



## Competition in Virtual Worlds and Generative AI

### Calls for contributions

Digital markets have become one of the main areas of attention for competition law enforcers, as well as for regulatory authorities and legislators, in recent years, as European citizens increasingly build their daily lives around digital products and services.

The concept of “metaverse” or “Virtual Worlds” has come to the fore as a term to describe the next stage in this digital transformation. A “Virtual World” seems to be widely regarded as a simulated, immersive environment – in its ultimate form amounting to a persistent, always-on world that operates in real time and is accessible everywhere. In these Virtual Worlds, people would also be represented in digital form, often referred to as an “avatar”. However, there are many different views on the future shape of Virtual Worlds, including whether there will be a single Virtual World platform or, rather, a collection of multiple Virtual Worlds.

On 11 July 2023 the Commission published a [Communication on Virtual Worlds and Web 4.0](#), setting out a vision, strategy and proposed actions to lay the foundations for the long-term transition towards Web 4.0 and the development of Virtual Worlds.

The concept of generative artificial intelligence (“Generative AI”) has equally attracted considerable public interest. A generative AI system is an AI system that is able to produce new content, such as texts, images or other media.

The EU’s approach to artificial intelligence centers on excellence and trust, aiming to boost research and industrial capacity while ensuring safety and fundamental rights. In April 2021, the Commission presented its AI package, including [its Communication on fostering a European approach to AI](#), a [review of the Coordinated Plan on AI](#) and its [proposal for a regulation laying down harmonised rules on AI \(AI Act\)](#). On 9 December 2023, the European Parliament and the Council achieved a political agreement on the AI Act.

While Virtual Worlds and generative AI systems are still taking shape, it has become clear that the potential impacts of this new phase of digital transformation could be wide-ranging with new technologies, business models and markets.

It has become clear in the past that digital markets can be fast moving and innovative, but they may also present certain characteristics (network effects, lack of multi-homing, “tipping”), which can result in entrenched market positions and potential harmful competition behaviour that is difficult to address afterwards.

Therefore, it appears opportune for the Commission as a competition law enforcer to engage in a forward-looking analysis of technology and market trends to identify potential competition issues that may arise in these fields.

The Communication and accompanying staff working document on Virtual Worlds and Web 4.0 already identify the main characteristics of Virtual Worlds platforms, enabling technologies, and services based on Virtual Worlds.

The purpose of these calls for contributions is to gather specific information and views in relation to competition aspects from regulatory experts, academia, industry and consumer organisations. The Commission may organise a workshop with relevant stakeholders to discuss these issues further building on the responses to the consultation.

Contributors are invited to submit their input either on the topic of Virtual Worlds or generative AI systems, or both, with a clear focus on competition. As input to the debate, please consider the two lists below, which contain questions separately for Virtual Worlds and Generative AI. These questions are for orientation only, and you are free to choose on what aspects of the chosen topic(s) you may wish to focus.

In case your contribution exceeds 20 pages, please add an executive summary. Please send your respective contributions to [COMP-VIRTUAL-WORLDS@ec.europa.eu](mailto:COMP-VIRTUAL-WORLDS@ec.europa.eu) and [COMP- GENERATIVE-AI@ec.europa.eu](mailto:COMP-GENERATIVE-AI@ec.europa.eu) by 11 March 2024 in pdf format.

In your cover e-mail, please provide the registered name and address of the undertaking on behalf of which you are replying to the call(s) for contribution. Please also indicate the name, position, e-mail address and telephone number of a contact person. If you or your company wishes to remain anonymous, please also indicate this clearly in your cover e-mail.

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Please note that the Commission plans to publish all relevant contributions received on the Commission's website(s). By submitting a non-confidential version or by submitting only a single version which is not clearly marked as confidential, you authorise the Commission to publish your contribution. The Commission does not assume liability for publishing confidential information or personal data which was not properly removed from your contribution.

## Generative AI

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

Answer:

These are data, computing capacity and infrastructures, and technical expertise.

- Data are needed at both stages of training: (i) for the pre-training, where data is used to build the GenAI Model's knowledge; and (ii) for further fine-tuning, where the GenAI Model's accuracy is improved through dedicated (e.g. domain specific) training. Important factors are availability and quality of data.
- Significant computing capacity and infrastructure is required to train GenAI Models.
  - Because of the size of the models and the amount of data used to train the model, GenAI Models require a very powerful compute capacity and infrastructure which in turn means that the underlying data centers need to be equipped with a significant number of so-called AI accelerator chips (such as e.g. Graphic Processing Units – “GPUs”)
  - These high-performance data centers with the corresponding compute capacity normally are provided by large cloud infrastructure providers. Alternatives are privately and publicly owned supercomputers that are also emerging (e.g. the supercomputing center of the French National Center for Scientific Research, and Leonardo, a high-performance computing cluster based in Italy which is open and available free of charge for industrial and scientific computing).
- Technical expertise: GenAI development requires a combination of talent and technical expertise. This includes data scientists and engineers, machine learning skills, programming, mathematics, and statistics and last but not least domain know of the customer/industry environment of the application. The skills and expertise needed may vary depending on the type and complexity of the AI model.

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.

Answer:

We do not see major barriers to entry for the time being. The factors below are of general importance in the industry:

- AI accelerator chips and compute capacity are important input factors. We believe there is sufficient capacity available. AI accelerator chips is a field of increasing competition where several FM developers are currently designing and developing their own AI accelerator chips or have supported other silicon suppliers to enter the market. On the compute capacity level amongst others well-established cloud providers compete in this segment. This could be complemented by funding and infrastructure building activities for public supercomputers to foster a competitive pan-European AI ecosystem even further. For all players in this industry, including SMEs, a trustworthy and reliable infrastructure for computing capacity is important for fostering a dynamic landscape in Europe.
- For the downstream layer of GenAI models and applications, development and supply are still

at an early stage but there has been increasing and strong competition and the number and diversity of players in the generative AI space, including many start-ups, evidence the fact that, thus-far, there are no significant barriers to entry or expansion. The pool of FM developers is increasing, with a large variety of end products. The availability of FMs through APIs and open-source licenses should further enable new entrants to enter, scale quickly and finetune domain-specific FM based on data with a specific scope.

- Cooperation between companies with a complementary knowledge will be important in this industry – be it in (digital) ecosystems, be it in partnerships or other forms of cooperation. This will ensure and further enhance competition in this field.

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?

Answer:

- Customer demand is one of the main drivers for competition. E.g. the downstream application layer encompasses applications that incorporate FMs where a variety of players is already active now. We believe that even more offerings will be developed with increasing customer demand.
- In addition, access to design and provision of AI accelerator chips, to computing and cloud infrastructure and/or services and access to the required amount of reliable, unbiased (domain-specific) data sources to train GenAI models.
- Today, in addition to commercial offerings, there are already publicly owned supercomputers, as well as EU-level efforts to make European supercomputers available to innovative European AI start-ups to train their GenAI models (e.g. the launch of the European Commission's AI innovation package to support AI start-ups and SMEs in January 2024). These funding and infrastructure building activities support the development of a competitive pan-European AI ecosystem.

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.

Answer:

- Overall, we see generative AI as a huge opportunity for European companies to foster their competitiveness and to compete effectively in the global economy.
- It is difficult as of today, to already make predictions on what kind of competition issue may emerge in this fast-evolving field but currently we don't see any competition issues.

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?

Answer:

- We expect that monetization will occur on every level along the GenAI value chain.

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.

Answer:

- Many GenAI developers are building upon open-source models to create their own customized downstream foundation model-based services.
- Additionally, developers can use existing foundation model applications to build use-case-specific applications on top of existing foundation model-based services.

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?

Answer:

- See our remarks related to data under questions 1 and 3

8) What is the role of interoperability in the provision of generative AI systems and/or components, including AI models?

Answer:

- Currently, we don't see an interoperability issue but we strongly believe that interoperability will be a key success factor for FM and application development.

Is the lack of interoperability between components a risk to effective competition?

Answer:

- Currently, we are not aware of interoperability issues.

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.

Answer:

- Each component of the GenAI stack (see answers to Q3) plays an important role in the seamless development, deployment, and optimization of AI systems. To our knowledge, there is hardly any player covering the whole AI stack including customer-facing AI applications, and no company controls all these components. Most are or will be based on complementary knowledge via new forms of partnerships and (digital) ecosystems enabling them to be competitive in the industry.

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?

Answer:

- The investments of, and partnerships with, small providers enable them to develop, train and commercialize their products and services much faster, thereby driving competition and creating customer benefits and efficiencies.
- Similarly, the general-purpose nature of GenAI technology means that it is optimal for start-ups' technology to be built upon by third parties using open APIs. Third parties can combine the underlying FMs with their own expertise in, for example, product development. This complementarity is likely to increase incentives to innovate.

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?

Answer:

- We do not see a need to adapt the current EU legal antitrust concepts. We believe the current antitrust rules as recently complemented by the DMA are sufficiently flexible and adaptable to effectively ensure competition in the market.
- Competition law is not the suitable tool to address wider societal or ethical concerns that may arise from the use of generative AI, such as misleading or biased content, intellectual property rights, or democratic values – this is a task e.g. for the upcoming AI Act. A clear and not overregulating framework would also support European competitiveness.
- On the contrary, restrictive rules would be more likely to hinder development and have a chilling effect on innovation and European competitiveness. The generative AI business with its high dynamism and innovative strength should be kept open and not unnecessarily limited by restrictive rules.
- Finally, we encourage the Commission to foster dialogue and cooperation with other jurisdictions and international organizations to ensure a coherent and consistent global framework for generative AI that supports innovation and competition, while respecting human rights and fundamental values.

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

Answer:

- In line with the above, from our perspective, there is also no need for the adaption of additional EU antitrust investigation tools and practices. The current competition law rules grant the European Commission far-reaching investigation powers.
- We believe the EU antitrust investigation tools and practices are fully sufficient to ensure competition in a highly innovative, dynamic, and competitive market environment of generative AI.

Please send your contributions to [COMP-GENERATIVE-AI@ec.europa.eu](mailto:COMP-GENERATIVE-AI@ec.europa.eu) by 11 March 2024