

AI Foundation Models: Initial review

Competition and Markets Authority

4 May 2023

Foreword

We are at a pivotal moment in the development of a transformative technology. The speed at which AI models are scaling across uses and markets is unrivalled in economic history. Sustaining this innovation and maximising its potential for people and businesses for the years ahead will require open, competitive markets as well as effective consumer protection. Supporting these economic foundations are at the core of the CMA's role.

Following the UK Government's AI White Paper, we are launching this initial piece of work to help create an early understanding of the market for foundation models and how their use could evolve; what opportunities and risks these scenarios could bring for competition and consumer protection; and what competition and consumer protection principles will therefore best guide the development of these markets going forward. The goal is to help this emergent and rapidly scaling technology develop in ways that result in open, competitive markets that will continue to bring benefits for people, businesses and the economy in the UK.

Artificial Intelligence models are a transformative technology.

Foundation models, including large language models and generative AI, that have emerged over the past five years have the potential to transform much of what people and businesses do across the spectrum of human activity, from searching, to learning, to creating, to how we solve problems across health, engineering, design and education, to name just a few domains. In the process, as with any technology breakthrough, they will disrupt existing markets and create new ones.

We are at a pivotal moment in the development of this technology.

In the past six months, the capabilities and deployment of foundation models have accelerated dramatically. The technology is going mainstream. Thousands of scientists, engineers and researchers are incorporating AI models into products and services spanning search and productivity software to medical research and scientific discovery. Investment by business in this domain is exploding across the world. Start-up activity has grown substantially in recent years while established global leaders in enterprise solutions, search, social media and commerce are also bringing AI functionality into their services. Hundreds of millions of people are already starting to use AI chatbots to search, learn, teach, create, save time, and fulfil tasks more productively.

The best way to help emerging technologies reach their maximum potential for people and businesses is by enabling them to develop in open, competitive markets.

Economic history has taught us that the best way to sustain innovation is through open, competitive markets. We recall the seismic changes brought on by the emergence of the internet, fast internet speeds and smartphones. The combination represented a disruption that brought huge optimism about the democratisation of everything from commerce to the creative arts, accompanied by an explosion in innovation and new companies offering new products and services. We've also seen that without clear pro-competitive conditions and clear consumer protections in place, such periods of dynamism and of 'a thousand flowers blooming' can be followed by increased concentration of market power and consumer dissatisfaction or harm.

In line with Government's AI White Paper and the CMA's role to support open, competitive markets, we are developing an initial view of the competition and consumer protection principles that can best guide the ongoing development of foundation models and their use.

In the White Paper of March 2023, the UK Government asked UK regulators, including the CMA, to think about how the innovative development and deployment of AI can be supported in line with the five overarching principles of: safety, security and robustness; appropriate transparency and explainability; fairness; accountability and governance; and contestability and redress.

Supporting open, competitive markets, protecting consumers and businesses from unfair behaviour, and enabling innovation to thrive are core to the CMA's mandate. We are therefore launching this initial piece of work to help create an early and shared understanding of:

- How the competitive markets for foundation models and their use could evolve;
- What opportunities and risks these scenarios could bring for competition and consumer protection;
- Which principles can best guide the ongoing development of these markets so that the vibrant innovation that has characterised the current emerging phase is sustained, and the resulting benefits continue to flow for people, businesses and the economy.

This focus is also in line with our strategic priority to ensure effective competition in emergent markets as set out in our Annual Plan.

The development of AI has raised several other issues, including safety; security; privacy; intellectual property and copyright; and human rights. These issues are being considered by other regulators and Government. Our work will focus on the questions that the CMA is mandated and best placed to address, namely questions around competition and consumer protection.

Sarah Cardell and Marcus Bokkerink

CEO and Chair of the CMA

Background

1. The CMA is an independent non-ministerial UK Government department and is the UK's principal competition and consumer protection authority. We help people, businesses and the UK economy by promoting competitive markets and tackling unfair behaviour.
2. This review fits with our proposed medium-term priorities and areas of focus, set out in our [draft Annual Plan 2023/24](#), to:
 - (a) enable open access to markets for innovating businesses;
 - (b) help emergent sectors to develop into high growth, innovative and competitive markets; and
 - (c) prioritise sectors that offer the biggest potential for improvement in innovation and productivity.
3. In March 2023, the Government published a white paper setting out its pro-innovation approach to AI regulation¹ which called on regulators, including the CMA, to implement five principles to guide and inform the responsible development of AI.²
4. Also in March 2023, Sir Patrick Vallance, the Government Chief Scientific Adviser, published his report on '[Pro-innovation Regulation of Technologies Review – Digital Technologies](#)', which made a number of recommendations in relation to generative AI. Further, in the [Spring Budget 2023](#), the Chancellor of the Exchequer referred to an [announcement](#) that the government will establish a new government-industry taskforce to advance UK sovereign

¹ [A pro-innovation approach to AI regulation - GOV.UK \(www.gov.uk\)](#)

² The CMA will publish its response to this white paper in due course. The principles are: safety, security and robustness; appropriate transparency and explainability; fairness; accountability and governance; and contestability and redress.

capability in foundation models, including large language models, that has £100 million in initial start-up funding committed.³

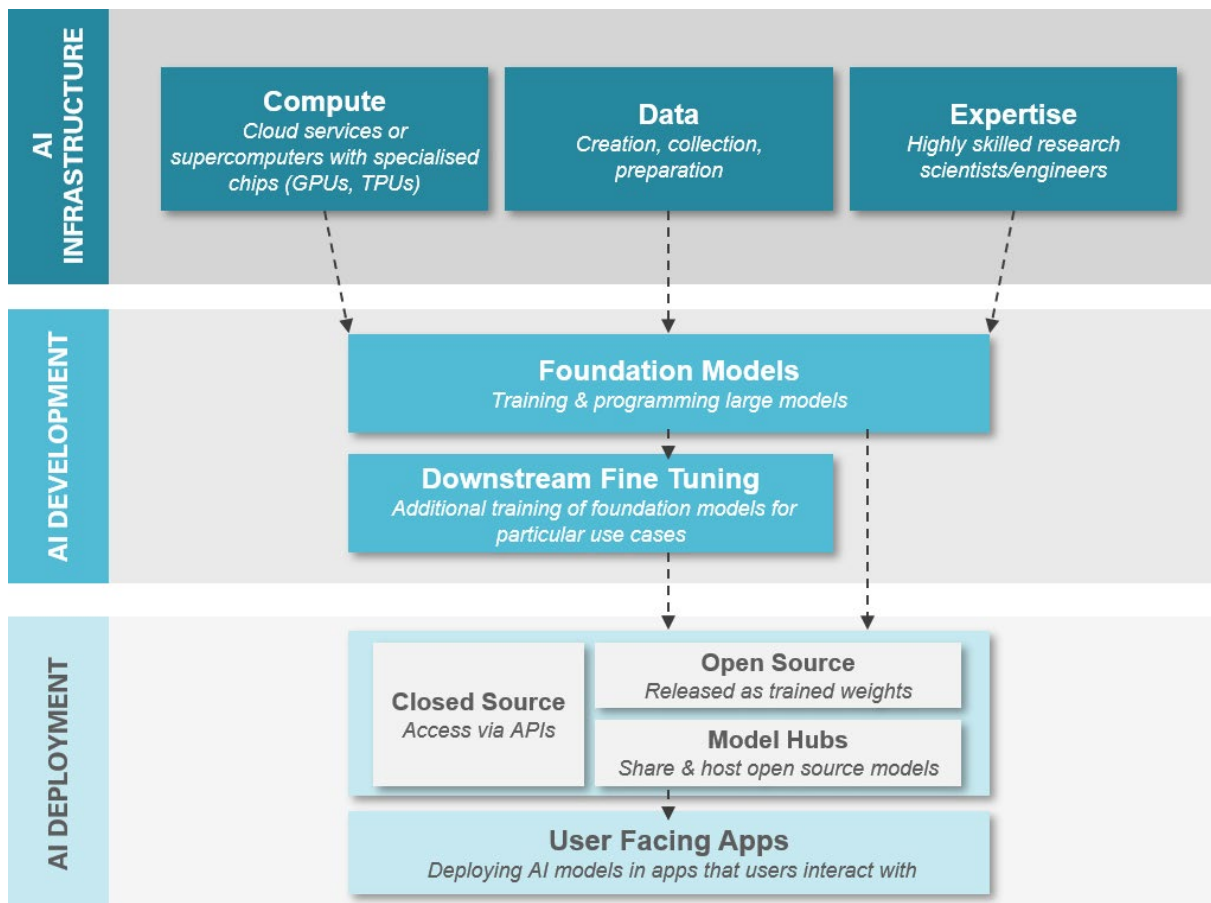
5. The CMA has been engaging with the government on its work in this area, and will continue to do both as the CMA and jointly with our fellow regulators in the Digital Regulation Cooperation Forum (DRCF).
6. This initial review forms part of our response to these developments and helps us prepare to meet the expectation from government that regulators, including the CMA, play their part in supporting innovation in AI that benefits consumers, businesses and the UK. In line with our existing duties and responsibilities, we will focus on questions around competition and consumer protection.

Overview of foundation models

7. Foundation models are a type of AI technology that are trained on vast amounts of data that can be adapted to a wide range of tasks and operations.⁴ Foundation models have many possible applications including chatbots, writing assistant and code writing, and generation of images for artistic or commercial purposes. Whilst they can be used directly by consumers, new products and services that utilise the technology are already being developed by new and existing businesses. Foundation models may also be used by organisations to automate some parts of their processes or workflow.
8. Foundation models were introduced in 2018 in the form of large pre-trained language models, early examples included BERT (by Google) and GPT (by OpenAI). These models are the output of a type of machine learning algorithm called transformers, trained on a large corpus of data (such as text and/or images). During training, the data is broken down into small tokens (for example text data can be broken down into words) and the model learns the probabilistic relationships between each token and every other token in the data it is provided.

³ Initial £100 million for expert taskforce to help UK build and adopt next generation of safe AI - GOV.UK (www.gov.uk).

⁴ Bommasani, R., Hudson, D. A., Adeli, E., Altman, R., Arora, S., von Arx, S., ... & Liang, P. (2021). [On the opportunities and risks of foundation models](#). *arXiv preprint arXiv:2108.07258*.



Source: CMA

9. Recent commercialisations of foundation models include OpenAI’s ChatGPT, Microsoft’s Bing Chat and integrations with 365, Google’s Bard and Anthropic’s Claude. There are also apps, such as Quora’s Poe chat, which make use of several AI labs’ foundation models. Cloud providers such as Google Cloud Platform, Azure and AWS have integrated them as software-as-a-service to developers.

Focus of this initial review

10. In this review, we will focus on the following three themes:
 - (a) **Competition and barriers to entry in the development of foundation models:** This theme will explore how competition currently works in the development of foundation models and whether this might be improved as the sector continues to grow. This includes examining potential barriers to entry e.g. accessing the requisite data, computational resources, talent, funding, and ways in which foundation models could disrupt or reinforce the position of the largest firms, and the distribution of value in these systems. In particular, we will consider the extent to which there are

economies of scale and other characteristics of foundation model development and deployment that would tend towards centralisation, consolidation and integration.

- (b) **The impact foundation models may have on competition in other markets:** Recent developments have confirmed that foundation models are likely to become an input to other markets, like search and productivity software. Many new and existing businesses are innovating and incorporating these capabilities in their products and services. There are a wide range of potential routes to market and business models as firms experiment with different offerings. Products and services using foundation model capabilities may develop into ecosystems which could be more open or closed.⁵

We understand that there are concerns that the market could potentially develop in ways which may give rise to competition concerns. For instance, if access to these models and capabilities become necessary to compete effectively in certain markets, but are restricted unduly or controlled by a few large private companies facing insufficient competitive constraint, this may frustrate competition and innovation that would benefit people, businesses and the economy.

- (c) **Consumer protection:** Foundation models and AI-enhanced products and services could empower consumers and increase their welfare. However, we are also interested in a range of potential risks to consumers arising from the use of foundation models in products and services, including from false and/or misleading information. We will explore the extent to which current practices and incentives in the market are leading to accurate and safe foundation models, that are consistent with businesses' obligations under consumer protection law.

11. Across each of these themes, in addition to refining our understanding of how the market currently works, we will also consider some of the ways it may develop in the near future. This will help inform principles that will best guide the ongoing development of foundation models for the public good.

Areas not in focus

12. The CMA's remit is focused on competition and consumer protection. We help people, businesses and the UK economy by promoting competitive markets and tackling unfair behaviour. There are several important areas which we do

⁵ Autorité de la concurrence and CMA, [The economics of open and closed systems](#), December 2014.

not propose to focus on in our review, as they cover matters that other authorities and/or Government are better placed to address.⁶ These include:

- (a) The opportunities and risks of artificial general intelligence and wider issues of AI alignment, beyond those identified in the section above on consumer protection;
- (b) The potential labour market impacts of foundation models;
- (c) Compliance with the forthcoming online safety regime, in relation to harmful content and misinformation unrelated to a transactional context;
- (d) Compliance with intellectual property laws, and the potential impacts on intellectual property rights holders and the sustainability of publishers and other content creators;
- (e) Compliance with data protection laws and privacy harms;
- (f) Additional investment in public cloud infrastructure or national research clouds, for academic and non-profit research in AI; and
- (g) A detailed assessment of the supply (including the design, manufacture and controlled export) of semiconductors and advanced chips.

Approach to evidence gathering

13. In addition to considering the responses from interested parties to this review, we intend to rely on various sources of evidence to assess the themes we have identified, including:
 - (a) drawing together and evaluating existing research;
 - (b) issuing short information requests to key stakeholders, including academic and industry labs developing foundation models, developers, researchers and academics, suppliers of inputs like compute and data (including leading technology firms), customers, investors, and other industry participants and commentators; and
 - (c) meeting key interested parties through bilateral meetings.
14. This review covers a rapidly developing area, focusing on issues that are relevant to many interested and well-informed parties. As noted above, we will

⁶ For a description of some of the wide range of considerations in the AI regulation under the current regulatory environment, see Part 2 of the Government's [AI regulation white paper](#).

seek views and evidence from stakeholders, including existing research and studies, through meetings and information requests. We also encourage interested parties to be proactive in responding and identifying relevant evidence.

15. Please see Annex A – use of information provided to the CMA – for a description of how the CMA may use information provided to it during the course of this review.

Potential outcomes and next steps

16. The development and deployment of foundation models is developing rapidly. The CMA is conducting this initial review to develop a shared understanding of how the competitive markets for foundation models and their uses could evolve, and set out what principles can best guide the ongoing development of these markets so innovation can continue to flourish.
17. Following evidence gathering and analysis, we will publish a short report which sets out our findings in early September 2023.
18. The CMA will use the findings of this initial review in a number of ways.
 - (a) It will inform the CMA's implementation of the Government's [approach to AI regulation](#), and any recommendations that the CMA may make to the government (including the Office for AI), other regulators (including the DRCF), as well as any guidance to suppliers, developers, businesses and end users.
 - (b) It will enable the CMA to decide whether further consideration of an issue is or is not appropriate, thereby facilitating the efficient and effective use of the resources of the CMA and other persons.
19. The CMA welcomes submissions on the review from interested parties by no later than 2 June 2023.
20. To respond to this invitation to comment, please email your submission to: AIFoundationModels@cma.gov.uk. In providing responses, please provide a description of your background and interests in this area, your name, address, contact information, and an indication of whether you would be happy for us to follow up with you.
21. We do not intend to publish summaries of the evidence that we receive on our website. However, we may include such information in our report. (See Annex A for further details.)

Annex A

Use of information provided to the CMA

- A.1 This annex sets out how the CMA may use information provided to it during the course of this review, in line with our legal responsibilities.

Why is the CMA asking for information?

- A.2 The information you provide will help the CMA to better understand the issues outlined in this document.

What will the CMA do with the information I provide?

- A.3 Your information will inform the report that the CMA intends to publish at the end of this review. This report will set out the CMA's findings.
- A.4 Where appropriate, the CMA may also use information you provide to facilitate the performance of its functions, including the use of its competition or consumer powers, or share your information with another enforcement authority or with another regulator for it to consider whether any action is necessary.
- A.5 The CMA may only publish or share information in specific circumstances set out in legislation (principally Part 9 of the Enterprise Act 2002). In particular, prior to the publication or any such disclosure, the CMA must have regard to (among other considerations) the need for excluding, so far as is practicable:
- (a) any information relating to the private affairs of an individual which might significantly harm the individual's interests; or
 - (b) any commercial information which, if published or shared, the CMA thinks might significantly harm the legitimate business interests of the undertaking to which it relates.
- A.6 The CMA will redact, summarise or aggregate information in published reports where this is appropriate to ensure transparency whilst protecting legitimate consumer or business interests.
- A.7 If you wish to submit information either in writing or verbally that you consider confidential and therefore do not wish us to publish or share, please let us know, with your reasons, when you contact us.**

- A.8 Unless an exemption applies, the CMA may disclose the fact that you have provided information to it, and the information you have provided, in accordance with its obligations under the Freedom of Information Act 2000.
- A.9 Any personal data you provide to us will be handled in accordance with the CMA's obligations under the UK General Data Protection Regulation and the Data Protection Act 2018. The CMA's [personal information charter](#) sets out the standards you can expect from it when it collects, uses or shares personal data and provides details of your rights in relation to that personal data and how to contact it.
- A.10 Further details of the CMA's approach can be found in Transparency and Disclosure: Statement of the CMA's Policy and Approach ([CMA6](#)).