internet), for a discussion on the number and sophistication of algorithms dedicated to the gathering of personal data for advertising purposes.

[5] Final report on the e-commerce sector inquiry, published 10 May 2017, para. 149, available here.

activities seem natural in the context of e-commerce. Moreover, the amount of information on offline offers that is available online appears to be increasing as well, which is also driven by the rise of multi-channel strategies comprising online and offline channels.

2.2. Pricing algorithms

6. Algorithms can also be used for the purpose of dynamic pricing[6], in particular based on a company's own cost, capacity, or demand situation. For example, companies active in the airline industry have been using automated yield management tools for several decades now.[7] While yield management tools can increase company revenues – partly due to optimised pricing – they can also help to manage and allocate inventories or production assets, thereby contributing to a more efficient use of resources.

7. Algorithms may also be used for setting or adapting prices based on other available offers. For instance, online sellers use (re)pricing tools to monitor prices set by other sellers and adapt their own prices following certain predefined rules.

8. In addition, algorithms can also be used to set the prices for goods sold in brick-and-mortar stores, taking into account the prices charged by competitors both offline and online. Moreover, electronic shelf labels used in stores can facilitate dynamic pricing based on the respective store's own cost, capacity or demand situation as well as pricing based on other available offers.[8]

2.3. Personalisation based on consumer data

9. Thanks to various targeting technologies and forecasting models used in combination with consumer data, algorithms can contribute to the personalisation of products and services, in particular ads. One classic example of employing algorithms in such a way are product suggestions based on the consumers' personal interests and previous purchases displayed on many e-commerce sites.[9]

10. Beyond such personalised suggestions, the possible use of personalised pricing strategies or, more generally, algorithm-based price discrimination is also being debated.[10] Such pricing practices can be distinguished from dynamic pricing as the latter refers to

[6] For the OECD, "dynamic pricing involves adjusting prices to changes in demand and supply, often in real time, not implying any kind of discrimination between consumers". OECD, Personalised Pricing in the Digital Era, 2018, p. 9, available here.

[7] In particular, American Airlines implemented an automated overbooking process as early as 1968, see, for instance, Smith/Leimkuhler/Darrow, Yield Management at American Airlines, Interfaces 1992, pp. 8 et seq.

[8] Cf. e.g. Pieters, Albert Heijn to combat food waste with "dynamic discounts", NL Times, 21 May 2019, available here, and XPlace, xplace completes switch to electronic shelf labels at Media Markt and Saturn, press release of 22 February 2017, available here.

[9] See, for instance, Linden/Smith/York, Amazon.com recommendations: Item-to-item collaborative filtering, IEEE Internet computing 2003, pp. 76 et seq.

[10] See, for instance, Borgesius/Poort, Online price discrimination and EU data privacy law, Journal of consumer policy 2017, pp. 347 et seq.; Reinartz/Haucap/Wiegand/Hunold, Preisdifferenzierung und -dispersion im Handel, Ausgewählte Schriften der IFH-Förderer 2017; Office of Fair Trading, Personalised Pricing – Increasing Transparency to Improve Trust, 2013, available here; CMA, Pricing algorithms – Economic working paper on the use of algorithms to facilitate collusion and personalised pricing, 2018, available here; OECD, Algorithms and Collusion, 2017, pp. 1 et seq. , available here.

price variation over time, whereas price discrimination predominantly refers to charging different (groups of) customers different prices at a single point in time. Such price discrimination between customers can have various and ambiguous effects on competition and consumer welfare.

2.4. Ranking algorithms

11. Algorithms can also be used for ranking purposes, including so-called recommender systems. Many services include filtering or ranking algorithms that either create a certain shortlist as a selection of a larger set of items or sort a number of items according to predetermined criteria. Areas of application include comparison websites – e.g. in the area of travel, insurance, financial services, telecommunications and energy[11] – as well as e-commerce platforms[12], app stores[13] and search engines.[14]

12. Furthermore, such algorithms are also a key element of many social media services that include "news feed" functionalities, which require a ranking of all posts that might be shown to the respective user.[15] By matching the ranked items to a user's needs or preferences, ranking algorithms can decrease search costs and hence increase welfare.[16]

2.5. Further fields of application

13. Another field of application of algorithms are matching functionalities. For instance, online dating platforms use algorithms to connect personal profiles to each other by calculating matching scores.[17] Other examples of services heavily relying on matching algorithms include dynamic ridesharing where passengers' ride requests and drivers' ride offers need to be matched at short notice.[18]

14. Many modern auctioning mechanisms also use complex algorithms. For example, in the context of online advertising, auctioning mechanisms were established to award advertising slots to advertisers as early as the late 1990s. Nowadays, companies offering online advertising services, including search engines such as Google, often use elaborate

[11] See, for instance, BKartA, press release of 11 April 2019 regarding the sector inquiry on comparison websites, available here.

[12] https://ec.europa.eu/competition/antitrust/cases1/202310/AT_40703_8990760_1533_5.pdf, paras 36 et seq.

[13] Cf. e.g. Nicas/Collins, How Apple's Apps Topped Rivals in the App Store It Controls, New York Times 2019, available here.

[14] Langville/Meyer, Google's PageRank and beyond: The science of search engine rankings, 2011.

[15] Cf. e.g. Constine, How Instagram's algorithm works, Techcrunch 1 June 2018, available here.

[16] Ursu, The power of rankings: Quantifying the effect of rankings on online consumer search and purchase decisions, Marketing Science 2018, pp. 530 et seq.

[17] BKartA, decision of 22 October 2015, case B6-57/15.

[18] See, for instance, Schreieck/Safetli/Siddiqui/Pflügler/Wiesche/Krcmar, A matching algorithm for dynamic ridesharing, Transportation Research Procedia 2016, pp. 272 et seq. and Chen/Mislove/Wilson, Peeking beneath the hood of Uber, in: ACM, Proceedings of the 2015 Internet Measurement Conference 2015, pp. 495 et seq.

automated real-time mechanisms to auction off and allocate advertising space to advertisers.[19]

15. Algorithms are also used by online price tracking services which monitor product offers and allow consumers to receive alerts when prices drop, supporting them in their decision on when and where to buy. Such services are often offered by online comparison websites. In a similar vein, the German Market Transparency Unit for Fuels receives price data from mineral oil companies and petrol station operators and passes them on to private consumer information service providers. These providers in turn inform consumers about petrol prices, e.g. via the internet, a smartphone or navigation system.[20]

16. Further demand-side applications include automated switching services, e.g. in the energy sector. Some authors also discuss a certain shift of decision-making processes from human consumers to algorithms, which comes with the use of "digital butlers", such as Apple's Siri, Google Assistant and Amazon's Alexa, or of "algorithmic consumers".[21]

17. Similar to the above example of apps listing petrol prices and providing recommendations on when to refuel, algorithms can help consumers compare a large number of offers. Extending on that, they could, at least in theory, automatically accept the best offer on behalf of the consumer, thus saving the consumer some time.

18. Further applications include tools used in B2B contexts, such as automated stock-keeping and order management based on past sales and current inventories.

3. Theories of harm related to the use of algorithms

19. The following section discusses different theories of harm relating to the risks algorithms might pose in different contexts.[22]

3.1. Collusion/Cartels

20. In the following, three scenarios are considered to evaluate algorithms with respect to competition and potential collusion. The legal assessment of the scenarios notably takes into account the fact that Article 101 TFEU and the corresponding domestic provisions only prohibit anticompetitive agreements and concerted practices. In other words, a violation of competition law requires some kind of communication between the companies

[19] Edelman/Ostrovsky/Schwarz, Internet advertising and the generalized second-price auction: Selling billions of dollars worth of keywords, American economic review 2007, pp. 242 et seq.; ADLC, Opinion no. 18-A-03 of 6 March 2018 on data processing in the online advertising sector, available here; BKartA, report for public discussion on sector inquiry into non-search-based online advertising, available here [only in German], executive summary in English available here.

[20] Cf. BKartA, webpage on the Market Transparency Unit for Fuels.

[21] Gal/Elkin-Koren, Algorithmic consumers, Harvard Journal of Law and Technology 2017, pp. 309 et seq. (314, 336). The authors define algorithmic consumers as algorithms that "could automatically identify a need, search for an optimal purchase, and execute the transaction. In the pet food example, a specialized algorithm would collect data from the pet and its food bag to determine whether it is time to replenish the supply and could also consider the actual nutritional needs of the particular pet".

[22] Further explanations, also on the role of algorithms in different collusion phases, are discussed in the above-mentioned joint paper by the Bundeskartellamt and the Autorité de la Concurrence.

concerned. Conversely, companies have the right to adapt their behaviour intelligently to the existing or anticipated conduct of their competitors.

3.1.1. Algorithms as supporters or facilitators of "traditional" anticompetitive practices

21. The first scenario covers situations in which a "traditional" anticompetitive practice resulting from prior contact between humans already exists. The algorithm thus only comes into play in a second step to support or facilitate the implementation, monitoring, enforcement or concealment of the respective anticompetitive practice.

22. Besides supporting or facilitating horizontal collusion, algorithms could also be used in the context of vertical agreements or concerted practices. For example, algorithms could be used to detect deviations from a fixed or minimum resale price or to allow manufacturers to retaliate against retailers not complying with a given price recommendation.

23. The fact that an algorithm is used in such a scenario does not raise specific competition law issues since it can be established that an agreement or concerted practice had already existed, which in general may be assessed under Article 101 TFEU.

24. Nevertheless, although an infringement might be found to exist without further consideration of the algorithm, developing a case-specific understanding of the algorithm might still be advisable, for example as this could make it possible to assess any counteracting efficiencies as well as reinforced negative effects the anticompetitive practice may potentially have.

3.1.2. Algorithm-driven collusion between competitors involving a third party

25. In the second scenario, a third party, e.g. an external consultant or software developer, provides the same algorithm or somehow coordinated algorithms to competitors. The particularity of this situation is that there is no direct communication or contact between the competitors, but a certain degree of alignment could nevertheless arise from the third party's actions.

26. Generally, a distinction could be made between an alignment at the level of the algorithm (code level) and an alignment at the level of input factors (data level). An alignment at code level could arise when a third party not only provides algorithms for the same purpose, for example the calculation of prices, but also uses a similar (or related) methodology to implement this.

27. A specific form of alignment at code level would arise in cases in which strategic decisions are completely delegated to the same third party who takes these decisions using an algorithm. An alignment at data level could involve the competitors using the algorithm as a means for exchanging information or a software supplier causing an alignment of input data by relying on a common data pool for competitors.

28. So far, there is only very limited algorithm-specific case law. Due to the variety of potential situations covered by this scenario, an assessment will always depend on the specificities of each case. Given the ECJ jurisprudence (VM Remonts[23], Eturas[24]), one of

[23] ECJ, VM Remonts v Konkurences padome, judgment of 21 July 2016, case C-542/14.

[24] ECJ, Eturas et al. v Lietuvos Respublikos konkurencijos taryba, judgment of 21 January 2016, case C-74/14.

the central questions in this scenario is whether the competitors are aware of the third party's anticompetitive actions, or could at least reasonably have foreseen them.

29. Potential competition concerns in such situations could, among other things, depend on the content of the algorithmic alignment. For example, an alignment of prices or price parameters at code level will likely constitute a restriction of competition by object. As for an alignment at data level, the established principles for exchanging information apply.

30. In all of these cases, market coverage might be relevant both for assessing competitive concerns and for authorities to exercise their discretion on whether or not to initiate an investigation.

3.1.3. Collusion induced by the parallel use of individual algorithms

31. The algorithms covered by this third scenario are unilaterally designed and implemented, i.e. each company uses a distinct pricing algorithm. There is no prior or ongoing communication or contact between the respective companies' human representatives. Still, the fact that several or even all competitors rely on pricing algorithms might facilitate an alignment of their market behaviour resulting from a mere interaction of computers.

32. Beyond algorithms reaching tacit collusion, the question arises of whether algorithms could engage in behaviour that resembles explicit forms of collusion. So far, however, there has been significant uncertainty as to the nature of potential "algorithmic communication", which is most often discussed in the context of self-learning "black-box" algorithms. A specific form of "algorithmic communication" could be signalling practices, i.e. situations in which algorithms indicate to competitors that they are about to change a relevant parameter of competition, such as the price, in a certain way.

3.2. Market power/abusive conduct

33. Authorities also have to pay close attention to possible relations between algorithms and the market power of companies that use them. First, having access to algorithms could in itself contribute to market power. This becomes all the more relevant as large tech companies in particular are increasingly investing in artificial intelligence, which, from a competitive perspective, might further boost already strong players, potentially reinforcing existing factors of market power like network effects and access to data.

34. In this context, the government memorandum accompanying the 9th amendment to the German Competition Act ("GWB") already acknowledged in 2017 that a company's capability to analyse and process data could potentially be relevant for gaining possible competitive advantages.[25] Consequently, algorithms contributing to market power can be of particular relevance both in merger control[26] and in the context of abusive conduct.

35. Abusive behaviour might also include pricing algorithms. First, authorities could be prompted to investigate potentially excessive pricing, i.e. whether a dominant position has been used in such a way as to reap trading benefits which a firm would not have reaped if there had been normal and sufficiently effective competition.[27] The Bundeskartellamt

[25] Bundestag printed paper 18/10207, p. 51.

[26] For a general discussion on merger control in digital markets, see BKartA, Merger control in the digital age – Challenges and development perspectives, 2022, available here.

[27] ECJ, judgement of 14 February 1978, case C-27/76 (United Brands), para. 249.

conducted such (preliminary) investigations, amongst others, in the 2018 Lufthansa case mentioned below.

36. Furthermore, as pricing algorithms might allow for individual pricing and price discrimination, authorities might have to consider whether such behaviour is abusive. While the use of pricing algorithms for price discrimination might raise consumer concerns, the overall effect of such discrimination could vary on a case-by-case basis. Additionally, even though price discrimination might turn out to require a certain degree of market power, it could also reinforce competition by allowing firms to offer lower prices to customers with a strong preference for another product.[28]

37. Moreover, in a current case, the Bundeskartellamt is examining to what extent Amazon uses algorithmic price control mechanisms that might influence the sellers' freedom to set prices on its Marketplace and whether this behaviour might constitute an abuse of a dominant position or abusive conduct of an undertaking of paramount significance for competition across markets.[29]

38. Ranking algorithms could also prove relevant when investigating potentially abusive behaviour. For example, in the Google Shopping case, the Commission had to consider whether the more favourable ranking and display of Google's own shopping service compared to competing one's constituted abusive behaviour.[30] In its more recent Amazon decision, the Commission accepted commitments that included equal treatment of all sellers when ranking the offers for the purposes of selecting the Buy Box winner.[31]

39. More generally, the German Commission 'Competition Law 4.0' regarded "implicit rules (e.g. those underpinning the ranking algorithms used by a platform)" as a form of platforms setting the rules governing interactions, e.g. in their market places.[32] Subsequently, the German legislator addressed such related behaviour, including self-preferencing, by introducing a provision on "paramount significance for competition across markets" (Section 19a GWB, introduced in early 2021), which in particular covers certain ranking practices, but also other types of detrimental conduct where algorithms might play a role.

4. Investigative approaches

4.1. Investigating algorithms

40. Competition authorities may have to deal with algorithms in a wide range of cases. There may be cases where investigating the inner workings of the algorithm itself is not a necessity from an investigative point of view. This might apply in cases in which an algorithm facilitates a "traditional" cartel and the documents seized during the investigation are sufficient to proof anticompetitive behaviour.

[28] For a more detailed discussion, see ADLC/BKartA, Competition Law and Data, 2016, pp. 21 et seq.

[29] BKartA, press release of 14 November 2022, available here.

[30] Commission, decision of 27 June 2017, case AT.39740 (Google Search (Shopping)).

[31] Commission, decision of 20 December 2022, case AT.40703 (Amazon Buy Box).

[32] Schallbruch et al., A new competition framework for the digital economy ('Competition Law 4.0'), 2019, pp. 16, 51.

41. In other cases, it might be necessary to analyse the inner workings of algorithms. So far, however, there seem to have been only a few cases where such an analysis was conducted.

42. Practical challenges regarding the investigation of algorithms already arise with regard to identifying potential types of evidence that might be used to establish a competition law infringement. The ways to obtain and analyse relevant information pose another challenge.

43. As the role and the function of certain algorithms may be unclear at the beginning of an investigation, authorities might decide that proceeding on a step-by-step basis by issuing successive requests for information is a viable option depending on the respective case.

44. With regard to the relevant information that could potentially be requested, internal documentation could turn out to be particularly important. Besides technical specifications, this also applies to log files, user guides and documentation on data sources, among other things. Depending on the case, authorities might also decide to analyse an algorithm directly. In that situation, a decision on an appropriate method of analysis might particularly have to take into account the extent to which the algorithm in question involves machine learning methods.

45. With regard to potential types of evidence, a distinction can be made between relevant information associated with the role of the algorithm and its context on the one hand, and the functioning of the algorithm on the other hand. For example, as regards the role of the algorithm and its context, information on the algorithm's objective, its implementation and changes over time could be relevant.

46. Authorities might also consider information on the input data used by the algorithm. Finally, it could be helpful to gather information on the output and the decision-making process connected with the algorithm.

47. Once an authority has initiated an investigation, it can draw on its established investigative powers, such as information requests, inspections and interviews, to obtain the necessary information. Depending on the case at hand, information could also be acquired by requesting internal documentation.

48. A more in-depth analysis of the algorithm may yield additional evidence, in particular revealing additional facts relating to how the algorithm works. For such an analysis, different investigative approaches could be envisioned, such as analysing (relevant parts of) the source code in connection with information on the respective environment and interfaces, comparing real (previous) input/output couples, simulating the algorithmic behaviour based on generated inputs or comparing the algorithm to other (more easily interpretable) algorithms and methods.

4.2. Practical experience

49. The Bundeskartellamt has already encountered algorithms in its case practice on several occasions. One example is the 2018 Lufthansa case:[33] In the airline industry, specialised pricing algorithms, often integrated into yield management tools, are commonly used to manage and allocate inventories, contributing to a more efficient use of resources

[33] BKartA, Lufthansa tickets 25-30 per cent more expensive after Air Berlin insolvency, press release of 29 May 2018.

and allowing for pricing decisions to be based on a firm's current capacity as well as demand.

50. In the 2018 case, Lufthansa held a monopoly position on some routes for a few months following the insolvency of the second-largest German airline. During this time, ticket prices were on average 25-30 per cent more expensive than before. The preliminary investigations showed that the airlines specified the parameters relevant for the algorithm to adjust the prices separately for each flight. The airlines also actively changed these framework data and manually entered events unaccounted for by the system.

51. However, it should not be decisive whether prices were adjusted by a pricing algorithm or an employee, because in the end the use of an algorithm naturally does not relieve a company of its responsibility.[34] As the Bundeskartellamt did not initiate formal proceedings in the Lufthansa case due to subsequent market developments, this question of responsibility was, in the end, of no significance for this particular examination and its outcome.

52. Furthermore, the Bundeskartellamt is currently examining to what extent Amazon uses algorithmic price control mechanisms that might influence the sellers' freedom to set prices on its Marketplace. The application of such mechanisms can make it difficult for end customers to find offers by sellers or even lead to these offers being no longer visible at all. Such behaviour could constitute an abuse of a dominant position or abusive conduct of an undertaking of paramount significance for competition across markets.

53. Moreover, the Bundeskartellamt has encountered matching algorithms particularly in the context of merger proceedings[35] and several of its sector inquiries. For example, the sector inquiry into online advertising touches upon "programmatic advertising," which involves algorithms that make it possible to automatically buy and optimise advertising campaigns.[36]

54. In the area of consumer protection, the Bundeskartellamt has dealt with ranking algorithms used by comparison websites.[37] In particular, it has examined the criteria on which pre-selections are based and the way in which comparison websites determine the ranking in the search results lists.

55. Ranking algorithms and their economic effects were also relevant in proceedings concerning hotel platforms.[38] The sector inquiry into online user reviews concluded in 2020 also involved considerations as to the ways in which algorithms support firms when dealing with potentially inauthentic user reviews.[39]

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[34] In a similar vein, Commissioner Vestager has stated that "[…] we need to make it very clear that companies can't escape responsibility for collusion by hiding behind a computer program" (Speech at the 18th Conference on Competition, Berlin, 16 March 2017).

[35] For example, BKartA, Clearance of merger between online dating platforms (B6-57/15), case summary of 31 March 2016.

[36] BKartA, report for public discussion, published 29 August 2022, available here (only in German).

[37] BKartA, sector inquiry into comparison websites, final report published on 11 April 2019, availablehere (only in German).

[38] For example, see BKartA, decision of 20 December 2013, B9-66/10 (HRS-Hotel); BKartA, decision of 22 December 2015, B9-121/13 (Booking.com).

[39] BKartA, final report regarding sector inquiry into online user reviews, published on 6 December 2020, available here (only in German)..

56. Last but not least, it has been suggested in previous literature that competition authorities could develop their own machine-learning algorithms to detect algorithmic collusion.[40] The Bundeskartellamt is pursuing the development of IT-based screening methods and comparable methods and has already put them to use in suitable cases in the context of bid rigging.

57. Even though the established investigative means, such as information requests, inspections and/or interviews, remain the same when obtaining relevant information on algorithms, these practical experiences have contributed to a better understanding of the peculiarities arising in investigations relating to algorithms.[41]

5. Addressing algorithmic harms

58. In the past years, debates about the adequacy of the established toolkit to address algorithmic harms have taken place at different levels. Several circles of experts have published elaborate reports and proposals.[42] At the enforcers' level, agencies continue to work on cases and market studies backed up by conceptual work. Against this background, several legislators around the world have already adapted or are currently considering changes to their respective legal framework.

59. In Germany, the 10th amendment to the German Competition Act (Gesetz gegen Wettbewerbsbeschränkungen – GWB) paved the way for earlier, quicker, and even more effective enforcement. The GWB now includes provisions addressing potentially harmful conduct of undertakings of paramount significance for competition across markets.

60. If the Bundeskartellamt issues a decision declaring a company to be of such significance, it can prohibit certain kinds of behaviour, including self-preferencing, certain types of (cross-market) data processing, and limitations on data portability or interoperability. At least certain types of conduct addressed by these provisions are likely to be connected to the use of algorithms.

61. On the one hand, algorithms could be used as a means to implement abusive practices, for example if an integrated ("hybrid") platform uses a ranking algorithm that favours its own products, possibly in a sophisticated way and as part of a potentially complex business strategy. On the other hand, remedies could also potentially include the use of algorithms, for example when it comes to facilitating data portability or interoperability via appropriate interfaces.

62. One should also bear in mind that digitalisation is transforming the economy on a global scale. As a global phenomenon, it continuously calls for close international

[40] Cf. e.g. Abrantes-Metz/Metz, Can Machine Learning Aid in Cartel Detection?, CPI Antitrust Chronicle July 2018; Huber/Imhof, Machine learning with screens for detecting bid-rigging cartels, International Journal of Industrial Organization 2019, pp. 277 et seq.

[41] For a detailed discussion of the practical challenges encountered when investigating algorithms, see ADLC/BKartA, Algorithms and Competition, 2019, pp. 61 et seq.

[42] See, for example, BRICS Competition Law and Policy Centre, Digital Era Competition, 2019; Crémer/de Montjoye/Schweitzer, Competition policy for the digital era, 2019; Furman et al., Unlocking digital competition, 2019; Schallbruch et al., A new competition framework for the digital economy ('Competition Law 4.0'), 2019; Schweitzer et al., Modernising the law on abuse of market power, 2018.

collaboration and exchange. International organisations such as the G7,[43] the OECD and the ICN work together very well to make the most of their specific strengths. At the European level, the ECN naturally is of particular importance when it comes to communication both between the different national agencies and also vis-à-vis the European Commission. At the same time, bilateral collaboration is also of great importance in the context of conceptual work, but also with regard to enforcement.

63. All in all, even though the digital economy might pose novel challenges, policy makers and enforcers have been making good progress so far. At the same time, it is sensible that they continue to improve their expertise in dealing with the digital economy in close cooperation with one another.

6. Conclusion

64. As digital markets keep evolving, authorities should continue expanding their expertise on algorithms, in exchange with one another as well as by interacting with businesses, academics and other regulatory bodies. Such an effort is in line with the authorities' more general tendency to devote more resources to the challenges posed by the ongoing process of digitalisation.

65. The Bundeskartellamt has already dealt with a certain spectrum of cases involving algorithms. In the situations considered so far, the contemporary legal framework allowed the Bundeskartellamt to sufficiently address competitive concerns relating to algorithms.

66. However, it is still unclear which types of algorithm-related cases competition authorities will have to deal with in the future. Consequently, it is not yet possible to predict whether it will be necessary to reconsider the current legal regime and the methodological toolkit to address potential challenges that algorithms – also including the use of artificial intelligence – might pose, and, if so, what this change will look like.

[43] During the 2022 G7 Joint Competition Policy Makers & Enforcers Summit in Berlin, two documents have been presented: The policy makers inventory of new rules for digital markets and the authorities compendium of approaches to improving competition in digital markets (available here).