Arcep's contribution to the call for contributions on competition in generative AI

March 2024

Generative artificial intelligence ("generative AI") could play a pivotal role for many sectors of the economy and raises both social and economic question. Until now, most attention has been focused on generative AI from the perspectives of personal data protection and the risks associated with certain uses of such technology. However, generative AI raises many other issues. Therefore, **Arcep (France's Electronic Communications, Postal and Print media distribution Regulatory Authority) warmly welcomes the launch of a call for contributions by the European Commission to identify competition challenges in the field of generative AI**. In response to this call for contributions, Arcep aims to share preliminary considerations related to competition matters but also regarding potential impacts on the openness of the internet and environmental challenges.

Generative AI systems create new content – including text, image, audio, and video – based on their training data and in response to prompts[1]. Generative AI relies on foundation models, which are large-scale AI models trained on vast amounts of data and that can be adapted to a wide range of use cases. Foundation models are used to build generative AI products, such as chatbots or co-pilots. Access to key inputs, such as computing power, data and technical expertise, is required to build foundation models.

Generative AI is an emerging technology which has seen an exceptionally fast uptake. In just 2 months, ChatGPT has attracted over 100 million unique users – by comparison, it took TikTok 9 months and Instagram 2.5 years to reach a comparable number of users. On the corporate side, a study commissioned by Amazon suggests that a third of European businesses used AI in 2023, up from just a quarter in 2022**.**

Generative AI is a versatile technology that has the potential to impact multiple industries and consumer behaviour. Its potential applications are vast and far-reaching. This type of artificial intelligence is expected to offer significant opportunities, from both an economic and societal perspective. It could also raise competition concerns, in particular with regard to its reliance on data and cloud services. **It is therefore important to consider what is the most appropriate industrial and competitive strategy for European companies to embrace and benefit from generative AI.**

In order to reap the benefits of generative AI, it is important to assess the potential impact of this technology on end-user's choice, while it is still in the early stages of market adoption. Generative AI is becoming a new gateway to access to internet content and services: this trend if confirmed could have implications on **internet openness,** which designates the right of users to access and share the content of their choice on the internet. As the Commission noted in relation to virtual worlds, the development of generative AI, if left uncoordinated and unregulated, could lead to '*a more closed ecosystem with the prevalence of proprietary systems and gatekeepers*'[2].

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[1] https://www.oecd-ilibrary.org/science-and-technology/initial-policy-considerations-for-generative-artificial-intelligence_fae2d1e6-en

[2] DG CONNECT, "An EU initiative on virtual worlds: a head start towards the next technological transition", Call for evidence, Ares (2023)2474961, 05.04.2023.

Furthermore, the rise of products and services based on generative AI comes with a fundamental challenge: the introduction of these technologies will almost certainly increase the environmental impact of digital ecosystems, particularly energy consumption. It is therefore necessary to assess this impact and take appropriate mitigation measures to ensure that the European Union's sustainability goals are met, in particular the 'Fit for 55' targets, which imply a reduction of greenhouse gas emissions by at least 55% between 1990 and 2030. European Union should also ensure a level playing field regarding those environmental issues.

In addition to the issues covered by the AI Act, the European Union should strive to promote sustainable, competitive, and open markets for generative AI for the benefit of the European economy and society.

1   The importance of a competitive and open market in ensuring innovation

The development of a competitive and open market for generative AI is essential to foster competitiveness and innovation in industries and services. However, some competition concerns might arise from the dependence of generative AI on data and cloud providers. One of the issues is to see whether the forthcoming regulation (DMA and Data act) can address this, while considering the innovation dimension.

1.1   Competition concerns regarding generative AI markets

1.1.1   A momentum that will shape the future competitive dynamics of generative AI and of digital services in general

There is a need to ensure that generative AI markets become and remain competitive, especially as many digital services are likely to integrate generative AI. In just a few months, generative AI-powered chatbots and services, have scaled across industries and reached hundreds of millions of regular users. Recent reports (French Competition Authority - ADLC; CMA; Portuguese Competition Authority) highlight that the current race to innovate and develop AI-based services is driving the emergence of multiple players and creating a momentum that will shape the future competitive dynamics of generative AI. At the same time, generative AI is likely to transform 'traditional' markets and services, which will incorporate generative AI features.

Arcep believes that the evolution of the competitive dynamics of generative AI will be largely shaped by the competitive conditions in the digital sector as a whole, in a context where the incumbent digital players have several advantages and market power, in particular regarding resources such as cloud computing services and data, which are crucial to the development of generative AI.

1.1.2   Generative AI dependency on cloud services and data can entail risks of market power leverage

The use of market power to ensure the dominance of one's specific digital ecosystem has already occurred in the past, so it is important to mitigate these risks. Given the dependence of generative AI on cloud computing, it will be important to monitor such markets and intervene where necessary. Computing power is essential for building, training and fine-tuning AI models but also for using generative AI-powered services. Most foundation models and generative AI vendors cannot afford to have their own computing infrastructure due to the massive investment required. They therefore rely on cloud providers that offer scalable and flexible computing resources to develop their AI products and models. **Therefore, competitive conditions in the cloud services market can affect the competitive situation in the generative AI market**.

The cloud market is currently concentrated around three major players (Amazon Web Services, Azure and Google Cloud Platform), especially for IaaS and PaaS[3] products. Technological and financial barriers to switching between providers and to multi-cloud negatively affect the competitive dynamics of the cloud computing market, which in turn could affect the market dynamics of the generative AI segment. In addition, large cloud providers are also direct suppliers of generative AI models and services. As a result, they could use their market power in the cloud industry, as well as in adjacent markets, to strengthen their position in the generative AI market, either by using competitive advantages derived from the provision of essential inputs (cloud services) or by engaging in anticompetitive practices (such as tying, bundling, self-preferencing, discriminatory terms) to strengthen their own digital ecosystem(s).

Moreover, data is also a key input for the development of generative AI models. Access to a large amount of data is essential when building an AI model. The characteristics – and quality – of the data used have a direct impact on the performance of the model and therefore on its competitiveness. Given the significant use already made of public data, the use of private data to improve models and develop competitive services and products may increase in the future. In this regard, Big Tech companies may benefit from their activities in adjacent digital markets where they collect data from end-users and business users, thereby strengthening their competitive advantage.

Forthcoming legislations – such as the Data Act and the Digital Markets Act (DMA) – will play an important role in shaping the regulatory environment for generative AI, as they can mitigate structural competitive advantages by creating a new framework to reduce barriers to entry for these essential inputs and foster innovation in AI-driven services. The DMA could address these concerns through data portability and access requirements.

Finally, the technical expertise is another essential input in the design of foundation models, from which generative AI services are built. For the development of these models, a significant engineering workforce with highly specific skills is required. However, new entrants face challenges in recruiting and retaining the necessary workforce, due to the scarcity of profiles and the highly attractive compensation packages offered by large companies.

As the demand for generative AI grows, it seems crucial to ensure that the key inputs of generative AI (cloud, data, technical expertise) remain accessible and that barriers to market entry are avoided.

1.2 To encourage innovation, openness of generative AI related services provided by cloud service providers could be promoted and ensured

Generative AI-related services offered by cloud service providers (CSPs) could make it easier for customers to adopt AI products. Cloud service providers (CSPs) are essential intermediaries for access to generative AI-related services. On the one hand, through partnerships with generative AI model developers such as OpenAI or Mistral AI, major CSPs offer highly managed and ready-to-use AI services (AI as a service - AIaaS) integrated into their cloud ecosystems. On the other hand, all major CSPs offer proprietary AI development platforms (PaaS) that facilitate the development and integration of generative AI products.

From a customer perspective, these types of cloud services can reduce product development and deployment time, thereby accelerating the time-to-market of new or customised AI products. Partnerships with AI model developers could lead to exclusive benefits for the use of corresponding models in the CSP's ecosystem. **However, the use of these solutions could lead to an excessive dependency on the CSP's services** and carry a risk of locking customers into the CSP's ecosystem, as

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[3] IaaS: infrastructure as a service. PaaS: platform as a service.

the use of AIaaS or generative AI PaaS is often combined with services such as proprietary data warehouses, cloud-specific software development kits (SDKs) and DevOps solutions.

The European Regulation on harmonised rules on fair access to and use of data (**Data Act**), which entered into force on 11 January 2024 and will apply from 12 September 2025, **will provide a framework that could, together with other existing or potential regulations including DMA, contribute to improve the conditions** under which businesses and consumers can access and leverage generative AI services through the use of cloud services. These legislations will have to be fully implemented, and their impact assessed with regard to competition and innovation in the generative AI market.

2 The support of businesses and their training in generative AI are crucial to leverage its benefits

AI could bring many benefits to businesses, provided they are able to integrate and exploit it to the greatest effect.

2.1 Generative AI potential beneficial effects on economy

The integration of AI technologies can lead to transformative benefits in terms of innovation, efficiency, and service quality.

Generative AI can be seen as a disruptive innovation: it may have the potential to change the way users interact with technologies, communicate with each other, access information, *etc.* and might stand out from previous innovation trends because of its significant growth potential through improved productivity and product and service innovation.

Generative AI could be a transformation driver and a productivity shock for businesses. According to Bloomberg[4], generative AI is expected to become a $1,304 trillion market by 2032. Generative AI offers opportunities for task automation and rapid analysis of large volumes of data. Generative AI could enable companies to better understand the characteristics of market demand and subsequently create new services. In addition, generative AI could enhance innovation, by creating new content and is capable of proposing innovative solutions to complex problems. These aspects could accelerate the innovation cycle, especially in the field of research and development. Finally, generative AI would have an impact on the labour market, although its impact cannot be predicted at this stage.

However, for generative AI to have a significant impact, companies should be able to integrate it successfully.

2.2 Maximizing the efficiency gains of generative AI through training and support

To realise the potential efficiency benefits of generative AI, businesses need to adopt successfully generative AI and technical experts must be trained, highlighting the importance of education.

Generative AI could exacerbate the digital divide, as its use requires an understanding of its capabilities and benefits. Therefore, **supporting companies in the use of generative AI** appears essential in order to avoid a digital divide and ensure access to the productivity gains and innovation expected from the use of generative AI, notably for small and medium enterprises (SMEs).

Furthermore, as we noted above, the development of foundation models, that serve as the basis for generative AI services, requires highly qualified individuals, typically with Master's of PhD

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[4] https://www.bloomberg.com/company/press/generative-ai-to-become-a-1-3-trillion-market-by-2032-research-finds/

qualifications in STEM. Thus, **the training of experts in generative AI seems essential to maximise all the benefits and innovative aspects of generative AI.**

3   End-users perspective: the impact of generative AI on the openness of the internet

Generative AI systems are becoming a new intermediary layer between users and content, on which may rely future gateways to access digital contents and services. Current developments tend to show a substitution between existing digital services and future generative AI-based applications. For instance, a recent Gartner study foresees that search engines volume could decline by 25% by 2026 due to the rise of AI chatbots[5]. From this perspective, generative AI – as a gateway to the internet and its content – raises new questions in terms of internet openness and end-user's empowerment.

3.1   The emergence of generative AI challenges the European principle of internet openness

3.1.1   Generative AI, a new interface between internet users and the online content

Generative AI providers or operators could have a growing influence on the conditions under which content is presented to users. As mentioned in the introduction, it appears that generative AI chatbots are increasingly replacing traditional search engines. Aside for these chatbots, it should be noted that generative AI systems are increasingly used by traditional digital services, including the most common ones such as search engines (integration of GPT-4 by Bing, Google conversational robot Gemini), social networks ('Meta AI' project), or in connected devices (for example, the Alexa voice assistant in Amazon devices).

While consumer-oriented applications of generative AI are the most visible, there are also numerous business use cases which integrate generative AI not only as resource management tools but as a driver of actions and decision-making processes[6].

Hence, generative AI products have the potential to become the main interface between users and digital contents and services, which requires an assessment of their impact on the internet openness and online user empowerment.

3.1.2   The "openness" of the internet, a critical concept in empowering users to benefit freely from internet content and applications

Internet openness is one of the pillars of the functioning, diversity and resilience of the net, the cornerstone of the empowerment of online users. This concept refers to the ability to freely access, share and provide content freely on the internet.

The openness of the internet has been challenged over time by various digital players, prompting action by EU regulators and policy makers. Since 2015, the Open internet Regulation has included a number of provisions aimed at safeguarding EU citizens right to access an open Internet[7], by preventing

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[5] See: https://www.gartner.com/en/newsroom/press-releases/2024-02-19-gartner-predicts-search-engine-volume-will-drop-25-percent-by-2026-due-to-ai-chatbots-and-other-virtual-agents

[6] For this instance, some examples of ChatGPT use cases for recommendations and decision-making in businesses were outline in this recent paper: Euclides Lourenco Chuma, Gabriel Gomes de Oliveira, Generative AI for Business Decision-Making: A Case of ChatGPT, 2023.

[7] Open internet regulation 2015/20 article 3 lays out that "End-users shall have the right to access and distribute information and content, use and provide applications and services, and use terminal equipment of their choice, irrespective of the end-user's or provider's location or the location, origin or destination of the information, content, application or service, via their internet access service."

abuses by internet service providers in particular. However, other intermediaries have the power to restrict users' ability to access certain content and services on the internet. Arcep has been an active defender of the openness of the internet, questioning in particular the influence of operating systems on the 'openness of devices' and, more generally the restrictive role of 'structuring' platforms in the freedom of users to access and share content[8]. The importance of internet openness has been also highlighted recently by the European Declaration on Digital Rights and Principles for the Digital Decade[9] which recognises the right to access to an open and neutral internet, as well as citizens freedom of choices on the internet, including when interacting with algorithms and AI systems.

The increasing use of generative AI as a new human-machine interface to access internet content, such as − but not limited to − online search queries, could create new challenges for internet openness and this issue has not been specifically addressed by EU regulation (neither the Digital Markets Act -DMA - nor the Artificial Intelligence Act - AI Act).[10]

3.2 Generative AI creates new challenges for the quality and diversity of content on the internet

3.2.1 Generative AI: a catalyst for opportunities and risks presented by the growing personalisation of users' online experience

Generative AI can lead to positive developments for the user experience and complement traditional ways of accessing content knowledge. Like any innovation, generative AI has a number of benefits that are worth highlighting. Thanks to their simple and user-friendly interface, generative AI tools open up functionalities to a wider range of users that were previously aimed at a more technical audience. It has never been easier to create text, images, or lines of code. Generative AI training can also enable a level of personalisation that was not achievable with classical algorithms, potentially increasing user satisfaction.

However, it seems difficult to ignore the significant risks of online user 'lock-in' it may create exacerbating problems already identified for more traditional digital services (social media, operating systems, etc.). Generative AI can amplify the phenomenon of **algorithmic bubbles**, where AI would provide access to content it deems specifically tailored for the end-user. This could mean a loss of control for the users over their online choices, as they have to rely on a new intermediary[11]. This risk, which has already been identified for algorithm-based digital platforms, may become more important as generative AI systems struggle to explain what led to their recommendations. For instance, while a traditional search engine could provide thousands of answers to a query whose ranking could already be an issue, AI chatbots generally provide only one answer per query, which may be unsubstantiated and usually provided without specific sources. Generative AIs can also lead to a shrinking of the available content. Another question relates to the possible economic model of AI-assisted search tools. Given that generative AI products personalise and limit the number of responses per query, it will also be necessary to consider the place of sponsored content in the limited number of responses sent to users and the ability of these search engines to prioritise accuracy of responses.

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[8] See in particular the report "Devices, the loophole of open internet" published in 2018.

[9] European Declaration on Digital Rights and Principles (2022) https://digital-strategy.ec.europa.eu/en/library/european-declaration-digital-rights-and-principles

[10] This section focuses on generative AI implications for the openness of internet. It should be noted that other concerns may appear regarding AI compliance to Open internet regulation notably regarding the use of AI in networks for optimisation or management of traffic as noted in Arcep paper on AI and electronic communications published in 2020. As for any technologies, AI use cases in electronic communications have to comply to Open internet regulation.

[11] In a recent study, Bender & Shah analyse the impact of LLM-powered search systems on information search and on the Web as an information ecosystem: Chirag Shah and Emily M. Bender. 2024. *Envisioning Information Access Systems: What Makes for Good Tools and a Healthy Web?* ACM Trans. Web Just Accepted (February 2024). https://doi.org/10.1145/3649468

Because of the (over)personalisation of content that generative AIs could produce, these applications reinforce the ability of providers to implement attention-grabbing techniques and the dynamics of the attention economy, to the detriment of end-users' capacity to monitor their online consumption.

3.2.2 Highlighting the specific role and accountability of "structuring content generators"

The use of generative AI has also consequences on information accessibility and media diversity, which underpins the need to address the specific responsibility of AI-based information tools. While the moderation role and accountability of digital platforms such as social networks or search engines is addressed by the Digital Services Act – the DSA – and the DMA, the specific issues of generative AI in accessing user content might not yet be fully characterised and addressed by EU digital regulation – as these technologies only boomed after the adoption of this text in the EU.

If only a handful of players dominate the market for generative AI, it is uncertain whether free competition will be sufficient to ensure the normalisation of relations between generative AI providers and content providers, whether they are individuals (e.g. via their own websites or digital commons such as Wikipedia for instance) or traditional content providers. The economic model of traditional content providers (especially media) and their ability to make content available to users could be disrupted by generative AI. Content providers may no longer receive traffic that they could monetise if their content is made directly available by generative AI solutions. A more positive development of their business model is possible considering that some generative AI providers are entering into agreements with traditional content providers (*e.g.* the 2023 agreement between the German press group Axel Springer and OpenAI). Nevertheless, **"structuring content generators"** – i.e. the main owners or providers of LLMs dominating the market of generative AI - could act as a barrier between users and content providers who do not have the will or the financial capacity to enter into an agreement with these dominant players.

3.2.3 Generative AI also creates new risks on the quality of the content on the internet due to the nature and existing limits of AI technologies

Generative AI stand out from other content provider applications in that it no longer simply provides a way to share, produce, or access user-generated content, but rather generates *ad hoc* content by the provider itself. It raises questions on the **quality and reliability** of internet content, as AI remains a statistical data processing tool that can have a prescriptive dimension in its way of categorising the world. Unlike search engines, which are designed to provide the most relevant answer to user's queries by pointing them to third-party content, generative AIs are currently designed to produce content whose form (syntax, semantics, style) makes it credible without mentioning the source of the information. The accuracy of the content generated by AIs system is not guaranteed: the content and the information provided are designed to be the most statistically "common" answer, rather than necessarily approximating an "objective" truth.

Moreover, the training datasets and data processing by the algorithms used in generative AI programming can introduce biases, especially stereotypes or language biases. Researchers show that generative AI still faces serious reliability and bias problems. For example, there are issues with the hyper-stereotyping of automatically generated images, raising concerns about the polarisation of content and a reduction in diversity. The risks of user restriction with generative AI are both quantitative, limiting users' access to the content of their choice, which is limited by the dataset controlled by the AI provider, and qualitative, due to the existence of biases. **Thus, the issue of internet openness resonates with concerns about AI ethics and biases**, whether related to stereotypes or language training.

3.3 What solutions? Assessing the relevance of policy measures to balance the open internet principle and online users' freedom with generative AI development

3.3.1 Ensuring the empowerment of generative AI users and the quality and diversity of internet content

A first area to explore to guarantee the openness of the internet in the context of generative AI is the empowerment of AI end-users through knowledge, transparency and greater user control over AI systems.

To be able to be fully aware of the benefits and limitations of generative AI and of their enrolment in AI training, users could be better informed about how these systems work and the role they play in the AI value chain. From a technical and economic point of view, end-users are at the centre of the value creation of generative AI systems. End-users may participate in the training of the systems, by correcting the answers they receive or by having the content they publish on the web scrapped, in some cases without being aware that they are participating in such a process. A first step in educating users on generative AI issues is to consider educational programmes on generative AI as part of digital skills policies and initiatives[12], a particularly vibrant policy area in the EU.

Complementary to educational tools, another lever of action to empower end-users in the use of generative AI is to guarantee a level of transparency and explicability of generative AI providers to users, particularly with regard to how their data is used. The implementation of the transparency tools provided by the recent IA Act could be monitored so as to ensure that they are easy to understand and could be complemented by a communication to end-users on how this information can be useful to them. Also, open source licensing and open data policies could be levers for more information about the training and operation of generative AI applications. In any case, further research and development is needed to ensure that AIs model are able to provide detail information about the composition of the input data corpus (which is currently rarely provided for now), in order to improve the explainability of their results.

The quality and diversity of internet content will also depend on the ability of providers to develop AI systems that are more reliable and less biased. The task may seem challenging but projects and research are already advancing towards models that correct these limitations. For example, in order to reduce amplification of bias, tools are emerging to better evaluate the models[13]. In this context, it is important that regulators and policy makers encourage such research and the adoption of more ethical and secure models for European users.

Other tools can be considered to secure end-user choice on the internet, even when accessing it through an AI, particularly with regard to the ability of users to choose and configure how the AI will behave. Therefore, further research and possible regulatory instruments could be considered at EU level to ensure the openness of digital environment and the rights of end-users in the context of generative AI. It would be beneficial to involve as much as possible citizens in the debate on generative

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[12] A good example could be the work highlighted by the paper "*Why, What and How to help each Citizen to Understand Artificial Intelligence?*" from the researchers - Frédéric Alexandre, Jade Becker, Marie-Hélène Comte, Aurélie Lagarrigue, Romain Liblau, Margarida Romero, Thierry Viéville - who developed an online training on the core principles of AI systems.

[13] Some works in that field: Nangia, N., Vania, C., Bhalerao, R., and Bowman, S. R. (2020). *CrowS-pairs: A challenge dataset for measuring social biases in masked language models*. In *Proceedings of the 2020 Conference on Empirical Methods in Natural Language Processing (EMNLP)*, pages 1953–1967, Online. Association for Computational Linguistics; and Zhao, J., Wang, T., Yatskar, M., Ordonez, V., and Chang, K.-W. (2017). *Men also like shopping: Reducing gender bias amplification using corpus-level constraints*. In Proceedings of the 2017 *Conference on Empirical Methods in Natural Language Processing*, pages 2979–2989, Copenhagen, Denmark. Association for Computational Linguistics

AI regulation, as end-users play a central role in the value chains of AI content generation and are directly affected by the societal consequences of the place of AI in the internet ecosystem.

3.3.2 Assessing the possibility to design specific measures for "structuring content generators" to prevent potential systemic risks

A second area of investigation would be to assess the relevance of establishing a framework to mitigate the risks of dominance by "structuring content generators" over access to internet content. Based on Arcep's experience in net neutrality and in the monitoring of the data interconnection market, three approaches could be considered at least:

i. Reflecting on the relevance of implementing **data collection from major content generators** to better monitor this new market and provide clear information to users on the functioning and access modalities to content through AI (data-driven regulation). This data collection could confirm or refute the hypothesis of "structuring content generator", i.e. gatekeepers in the generative AI market. The information collected should reflect the transparency obligations provided by the **AI Regulation Act (2024**) on foundation models.

ii. Defining **clear rules to secure the possibility of techno-economic agreements between traditional CAPs and content generators** to preserve the innovation capacity of the internet ecosystem while ensuring fairness and identifying potential barriers by dominant players. This includes ensuring that there are no barriers to users' access to content (open internet) while also respecting pluralism and the reliability of information.

iii. **Ensuring the freedom of users to easily switch between content generators** by monitoring the implementation of existing portability obligations and promoting the use of interoperable standards by major generative AI providers.

To conclude, Arcep invites the European Commission to ensure that European citizens' right to access an open internet is guaranteed at every stage of the user experience, including when accessing content through generative AI.

4 The development of generative AI raises environmental challenges

A recent study led by Arcep and the French Agency for Ecological Transition (ADEME) on the digital environmental footprint in France[14] highlights that with no further action to contain ICT's growing impact on the environment, the carbon footprint of the digital ecosystem could triple and its energy consumption could double between 2020 and 2050.

This study also underlines that the increase of the digital environmental footprint is driven by the growth in the use of digital services, and that those services rely on physical infrastructures. The interdependence between devices, networks and data centres created by consumption of digital services must therefore be taken into account when drafting public policies targeting the digital environmental footprint as a whole.

Generative AI is relying on these infrastructures, especially on data centres, and will increase their environmental impact and energy consumption. It is therefore necessary to monitor the environmental footprint of IA and take into account in energy planning policies the forecasted increased consumption of energy by IA (see section 4.1).

In Toulouse Call for a Green and Digital Transition in the EU[15] in June 2022, 18 EU Member States asked, inter alia, "*to address the environmental impact of digital infrastructures and services across the digital*

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[14] https://en.arcep.fr/news/press-releases/view/n/environment-060323.html

[15] https://www.economie.gouv.fr/files/files/2022/Call_for_Green_Digital_Transition_EU.PDF

value chain by [...] Incentivising the development of green tech by design, such as the creation of a seal for green tech by design products or digital services as a way [...] to make software, AI and other applications greener in the EU, for example with the launch of initiatives to develop green coding practices and sustainable design".

In this regard, some initiatives on eco-design already exist and should be complemented and implemented to make AI sustainable (see section 4.2).

4.1 The growing environmental footprint of AI needs to be monitored and AI energy consumption needs to be taken into account in energy planning

Arcep is drawing the European Commission's attention to the importance of integrating environmental concerns into its AI regulatory policy, in particular into its energy planning, through a better environmental transparency and environmental studies allowing to identify the main levers.

The swift development of AI, including generative AI, has prompted concerns regarding its environmental impact and its sustainability. As with any digital service, AI depends on physical infrastructure and equipment, requiring a substantial amount of resources to manufacture and operate. Its impact is mainly on servers, due to production and power consumption needs for computation, as well as on devices and networks.

Prospective studies suggest that due to AI, the global electricity consumption of data centres could double between 2022 and 2026 (IEA, 2024). Member States must consider this issue as it could threaten their energy reduction pathways – in particular for countries where data centres energy consumption is significant – and thus their low-carbon pathways. Therefore, it is crucial to measure and predict the energy consumption of AI.

However, due to a lack of exhaustive data and also to the difficulty to consider the entire lifecycle of AI-based services, it has not yet been possible to properly estimate the proportion of digital emissions attributable to generative AI.

Further environmental assessments should be carried out for a better understanding of areas of concern, using a multi-criteria, multi-component and multi-stage approach. Those studies will allow to identify the main levers in order to reduce the environmental footprint of AI, towards a "frugal AI". Such assessments should focus on IA more broadly, including IA-powered devices (IA-embedded smartphones or IA-centered devices).

The increasing capability and adoption of generative AI models also raise environmental challenges. There are already some initiatives to reduce the environmental footprint of digital services which could be complemented.

4.2 Towards the eco-design of AI-based digital services, thanks to existing initiatives

AI can only contribute to the environmental transition of the economy if AI-based services are themselves sustainable. Some initiatives aim at reducing the environmental footprint of those digital services: for example, Arcep has cooperated with other French authorities in the development of a **general framework on software eco-design[16]** that identifies first steps of actions to reduce the environmental footprint of AI models training and inference. This type of work could inspire the development of environmental standards to develop more sustainable AI models, or for the development of a European label on the footprint of end-users digital services based on AI (in

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[16] A first version of this framework was published on October 2023 for public consultation (available here). The final version of this general framework on digital services eco-design will be published in S1 2024.

particular, generative AI applications). Beyond transparency, for AI-models to minimize their environmental footprint, eco-practices should be designed and implemented through regulatory measures and/or voluntary actions. This approach towards a more sustainable AI should be complemented with further consideration on the digital sufficiency principle and on a proportionate use of AI, relatively to its environmental impact and the resources it demands.

Environmental issues should also be integrated into EU innovation policies that support the AI industry. Digital services should include eco-design practices at the early stage. This type of approach is needed to twin innovation policies with sustainability objectives.

Eventually, in line with the recent EC White Paper[17], all players of the digital value chain, including digital services providers such as AI-based services, should be considered environmentally accountable.

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[17] White Paper - How to master Europe's digital infrastructure needs? https://digital-strategy.ec.europa.eu/en/library/white-paper-how-master-europes-digital-infrastructure-needs.