

## Generative AI competition consultation

### 1) What are the main components (i.e., inputs) necessary to build, train, deploy and distribute generative AI systems? Please explain the importance of these components

The main components needed to build and train generative AI systems are included in the so-called AI Triad: a) data, b) algorithms, and c) computing power (compute). They are connected by d) specialized skills and know-how (e.g., methods of model training, evaluation, optimization, research on new capabilities). Frontier generative AI systems now require very significant specialization and amounts of all main four components a-d), accessible only to the largest actors in the field with the most resources.

Deployment and distribution of generative AI systems is on the margin much less resource-intensive than building and training them<sup>1</sup>, however they still require a significant computing infrastructure (cloud, data centres) to be widely deployed and distributed. At the same time, generative AI systems can be integrated into wide range of existing digital products and services, very likely across most of the economy. Even right now they can be readily integrated at multiple points e.g., into Core Platform Services as designated by the DMA.

Owing to this, the fifth input, critical for deployment, distribution and monetization of AI systems is e) the preexisting digital platforms and ecosystems. Thanks to mechanisms such as economies of scale and economies of scope, it is the actors with most resources, with currently the greatest digital market share, which are the best suited to perpetuate their market dominance in AI as well.

### 2) What are the main barriers to entry and expansion for the provision, distribution or integration of generative AI systems and/or components, including AI models? Please indicate to which components they relate.

- a) **Data:** generative AI systems require significant amounts and/or quality of data. To ensure legal certainty and decrease the risk of perpetuating harm, data needs to have a determined intellectual property and privacy rights status and be free from bias and illegal content. Curating data which satisfies above criteria is very costly.
- b) **Algorithms:** The frontier research on AI is increasingly proprietary. At the same time, in distribution of AI components (including, but not limited to algorithms), open-source licences are increasingly often exchanged into restrictive and non-permissible licences by a number of market actors. Notably, there is a significant rise of licences which prohibit commercial use of AI components<sup>2</sup>.
- c) **Computing power (compute):** Building, training, deploying and distributing AI systems, is reliant on cloud computing or in-house computing capabilities (data centres), with

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<sup>1</sup> <https://www.brookings.edu/articles/market-concentration-implications-of-foundation-models-the-invisible-hand-of-chatgpt/>

<sup>2</sup> <https://towardsdatascience.com/the-golden-age-of-open-source-in-ai-is-coming-to-an-end-7fd35a52b786>

estimates of the cost of computing power needed to train frontier models exceeding tens or even hundreds of millions USD<sup>3</sup>.

- d) **Skills and know-how:** There is a significant shortage of AI skills in Europe which is one of the biggest barriers for expansion. In 2023 the Artificial Intelligence Skills Alliance (ARISA), issued a report entitled “AI Skills Needs Analysis”. The report states: “The AI practitioners' roles that are needed most are data scientists, data engineers and especially machine learning engineers including NLP engineers and computer vision engineers”<sup>4</sup>. AI skills are in shortage in Europe as a part of general shortage of ICT specialists, as presented e.g., by 2023 Report on the state of the Digital Decade<sup>5</sup>.
- e) **The preexisting digital platforms and ecosystems:** Owing to low marginal cost of distribution and possibility for deploying generative AI systems very likely across most of the economy, AI can be easily integrated into preexisting digital platforms and ecosystems. This can create a barrier for entry for market actors without such platforms and ecosystems.

Absence of any single aforementioned component makes it infeasible to effectively compete in generative AI. For smaller actors, such as SMEs, but even many larger companies, the choices are currently mostly limited to either joining with the dominant actors or being dependant on their resources (cloud computing, openly released AI models) in order to become a downstream deployer, creating products and services, but with less possibilities to innovate or scale upstream.

### 3) **What are the main drivers of competition (i.e., the elements that make a company a successful player) for the provision, distribution or integration of generative AI systems and/or components, including AI models?**

The inputs outlined above (a-e) can be considered among the main drivers for competition, generally very much harder accessible e.g., to SMEs. Moreover, there are other drivers of competition, such as<sup>6</sup>:

- **Economies of scale:** Deployment and distribution of generative AI systems is on the margin much less resource-intensive than building and training them (building and training require a significant fixed cost as discussed in 1) and 2). Such arrangement

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<sup>3</sup> <https://www.wired.com/story/openai-ceo-sam-altman-the-age-of-giant-ai-models-is-already-over/> Sam Altman, CEO of OpenAI commented at an event held at MIT that training GPT-4 cost over 100 million USD. <https://thefuturesociety.org/wp-content/uploads/2023/12/EU-AI-Act-Compliance-Analysis.pdf> estimates the cost of creating general purpose generative AI model similar to GPT-4 at upwards of 450 million EUR. In both cases the costs of computing power are likely the largest chunk of overall cost.

<sup>4</sup> <https://aiskills.eu/resource/europes-most-needed-ai-skills-and-roles/>

<sup>5</sup> <https://digital-strategy.ec.europa.eu/en/library/2023-report-state-digital-decade>

<sup>6</sup> <https://www.brookings.edu/articles/market-concentration-implications-of-foundation-models-the-invisible-hand-of-chatgpt/>

favours market actors which can distribute and integrate generative AI systems and components at scale i.e. the largest actors with the most resources.

- **Economies of scope:** Generative AI systems can be employed across a wide range of use cases with minor tweaks and fine-tuning, compared to the high fixed costs of building and training generative AI. Therefore, the largest actors will be able to streamline costs and compete in multiple products and services. At the same time, smaller actors, with more narrow focus will not enjoy such advantage.

**4) Which competition issues will likely emerge for the provision, distribution or integration of generative AI systems and/or components, including AI models? Please indicate to which components they relate.**

Because of the barriers described in 2) and competition drivers described in 3) generative AI market will have a tendency towards concentration in the hands of the actors with the most resources. This can lead to competition issues such as:

- Enclosed digital ecosystems and platforms; resulting in lack of interoperability and difficulties for downstream actors to access these ecosystems and offer products and services (similar to how issues arise currently with app stores).
- Self-preferential treatment and bundling of products from vertically integrated platforms.
- Leveraging data collected from current customers (e.g., by using linked services).

**5) How will generative AI systems and/or components, including AI models likely be monetised, and which components will likely capture most of this monetization?**

Likely future avenues of monetization include:

- Generative AI components will be integrated into existing Core Platform Services and other apps and software.
- Interactions with users will be a source of training data and human feedback.
- Interactions with users will be a source of data for advertising and new advertising models will be invented for generative AI systems.
- Generative AI systems will allow for creating custom apps (e.g., customized chatbots), creating monetization models similar to the existing platforms with user created content (e.g., video content).
- Autonomous AI agents and assistants will gain in popularity, creating new avenues for monetization via subscriptions etc.
- Generative AI providers will be selling associated services: training, deployment, fine tuning of AI systems.

- New “AI first” user interfaces and consumer devices will be created. Generative AI systems will extend to cars, robots etc. (e.g., generative AI will provide voice assistant capabilities in cars etc.).
- AI systems will become platforms themselves, serving as a one-stop shop for all digital needs of their users.

In all, it is likely, that user facing applications and plugins will be a significant point of monetization of generative AI systems (but likely not the only one). Monetization will likely happen either directly (subscriptions, consumer devices) or indirectly (collecting user data, advertising, profiting from user generated content) – mimicking the current trends in the digital economy.

**6) Do open-source generative AI systems and/or components, including AI models compete effectively with proprietary AI generative systems and/or components? Please elaborate on your answer.**

Open-source generative AI systems are already significantly influenced by the actors with the most resources who distribute their own models and other AI components as open-source (however, also increasingly switching to restrictive licences, see 2b). This leads to many open-source projects being extensions of the technologies shared by said actors<sup>7 8</sup>. Because of the barriers mentioned in 2) open-source developers have limited options to build and train generative AI models from the ground up<sup>9</sup>. Such dependencies limit the possibility for effective competition with proprietary AI generative systems - especially since open-source developers have limited opportunities to utilize drivers for effective competition (as mentioned in 3) and do not own preexisting digital platforms and ecosystems (these are critical for deployment and distribution of AI systems and components – and will likely remain critical, as described in 5). Currently, open-source developers are already faced with competition issues (such as described in 4) and the situation is likely to persist.

**7) What is the role of data and what are its relevant characteristics for the provision of generative AI systems and/or components, including AI models?**

Generative AI systems require significant amounts and/or quality of data. To ensure legal certainty and decrease the risk of perpetuating harm, data needs to have a determined

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<sup>7</sup> <https://www.technologyreview.com/2023/05/12/1072950/open-source-ai-google-openai-eleuther-meta/>

<sup>8</sup> [https://papers.ssrn.com/sol3/papers.cfm?abstract\\_id=4543807](https://papers.ssrn.com/sol3/papers.cfm?abstract_id=4543807)

<sup>9</sup> The so-called Small Generative AI Models, which require less amounts of computing power and data to be built, trained, and run, can in certain cases approximate the performance of state-of-the-art generative AI systems (not necessarily the frontier systems). However, building and training Small Generative AI Models also requires extensive knowledge of algorithms, specialized skills, and know-how, which again gives advantage in building and training of Small Generative AI Models to the actors with the most resources.

intellectual property and privacy rights status and be free from bias and illegal content. Curating data which satisfies above criteria is very costly.

**8) What is the role of interoperability in the provision of generative AI systems and/or components, including AI models? Is the lack of interoperability between components a risk to effective competition?**

As in the current digital economy, interoperability will remain a central concern for competitiveness in generative AI systems. Lack of interoperability will further entrench the dominant position of the actors with the best access to data, algorithms, computing power, specialized skills and know-how, as well as preexisting digital platforms and ecosystems. Barriers to entry and expansion in AI (as described in 2) already confine a significant number of smaller actors to downstream applications, i.e. creating products and services, but with less possibilities to innovate or scale upstream. Lack of interoperability risks further exacerbating these dynamics by limiting access of downstream developers to the already existing digital platforms and ecosystems, resulting in competition issues as described in 4).

**9) Do the vertically integrated companies, which provide several components along the value chain of generative AI systems (including user facing applications and plug-ins), enjoy an advantage compared to other companies? Please elaborate on your answer.**

Vertically integrated companies are likely to enjoy an advantage compared to other companies. As described in 1)-3) the ability to be competitive in the generative AI market depends on utilizing large amounts of data and computing power, specialized algorithms, skills and know-how, as well as preexisting digital platforms and ecosystems – in order to take advantage of economies of scale and economies of scope. Vertical integration makes it easier to acquire all these resources and scale more effectively, especially given the fact that user facing applications and plugins will likely be a significant point of monetization of generative AI systems (as discussed in 5). Moreover, vertical integration opens the possibility engage in self-preferential treatment, bundling products and leveraging data collected from current customers (e.g., by using linked services), which are harming the competitiveness of other market actors (as discussed in 4).

At the same time, smaller actors, such as SMEs are unlikely to be able to perform significant vertical integration of the AI supply chain. Therefore, vertical integration is once again a business strategy which can be mainly utilized by the actors with the most resources - such asymmetry risks to exacerbate concentration in the digital and AI markets, with negative consequences for creating a competitive environment.

**10) What is the rationale of the investments and/or acquisitions of large companies in small providers of generative AI systems and/or components, including AI models? How will they affect competition?**

Investments and/or acquisitions are one of the ways of sourcing hard to find inputs needed for building and training generative AI systems - as discussed in 1) and 2). Since the actors with the most resources operate both upstream and downstream in the AI value chain (both as developers and deployers of the technology), they have the means to integrate acquired companies across multiple points in the AI value chain (leading to multiple benefits), as well as sign exclusivity contracts and exchange information critical from the point of view of competitiveness<sup>10</sup>.

At the same time acquisitions should not be viewed as the only possible way to utilize innovation potential of SMEs and start-ups. Dynamic and competitive markets are able to make innovative SMEs and start-ups grow - for example by increasing their access to growth capital. Furthermore, institutions could support the creation of business as well as public partnerships. These tools are key to bringing structural support to SMEs and start-ups and fostering the innovative potential of the EU's industrial base.

**11) Do you expect the emergence of generative AI systems and/or components, including AI models to trigger the need to adapt EU legal antitrust concepts?**

(this answer intentionally left blank)

**12) Do you expect the emergence of generative AI systems to trigger the need to adapt EU antitrust investigation tools and practices?**

**Creating new tools to investigate collaborations:** due to propensity of the AI market to undergo concentration, companies will be more likely to collaborate with one another. This opens the need to investigate such collaborations to ensure they serve the EU AI ecosystem and do not create anticompetitive dynamics.

**Designating new Core Platform Services:** relevant EU authorities ought to investigate adding gatekeepers in cloud computing, and AI (foundational models) under DMA.

At the same time EU should **promote creation of “digital commons”** (e.g., AI models, AI components, data, computing power, know-how etc.) to democratize access to the AI market and take down barriers to entry and expansion (such as outlined in 2).

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<sup>10</sup> <https://www.digitalsme.eu/digital/uploads/DIGITAL-SME-Letter-on-OpenAI-Microsoft.pdf>