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Cloud sovereignty and contestability: what role for the EU Digital Markets Act and the Data Act?☆

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ABSTRACT

Cloud computing, that emerged as an early response to outsourcing by small and mid-sized firms, has over time, emerged as the foundation of the data economy. Cloud computing is no longer merely outsourcing of non-core functions by firms. It is an irreversible trajectory to path dependence and reliance on the digital ecosystem of the global hyperscalers, Amazon, Microsoft and Google. The dependence on cloud will only strengthen further, as AI and quantum computing, that rely on large cloud capabilities, become central to the big data-driven digital economy. What technical (such as complexity of the technology, learning effects and interoperability) and economic considerations (such as ecosystem effects, egress fee and lock-in) can potentially explain the enduring global dominance of the three hyperscalers? Together these economic and technical considerations, also raise non-economic concerns, such as sovereignty and innovation, in cloud computing, that well underline the urgent call by Nation States across the globe for workable competition in the cloud computing industry. This research contribution develops the foregoing considerations, and reasons that in light of the infrastructural and foundational nature of the cloud, it should be seen as part of a digital ecosystem owned and controlled by the hyperscalers, that also qualify as gatekeepers in the EU's Digital Markets Act (DMA), and other equivalent ex-ante regulatory frameworks across the globe. This ecosystem-driven view offers a normative foundation to consider cloud sovereignty as a non-economic consideration in competition, particularly in light of the irreversible structural impact of cloud on functional autonomy and innovation capabilities of firms. This contribution elucidates how a flexible interpretation and qualitative approach may be more suited to qualify cloud under the DMA, and the relevant obligations therein. It then evaluates the portability and interoperability requirements under the Data Act. The discussion critically evaluates the landscape of cloud computing, and discusses whether together, these legal instruments can effectively promote contestability, fairness and sovereignty in cloud computing, the infrastructure layer of Industry 4.0.

1. Introduction

Cloud is the infrastructural backbone of digitalisation, and increasingly also innovation. It has a variety of applications ranging from storing large volumes of data to training generative AI models. As digitalisation became commonplace, firms started outsourcing a part of their IT infrastructure requirements. Cloud is also a highly valuable market. The worldwide market for cloud computing is expected to be worth $2 trillion by 2030, with generative AI accounting for 10-15% of the market, that is between $200 and $300 billion of this worldwide spending.[1] The rise of the big data economy, coupled with the centrality of cloud computing, that offered the ability to harness the potential of big data, also caught the attention of policy makers. In its 2015 Work Programme, the European Commission under the leadership of the then President, Jean-Claude Junker, launched its 'Digital Single Market Strategy'. The strategy had three key pillars of action: namely, facilitating access to digital goods and services in the EU (1); creating possibilities for the flourishment of digital networks and services (2) and

☆ For more information, please refer to the relevant sections under submission guidelines for the journal in the Guide for Authors.

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[1] Goldman Sachs, 'Cloud revenues poised to reach $2 trillion by 2030 amid AI rollout' (4 September 2024) https://www.goldmansachs.com/insights/articles/cloud-revenues-poised-to-reach-2-trillion-by-2030-amid-ai-rollout

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fostering a European Digital Economy and Society with sustainable growth potential (3).[2] Within the framework of the third pillar, the Commission took note of the rapid uptake of cloud computing, which the statistics at the time revealed, '[would grow] from 20% in 2013 to 40% in 2020'.[3] This emphasis on cloud was further re-enforced in the Commission's 2020 'EU Data Strategy', wherein the Commission promised an investment of two billion euros in the 'European High Impact Project to develop…. […] trustworthy cloud infrastructures and related services', as well as develop a clear 'applicable regulatory framework' for the cloud.[4] The focus on cloud and the platform economy thus, gave way to a range of legal frameworks and committed investment programs to create a fair and competitive data-driven economy. The centrality of cloud to promote innovation in frontier technologies, such as AI and quantum computing, was reiterated in the Commission's 2025 'Data Union Strategy' that emphasized the need to connect the dispersed Commission initiatives on cloud technology and computing into a 'seamless, interoperable, and sustainable data ecosystem' that promotes innovation and EU's digital sovereignty.[5] Recognising the significane of digital sovereignty in ensuring 'Europe's long-term competitiveness, [which in turn can safeguard EU's] economic resilience, innovative strength and democratic values', in November 2025, France and Germany together organised the 'Summit on European Digital Sovereignty' in Berlin.[6] At the Summit, France and Germany alongside other Member States reiterated the need for a secure and sovereign cloud to meaningfully ensure European Digital Sovereignty. Cloud thus, found a place in the EU industrial policy, as European clouds seek to 'develop an ecosystem of interconnected cloud and edge systems' to create connected digital space in the EU and beyond.[7]

Cloud is the underlying infrastructure that lays the foundation for other building blocks of the data economy. The centrality of cloud for training general purpose AI models (GPAI) has also been highlighted in several market studies, including the detailed market studies on generative AI by the Competition and Markets Authority (CMA), UK[8] and Autorité de la concurrence, the French Competition Authority (FCA)[9]. In the generative AI value chain, the cloud infrastructure forms a part of the upstream market, the AI infrastructure layer for generative AI.[10] This AI infrastructure layer (*see* Fig. 1: Locating Cloud in the Generative AI value chain) comprises of the following four key inputs - data, computing power, technical know-how, and financial resources.[12] This research contribution focusses on the second element, namely, the computing power, an input that is offered by Graphic Processing Units (GPU) chips[13] and cloud computing (which in turn also uses the GPU chips).[14] Amongst these two inputs – namely the GPU chips and cloud services, the latter presents more imminent contestability concerns, as the global market for cloud services is concentrated in the hands of only three key players, namely, Amazon, Microsoft and to a certain extent, Google, together also known as hyperscalers.[15] Hyperscalers enjoy an advantageous position, as they are also 'vertically integrated providers of accelerated compute and AI-related cloud services'.[16] In addition to the in-house model, these hyperscalers also enjoy formal and informal partnerships with AI model developers, a relationship that benefits from investments from big tech firms in innovative tech start-ups, a phenomenon commonly referred to as corporate venture capital (CVC).[17] The AI start-ups' universe, with the exception of digital healthcare, is largely controlled by big tech.[18] These investments may be financial or non-financial, with access to cloud computing being a key component of the non-financial investment portfolio. Microsoft and OpenAI, for example, collaborated early on to design a dedicated infrastructure comprising of 'thousands of NVIDIA AI-optimized GPUs linked together

[2] European Commission (25 March 2015) 'Digital Single Market Strategy: European Commission agrees areas for action' https://ec.europa.eu/commission/presscorner/detail/en/ip_15_4653

[3] European Commission (25 March 2015) 'Digital Single Market Strategy: European Commission agrees areas for action' https://ec.europa.eu/commission/presscorner/detail/en/ip_15_4653

[4] A European strategy for data, https://digital-strategy.ec.europa.eu/en/policies/strategy-data

[5] European Commission, Communication from the Commission to the European Parliament and the Council: Data Union Strategy for Unlocking Data for AI (Brussels, 19.11.2025) COM (2025) 835 final, p. 4.

[6] Council of the European Union (2 December 2025, Brussels) AOB for the meeting of the Transport, Telecommunications and Energy Council on 5 December 2025: Summit on European Digital Sovereignty (Berlin, 18 November 2025) – Information from France and Germany https://data.consilium.europa.eu/doc/document/ST-16186-2025-INIT/en/pdf

[7] *See* reference to European Commission, 'Communication: A New Industrial Strategy for Europe' (Brussels 10.03.2020) COM(2020) 102 final and European Commission, '2030 Digital Compass: the European way for the Digital Decade' (2021) 09.03.2021 COM (2021) 118 final in John David Michels, 'Sovereign Cloud for Europe: Independent Research Report Prepared for Broadcom' (February 2025) p.10

[8] Competition & Markets Authority (18 September 2023) 'AI Foundation Models Initial Report' p. 35.

[9] Autorité de la concurrence (2023) Opinion 23-A-08 of 29 June 2023 on competition in the cloud sector, p. 70

[10] French Competition Authority (Autorité de la concurrence) (8 February 2024) 'Intelligence artificielle générative: l'Autorité s'autosaisit pour avis et lance une consultation publique jusquáu vendredi 22 mars' available here https://www.autoritedelaconcurrence.fr/fr/communiques-de-presse/intelligence-artificielle-generative-lautorite-sautosaisit-pour-avis-et-lance

[11] *See also* FCA (28 June 2024) 'Generative artificial intelligence: the Autorité issues its opinion on the competitive functioning of the sector' https://www.autoritedelaconcurrence.fr/en/press-release/generative-artificial-intelligence-autorite-issues-its-opinion-competitive. For a complex overview, see also the image therein.

[12] French Competition Authority (Autorité de la concurrence) (8 February 2024) 'Intelligence artificielle générative: l'Autorité s'autosaisit pour avis et lance une consultation publique jusquáu vendredi 22 mars' available here https://www.autoritedelaconcurrence.fr/fr/communiques-de-presse/intelligence-artificielle-generative-lautorite-sautosaisit-pour-avis-et-lance

[13] Although Nvidia, in its current shape, seems to have an edge in the provision of high-quality GPU used for training generative AI models, it is not identified as a competition concern. This is on account of the emerging market realities, wherein Nvidia faces significant potential competition from the hypersclaers that are investing heavily to develop their own GPUs. Additionally, Nvidia's financial turnover indicates that its profits, and business turnover may be highly inflated. *See*, for example, Shanaka Anselm Perera, 'The Algorithm that detected a $610 billion fraud: How Machine Intelligence Exposed the AI Industry's Circular Financing Scheme' *Substack* https://substack.com/inbox/post/179453867

[14] These two areas are also the focus areas of the Commission's Technological Sovereignty Package

[15] For a detailed discussion on the GPU chips and cloud computing, and how these markets are concentrated in the hands of three market players, *see* Kalpana Tyagi, 'Mapping competition concerns along the generative AI value chain' pp. 7-11.

[16] https://www.gov.uk/cma-cases/cloud-services-market-investigation

[17] For an econometric study evaluating the relationship between venture capital and corporate venture capital and its interplay with competition and innovation in the Chinese digital markets, *see* Ke Rong, D. Daniel Sokol, Di Zhou and Feng Zhu, 'Antitrust Platform Regulation and Entrepreneurship: Evidence from China' (2024) *Harvard Business School Working Paper 24-039*

[18] Cecilia Rikap, 'Dynamics of Corporate Governance Beyond Ownership in AI' (15 May 2024) *Common-Wealth* https://www.common-wealth.org/publications/dynamics-of-corporate-governance-beyond-ownership-in-ai

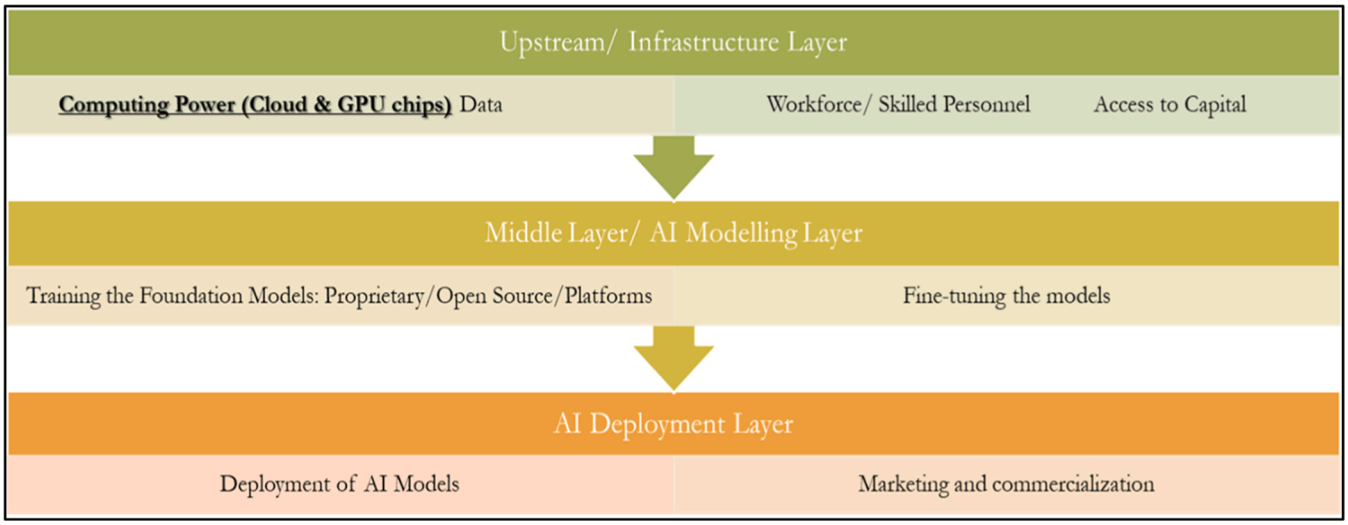

Fig. 1. Locating Cloud in the generative AI value chain [Simplified representation based on author's understanding of the AI value chain, as relevant from a competition law perspective][11].

in a high-throughput, low-latency network' used for training generative AI models.[19]

Considering that cloud offers a home to data, cloud computing also carries other dimensions, such as sovereignty, cybersecurity, data protection and contestability.[20] This research contribution focusses on the issue of sovereignty, fairness, contestability and competition in cloud computing. In light of the role, and position of the cloud in the upstream infrastructure layer of frontier technologies in Industry 4.0, such as generative AI and quantum computing, market-driven discussions on fairness and contestability in the cloud cannot be segregated from the discussion on technological and digital sovereignty, an observation also made in the Commission's 2025 Data Union Strategy.[21] Cloud sovereignty is a part of a larger policy debate 'about digital sovereignty that involves geopolitical and technology policy'.[22] Thus, this discussion also reflects on digital sovereignty, and develops a framework to consider sovereignty as a non-economic consideration in EU competition, data and digital markets regulation. The paper is organised as follows. Section 2 discusses the technical considerations that determine the choice of a cloud service provider, and how these strategic considerations may lead to user lock-in the ecosystem of the hyperscalers in the long run. Section 3 offers a brief history of the development of cloud, and how the nature of the frontier technologies has contributed towards the enduring market power of the hyperscalers, the first movers in the cloud computing industry. Section 4 discusses the economic considerations in cloud. Section 5 offers a working definition of cloud sovereignty (Section 5.1) and develops the relationship between sovereignty, fairness and contestability to reason why these non-economic considerations merit close scrutiny in the concentrated cloud computing industry (Section 5.2). Section 6.1 first offers a comprehensive overview on the overarching legal framework to address competition, contestability and fairness concerns in the cloud. It then narrows down the discussion to the EU Digital Markets (Section 6.2) and the EU Data Act (Section 6.3), as these two instruments, respectively offer general and directed approaches that can potentially facilitate portability and switching in the clouds, that in turn may contribute towards the larger policy objective of digital sovereignty. Section 7 concludes with roadmap for further research.

2. Technical considerations and strategic choices in the cloud

The Information Technology (IT) requirements of an undertaking can be met either traditionally, such as through the purchase, installation, maintenance and management of on-premise data centers, or in the alternative, via outsourcing the foregoing requirements to a cloud service provider.[23] With the use of the cloud computing, the undertaking is only required to have a smooth internet connection, and then pay variable costs depending on the amount of services used. In other words, the undertakings[24] are relieved from the uphill challenge of continuously upgrading the infrastructure, which in light of shorter innovation cycles, and the fast-moving nature of the IT industry, is prone to quick obsolescence. From the demand side, therefore, there are economic advantages that rationalize the outsourcing of IT infrastructural requirements through cloud services. A related question emerges - when an organization decides to outsource its IT requirements, what additional considerations influence the degree of outsourcing, and can this outsourcing mean a unidirectional path, in other words, a permanent dependence and lock-in into the cloud service provider?

Cloud is offered 'as a service' (and not a product), and depending on the strategic decision to outsource, this service can be limited to infrastructure, platform or software as a service – respectively known as IaaS (Infrastructure as a Service), PaaS (Platform as a Service) and SaaS (Software as a Service).

[19] John Roach, 'How Microsoft's bet on Azure unlocked an AI revolution' (13 March 2023) Microsoft https://news.microsoft.com/source/features/ai/how-microsofts-bet-on-azure-unlocked-an-ai-revolution/?ocid=eml_pg394041_gdc_comm_mw&mkt_tok=MTU3LUdRRS0zODIAAAGKwmbrwlHO5mYvwKCSRwk2rcEO-79_q_J-nzO8jDiYkLCqxQDI3WXezvp1v-R1XS1chmfOLULFh7NnuL1mIejIT2WWNnZHWf1mc2zzg39WJ2aT7z8ppJQFXEi5

[20] For a discussion on cloud sovereignty, *see* for example, Johan David Michls, Christopher Millard and Ian Walden, 'On Cloud Sovereignty: Should European Policy Favour European Clouds?' (2023) *Queen Mary Law Research Paper No. 412/2023*

[21] European Commission, Communication from the Commission to the European Parliament and the Council: Data Union Strategy for Unlocking Data for AI (Brussels, 19.11.2025) COM (2025) 835 final, p. 4.

[22] John David Michels, 'Sovereign Cloud for Europe: Independent Research Report Prepared for Broadcom' (February 2025) p. 8.

[23] Chrystal R. China and Michael Goodwin, 'IaaS, PaaS, SaaS: What's the difference?' *IBM Think* https://www.ibm.com/think/topics/iaas-paas-saas

[24] In competition law, an 'undertaking' refers to an entity that is engaged in an economic activity. The manner of funding, its profit or non-profit nature, or its legal status are irrelevant. The key consideration is whether the entity is engaged in an economic activity. *See* C-41/90 *Höfner and Elser v. Macrotron* Judgment, 23/04/1991, ECLI:EU:C:1991:161

IaaS offers 'on-demand access to cloud-hosted compute, storage and networking', the three key back office functionalities required to manage the IT requirements of an undertaking.[25] PaaS involves additional services, as it offers a comprehensive 'on-demand cloud platform (hardware, software and infrastructure) for developing, running, maintaining and managing applications'.[26] The key difference between these services is that whereas IaaS offers on-demand access to infrastructure, PaaS helps undertakings quickly update and scale at the application layer. This is possible because PaaS offers 'building blocks', with 'ready-to-use code', that can be used to develop a customized application 'without [an accompanying] need to program each component'.[27] Amazon Simple Storage Service (S3) offered by Amazon Web Services (AWS) is a typical IaaS solution.[28] Examples of PaaS include Google Cloud Run, and Microsoft's Azure SQL Database.[29] SaaS is 'cloud-hosted software application' that runs on 'compatible' IT infrastructure.[30] To use SaaS, users only need use the organisation's account, log-in ID, and work using the software offered by the SaaS service provider. SaaS is a complex market with different software service vendors. Microsoft Office, Calendar and Zoom communication services are some of the typical examples of SaaS.

Depending on the cloud service provider, the boundaries between IaaS, and PaaS are somewhat fluid, meaning what some service providers may categorize as IaaS, others may classify as PaaS and vice versa.[31] Moreover, on the buy side, users do not use only one service to the exclusion of the other. In other words, undertakings use both Iaas as well as PaaS, and the exact proportion in which these two services may be used, depends on the undertaking's individual requirements. SaaS, on the other hand, is more clearly delineated from IaaS and PaaS.[32] In practice, there is a mixed use of all these three services by an undertaking.

Common to the industry is the broad categorisation of services as IaaS, PaaS and SaaS.[33] There also exist further sub-classifications, such as Housing as a Service (HaaS), and Data as a Service (DaaS), but from the lens of competition, regulation and digital sovereignty, it is sufficient to limit our discussion to the three broadly laid out categories of IaaS, PaaS and SaaS. The National Institute of Standards and Technology (NIST) also recognises these three approaches as the key models to offer cloud services.[34] Further, as discussed in section 5 *infra*, contestability and path dependence in IaaS and PaaS is also closely intertwined with digital sovereignty concerns, an issue that may remain un- (or under-) addressed in competition and regulation (section 5 and 6 *infra*) in light of their non-economic dimension.

As regards implementation, cloud may be private, community, public or hybrid in nature.[35] The competition authorities have considered competition concerns only in public cloud, as private cloud is exclusively available for use by the undertaking that own and control the same.[36] It is not possible to quickly scale up or scale down the operations of private cloud on the basis of real time requirements of different undertakings.[37] In a hybrid cloud environment, firms use a mix of private cloud infrastructure with the public cloud being offered by an external service provider, that is usually a hyperscaler. This requires that the two clouds can talk to each other, a task that is facilitated at the management layer. The management layer facilitates communication between different APIs in a single dashboard. This layer also helps move data between different servers, ideally in the form of an application built in containers in a standardized format that is interoperable across different IaaS platforms.[38] This requires standardization of formats in the design of containers. Google created Kubernetes as a standard design of containers. This also helped Google penetrate the cloud market hitherto dominated by Amazon and Microsoft, and in the quick adoption of Google Cloud, as a competitive third player. To meaningfully compete in the market, cloud operators enable hybrid cloud operations and offer platforms such as 'VMware by CloudFoundation and IBM by Openshift'.[39] Management layer, thus, offers the platform the possibility to integrate different clouds (public and private). Containerization has another additional benefit, namely diminished interconnectedness between the hardware and the software, as different parts of the application can now be 'updated and scaled' independently.[40] In practical terms, this means that transition to a new-generation network, such as is the case with 'Rakuten Mobile 5G network', requires only a software update, without simultaneous updates to the hardware, the physical infrastructure.[41] Cloud deployment, therefore, has notable cost advantages, as undertakings using cloud may no longer worry about technical infrastructural obsolescence, and are only required to upgrade the software and enjoy a similar infrastructural capability as enjoyed by a large firm that can invest in its own in-house IT capabilities.

Depending on their level of organizational resources, constraints (such as the need for legal and regulatory compliance) and IT requirements, firms use cloud in varying degrees and proportions. Furthermore, when cloud computing is deployed in the training of generative AI models, the relevant service models are IaaS and PaaS. The reference here is to IaaS as well as PaaS, because, as already referred to above, the boundaries between the two are somewhat fluid. What some cloud service providers may consider as IaaS, others may deem as PaaS, and vice versa. SaaS on the other hand, can be clearly delineated from

[25] Chrystal R. China and Michael Goodwin, 'IaaS, PaaS, SaaS: What's the difference?' *IBM Think* https://www.ibm.com/think/topics/iaas-paas-saas

[26] Chrystal R. China and Michael Goodwin, 'IaaS, PaaS, SaaS: What's the difference?' *IBM Think* https://www.ibm.com/think/topics/iaas-paas-saas

[27] Autoriteit Consument and Markt 'Market Study Cloud Services' Case no. ACM/21/050317/ Document no. ACM/INT/440323, p. 16.

[28] Autoriteit Consument and Markt 'Market Study Cloud Services' Case no. ACM/21/050317/ Document no. ACM/INT/440323, p. 16.

[29] Autoriteit Consument and Markt 'Market Study Cloud Services' Case no. ACM/21/050317/ Document no. ACM/INT/440323, p. 16.

[30] Chrystal R. China and Michael Goodwin, 'IaaS, PaaS, SaaS: What's the difference?' *IBM Think* https://www.ibm.com/think/topics/iaas-paas-saas

[31] Cf Case M. 8994 Microsoft/GitHub, para 61. In Microsoft/GitHub the Commission considered the challenges associated with categorically distinguishing between IaaS and PaaS and eventually left this as open-ended.

[32] Cases AT. 40721 - Microsoft Teams and AT. 40873 Microsoft Teams II, paras 24-28.

[33] Jon Dishotsky, 'The Housing as a Service (HaaS) Revolution Has Begun….' (21 August 2016) *Medium* https://medium.com/@jondishotsky/the-housing-as-a-service-haas-revolution-has-begun-fcec08a7562d

[34] Peter Mell and Timothy Grance, 'The NIST Definition of Cloud Computing: Recommendations of the National Institute of Standards and Technology' (September 2011) *NIST Special Publication 800-145* pp. 2-3 https://nvlpubs.nist.gov/nistpubs/legacy/sp/nistspecialpublication800-145.pdf

[35] Peter Mell and Timothy Grance, 'The NIST Definition of Cloud Computing: Recommendations of the National Institute of Standards and Technology' (September 2011) *NIST Special Publication 800-145* p.3 https://nvlpubs.nist.gov/nistpubs/legacy/sp/nistspecialpublication800-145.pdf

[36] *See* for example, studies by UK CMA, 'Cloud Infrastructure Services: Final decision report' (31 July 2025); Dutch Autoriteit Consument and Markt 'Market Study Cloud Services' Case no. ACM/21/050317/ Document no. ACM/INT/440323 and French Autorité de la concurrence (29 June 2023) 'Avis du 29 juin 2023 portant sur le fontionnement concurrential de l'informatique en nuage ('cloud') https://www.autoritedelaconcurrence.fr/sites/default/files/integral_texts/2023-06/23a08.pdf

[37] Autoriteit Consument and Markt 'Market Study Cloud Services' Case no. ACM/21/050317/ Document no. ACM/INT/440323, p. 13.

[38] Autoriteit Consument and Markt 'Market Study Cloud Services' Case no. ACM/21/050317/ Document no. ACM/INT/440323, pp. 13-14.

[39] *See* GAIA-X-Home (data-infrastructure.eu) as discussed in Autoriteit Consument and Markt 'Market Study Cloud Services' Case no. ACM/21/050317/ Document no. ACM/INT/440323, p. 14.

[40] Autoriteit Consument and Markt 'Market Study Cloud Services' Case no. ACM/21/050317/ Document no. ACM/INT/440323, p. 30.

[41] Autoriteit Consument and Markt 'Market Study Cloud Services' Case no. ACM/21/050317/ Document no. ACM/INT/440323, p. 30

IaaS and PaaS. Diagrammatically, the three service models, based on their degree of outsourcing, may be represented thus (Fig. 2):

In the IaaS and PaaS market for public cloud, the hyperscalers, also known as 'the top three [together control] 72%' of the global market.[42] Moreover, this market concentration has only strengthened over time. What can potentially explain this sustainable position of strength enjoyed by the three hyperscalers at the infrastructure layer? The following section looks at the evolution of the industry to decipher how an early mover strategy contributed towards the sustainable competitive position of these hyperscalers in the market for cloud computing.

3. A brief history of the hyperscalers: Amazon, Microsoft and Google

Amazon was the first mover and one of the earliest providers of IaaS in cloud computing. Amazon had developed its web services for its internal requirement, namely, to develop an efficient platform wherein it could develop its website, use data therefrom to make meaningful inferences, and to safely keep it in-house on its own web servers.[43] While working on different projects, its software engineers oftentimes found themselves independently, but repeatedly, performing 'similar' tasks, and this duplication of tasks created inefficiencies in daily operations and research and development.[44] This prompted Amazon's management team to evaluate whether there existed advantages in building a 'shared layer of infrastructure services' that could then be accessed by in-house engineers across different departments at Amazon.[45] Evidently, this offered economies of scope, as this would allow different divisions in the firm to share 'general capabilities like storage, compute capabilities, [and] databases'.[46]

As Amazon also collaborated with sellers, who were also its competitors, this offered Amazon an insight in their internal operations and it was quick to realise that external developers confronted challenges similar to its own inhouse developers.[47] Amazon identified a gap in the market. This led to conceptualization and launch of Amazon's inaugural cloud computing service, S3, an acronym for Simple Storage Service, in March 2006.[48] S3 was soon complemented by other value propositions such as EC2, Elastic Compute Cloud, that were different versions of what is today referred to as cloud computing services.[49] This was coupled with the rise of the virtualization software, that created ease amongst small and medium enterprises (SMEs) to outsource their infrastructural requirements to S3, an early version of what is today known as cloud computing. Early on, firms had to use different servers to manage distinct software applications. This contributed to large operational costs of maintaining and continuously updating different servers. To remedy this, VMware created 'virtualization software' that offered a virtual (as distinct from earlier real, multi-server environment) to 'run multiple virtual servers on a single physical server'.[50] This innovation offered an additional impetus to push small and mid-sized firms to gravitate towards cloud adoption. Virtualization ensured that firms could run a multi-server environment in the cloud located at a server away from their own physical premises.[51]

Following this technical innovation, the next challenge was commercialization. Amazon, in the process, had to make important strategic choices. Amazon's dilemma was whether it should also offer cloud services to its competitors. Generally, when undertakings compete in a certain market, it may limit their interest to choose cloud services offered by competing service providers. Amazon offers e-retail services. Additionally, Amazon, for example, also has a banking license in the Netherlands. This limits the interest of competing retailers and financial institutions to choose Amazon Web Services (AWS) in the Netherlands.[52] However, Amazon as a service provider viewed the situation differently – it found an opportunity to simultaneously cooperate, and cooperate across the value chain, a strategy known as 'co-opetition' in management strategy literature.[53] Consider for instance, the case of Netflix. Even though Amazon offers a competing service, namely Amazon Prime; early on in their business decision to go on cloud, Netflix opted for AWS as its competing cloud service provider, a request that was readily agreed to by Amazon.[54] 'Co-opetition' helps Amazon and Netflix engage in collective value creation in the market for streaming services.[55] As

[42] Synergy (3 August 2023) 'Quarterly Cloud Market Once Again Grows by $10 Billion from 2022; Meanwhile, Little Change at the Top' https://www.srgresearch.com/articles/quarterly-cloud-market-once-again-grows-by-10-billion-from-2022-meanwhile-little-change-at-the-top

[43] There are conflicting accounts of how AWS came into being. While some scholarship contends that it was a chance discovery, as Amazon had excess in-house capacity; others, including Amazon's own official account is that AWS was part of a well-planned strategy to offer cloud services. As either of the positions do not effect the findings in this article, the author retains a neutral stand on how AWS first emerged. The key takeaway from a competition law perspective is that AWS was the first entrant in the market.

[44] Geoff Colvin, 'How Amazon grew an awkward side project into AWS, a behemoth that's now 4 times bigger than its original shopping business' (30 November 2022) *Fortune* https://fortune.com/longform/amazon-web-services-ceo-adam-selipsky-cloud-computing/

[45] Geoff Colvin, 'How Amazon grew an awkward side project into AWS, a behemoth that's now 4 times bigger than its original shopping business' (30 November 2022) *Fortune* https://fortune.com/longform/amazon-web-services-ceo-adam-selipsky-cloud-computing/

[46] Geoff Colvin, 'How Amazon grew an awkward side project into AWS, a behemoth that's now 4 times bigger than its original shopping business' (30 November 2022) *Fortune* https://fortune.com/longform/amazon-web-services-ceo-adam-selipsky-cloud-computing/

[47] Benjamin Black causes trouble here, https://blog.b3k.us/2009/01/25/ec2-origins.html; Geoff Colvin, 'How Amazon grew an awkward side project into AWS, a behemoth that's now 4 times bigger than its original shopping business' (30 November 2022) *Fortune* https://fortune.com/longform/amazon-web-services-ceo-adam-selipsky-cloud-computing/

[48] Geoff Colvin, 'How Amazon grew an awkward side project into AWS, a behemoth that's now 4 times bigger than its original shopping business' (30 November 2022) *Fortune* https://fortune.com/longform/amazon-web-services-ceo-adam-selipsky-cloud-computing/

[49] Geoff Colvin, 'How Amazon grew an awkward side project into AWS, a behemoth that's now 4 times bigger than its original shopping business' (30 November 2022) *Fortune* https://fortune.com/longform/amazon-web-services-ceo-adam-selipsky-cloud-computing/

[50] *See* discussion on the Meeting with Hans Wanders, (12 April 2021) in Autoriteit Consument and Markt 'Market Study Cloud Services' Case no. ACM/21/050317/ Document no. ACM/INT/440323, p. 12.

[51] *See* for example, Volker Stocker, Günter Knieps and Christoph Dietzel (September 2021) 'The Rise and Evolution of Clouds and Private Networks: Internet Interconnection, Ecosystem Fragmentation' *Paper presented at the 49th Annual Research Conference on Communications, Information, and Internet Policy (TPRC)*, pp. 11-12 https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3910108

[52] Autoriteit Consument and Markt 'Market Study Cloud Services' Case no. ACM/21/050317/ Document no. ACM/INT/440323, p. 28.

[53] For an early discussion on how firms collaborate and compete, *see* G Hamel, Y.L. Doz and C.K. Prahalad, 'Collaborate with Your Competitors-and Win' (1989) *Harvard Business Review* 67(1).

[54] L Dignan, 'Netflix and Amazon: Quite the co-opetition case study' (2012) *ZDNet*; Paavo Ritala, Arash Golnam and Alain Wegmann, 'Coopetition-based business models: The case of Amazon.com' *Industrial Marketing Management* 43 (2014), available here <https://www.sciencedirect.com/science/article/pii/S0019850113002150>

[55] Paavo Ritala, Arash Golnam and Alain Wegmann, 'Coopetition-based business models: The case of Amazon.com' *Industrial Marketing Management* 43 (2014) p. 245 , available here <https://www.sciencedirect.com/science/article/pii/S0019850113002150>

Netflix benefits from 'value creation by providing [its]cost-effective [lucrative content portfolio] on the AWS infrastructure', Amazon also benefits as it earns revenues from the AWS at the expense of competition to its other service, namely, Amazon Prime.[56] Today, Amazon hosts companies such as Netflix, Zoom, Intuit and Caesers Entertainment, and its AWS offers Amazon up to four times more revenue than its more popular and well-known e-shopping platform.[57]

Microsoft, the other hyperscaler, on the other hand, confronted a real dilemma, about whether or not to adopt cloud, as it enjoyed a position of strength in the traditional market for productivity software. As an incumbent monopolist, Microsoft feared that cloud services may replace[58] its traditional advantage in productivity software. In 2005, at the time, while AWS was still emerging on the cloud computing scene, Ray Ozzie presented an internal memo with a vision to build 'a disruptive platform' that could one day 'replicate the design of Microsoft Windows OS, .NET application services and Microsoft Office Suite' on the internet. There were fears amongst the Microsoft top management team that cloud could potentially cannibalize their cash cow, the MS productivity software, that at the time contributed over eighty percent of Microsoft's total revenue.[59] Following Ozzie's memo, the top management, thus, had an exceptionally difficult choice to make. Steve Balmer, the then CEO of Microsoft, betted on a full-fledged cloud strategy with his 'we're-all-in' war cry', an approach that was further strengthened by Satyam Nadella, the current CEO of Microsoft, with his 'Mobile first and cloud first strategy'.[60] However, unlike Amazon, that targets the IaaS and PaaS layer, Microsoft has successfully targeted all the three layers of cloud computing, namely, IaaS, PaaS and SaaS. While Microsoft has targeted IaaS and PaaS with its Microsoft Azure service, it has focussed on the SaaS layer with its MS productivity software. These, in turn, have led to different competition concerns. As regards SaaS, Microsoft recently offered a range of commitments to address Commission's following competition concerns - namely, Microsoft's anti-competitively tying of its communications solution, Microsoft Teams with its dominant Productivity Applications (comprising of Word, Excel, PowerPoint and Outlook).[61] As regards IaaS and PaaS, the issues are somewhat different and relatively more complex, as contestability (or the lack thereof), not only impacts the Iaas and PaaS layers in cloud computing, they also touch upon other larger concerns, such as digital sovereignty and perpetual customer lock-in in the ecosystem of hyperscalers (developed more detail in sections 4 & 5 *infra*). The follow-on discussion, will therefore, focus only on competition, contestability and sovereignty in IaaS and PaaS, that may together, be referred to as 'the infrastructure layer of cloud computing'. Hence, in this article, the term cloud computing, or cloud or infrastructure layer in cloud are, depending on the context, used interchangeably to refer to the infrastructure layer comprising of IaaS and PaaS.

Following the example of Amazon and Microsoft, Google too entered the cloud computing services market, and launched Google Cloud Services (GCS) in 2011. It quickly emerged as an important competitor alongside AWS and Microsoft Azure. Even though these three providers, collectively known as hyperscalers, offer similar functionality, GCS' success can additionally also be contributed to its relatively more promising user-friendly interface[62], and technical innovation, Google Kubernetes Engine (GKE) that enabled easier communication and movement of data, particularly in case of hybrid cloud settings[63]. This draws parallels with the telecoms sector, wherein the later entrants are known to be 'mavericks', that introduce disruptive innovations and better value propositions for their service to gain quick and meaningful adoption amongst consumers.[64]

The consideration whether to qualify Google Cloud, Microsoft Azure and AWS[65] under the DMA, as section 6 *infra* elaborates further, may be appreciated more profoundly, as we slide away from a quantitative towards a more qualitative approach to the DMA.

As the foregoing discussion establishes, interestingly, thought not surprisingly, the timing of entry of hyperscalers has a positive correlation with their market share. Amazon, as the first entrant, enjoys a clear first mover advantage with the largest market share. Amazon is then followed by Microsoft as the second largest provider of the infrastructure layer in cloud, with Google as the last entrant, and the most disruptive of the three hyperscalers. This is an important observation as it reinforces hyperscalers' early mover advantage[66], and innovation by disruptive, later entrants, such as GCS, in the cloud computing industry.

4. Economic and technical considerations in the cloud

To understand the dynamics and drivers of competition in the cloud computing industry, in addition to the timing of entry, following additional economic, commercial and technical barriers merit attention. Cloud computing is prone to lock-in effects as customers face 'commercial and technical barriers' to switching.[67] Technical barriers include limited interoperability, latency between the clouds, learning effects and insufficient transparency about the technical requirements to enable meaningful customer migration from one cloud to another.[68]

[56] Paavo Ritala, Arash Golnam and Alain Wegmann, 'Coopetition-based business models: The case of Amazon.com' *Industrial Marketing Management* 43 (2014) pp. 245, 246 , available here <https://www.sciencedirect.com/science/article/pii/S0019850113002150>

[57] Geoff Colvin, 'How Amazon grew an awkward side project into AWS, a behemoth that's now 4 times bigger than its original shopping business' (30 November 2022) *Fortune* https://fortune.com/longform/amazon-web-services-ceo-adam-selipsky-cloud-computing/

[58] *See* Kenneth J Arrow, 'Economic Welfare and the Allocation of Resources to Invention' in Richard Nelson (ed) *The Rate and Direction of Economic Activity* (Princeton University Press 1962). Arrow discusses how incumbent monopolists fearing a replacement effect may refrain from engaging in disruptive and breakthrough innovations.

[59] George Serafeim, 'Why analysts pushed back on Microsoft's CEO strategy that later created trillions' (22 October 2025) *The Edge Letter* https://theedgeletter.substack.com/p/why-analysts-pushed-back-on-microsofts?triedRedirect=true; Janakiram MSV, 'A Look Back At Ten Years of Microsoft Azure' (3 February 2020) *Forbes* https://www.forbes.com/sites/janakirammsv/2020/02/03/a-look-back-at-ten-years-of-microsoft-azure/

[60] George Serafeim, 'Why analysts pushed back on Microsoft's CEO strategy that later created trillions' (22 October 2025) *The Edge Letter* https://theedgeletter.substack.com/p/why-analysts-pushed-back-on-microsofts?triedRedirect=true; Janakiram MSV, 'A Look Back At Ten Years of Microsoft Azure' (3 February 2020) *Forbes* https://www.forbes.com/sites/janakirammsv/2020/02/03/a-look-back-at-ten-years-of-microsoft-azure/

[61] Cases AT. 40721 - Microsoft Teams and AT. 40873 Microsoft Teams II.

[62] Akash Chauhan, 'A Comparative Study of Cloud Computing Platforms' (2020) *Turkish Journal of Computer and Mathematics Education Vol. 11 No. 1* p.823 https://pdfs.semanticscholar.org/792f/bf4742f93c195e549b889a266043640599b1.pdf

[63] Janakiram MSV, 'A Look Back At Ten Years of Microsoft Azure' (3 February 2020) *Forbes* https://www.forbes.com/sites/janakirammsv/2020/02/03/a-look-back-at-ten-years-of-microsoft-azure/

[64] On the role of mavericks in competition, *see* Section 3.2 Mavericks and Competition in Kalpana Tyagi, 'Four-to-Three Telecoms Mergers: Substantial Issues in EU Merger Control in the Mobile Telecommunications Sector' *IIC*

[65] At the time of writing this research contribution, the Commission launched three related markets investigations on cloud computing services under the Digital Markets Act. These considerations are also at the heart of the Commission's market investigations. *See* European Commission, 'Commission launches market investigations on cloud computing services under the Digital Markets Act' (Brussels, 18 November 2025) *European Commission* https://ec.europa.eu/commission/presscorner/detail/en/ip_25_2717

[66] Marvin B. Lieberman and David B. Montogomery, 'First-Mover Advantages' *Strategic Management Journal Vol. 9 Special Issue: Strategy Content Research* (Summer, 1988) https://www.jstor.org/stable/2486211?seq=1

[67] https://www.gov.uk/cma-cases/cloud-services-market-investigation

[68] https://www.gov.uk/cma-cases/cloud-services-market-investigation

This section develops these additional economic and technical considerations, followed by a discussion on how one may map these considerations alongside non-economic concerns, such as cloud sovereignty (as developed in section 5, *infra*).

4.1. Cost of cloud services

Cloud services emerged in response to the organizational need to outsource their IT requirements. The users must only pay variable costs based on the amount of consumption. However, they may be required to commit certain minimum spend, or budget for these services. For this, users enter a contractual arrangement with the service provider. Pricing, even though variable, is highly nuanced as there exists a very complex pricing structure, based on a range of factors such as the frequency, volume, minimum spend commitments, and the duration of the contract.[69] Additionally, users must also pay each time data is migrated within and across the cloud. These costs are referred to as ingress and egress fees. Ingres fees are the costs incurred while migrating data to the cloud, whereas egress fees are the costs paid for moving data outside the cloud. While cloud providers do not charge any ingress fees, that is no fees are charged for placing the data in the cloud; providers do charge for moving data within and outside the cloud.[70] Additionally, egress fee must also be paid when streaming videos or viewing content on the cloud. While these costs may be negligible for text-based files, audio-visual content, such as videos, involve substantial egress fees. Egress fees may act as barrier to cloud migration or the adoption of a multi-cloud strategy. Egress fees, can be particularly high for smaller customers, which in the long run can be a real commercial barrier to switching.[71] It is trite to re-emphasize here that while the ingress fee are near zero, or invariably zero, egress fees are not only high, they are also subject to 'complex billing and cost' accounting.[72] The higher the egress fee, larger are the costs of switching to a competing cloud service provider or adopting a multi-cloud architecture.[73] High egress fees, when compounded with free initial cloud credits, as discussed next, create an insurmountable barrier to switching, and have been identified by the UK's Office of Communications (OfCom), and the French competition authority, as a '*de facto* penalty for leaving the service'[74].

4.2. Cloud credits

Hyperscalers offer startups and SMEs free 'cloud credits'. Cloud credits are attractive financial instruments for start-up and early-stage firms to nudge them in using the cloud, and applications, such as 'data analytics, databases, networking, security, and AI/ML' without making any payment for the resources used.[75] These cloud credits create dependence not only as regards IT requirements but also lock-in as regards innovation. The UK CMA in its market study, for example, found that Microsoft's internal documents revealed that the AI-related services, including 'accelerated compute and access to FMs', was a key focus area as it helped Microsoft 'target digital natives to its cloud, a customer demographic' wherein it, at the time, had a relatively weak position.[76]

Cloud credits [for the infrastructure layer, IaaS and PaaS] are like venture capital, that not only help these hyperscalers 'expand their marketplace' by incentivizing start-ups to use SaaS[77], but also induces them 'build AI applications' on the generative AI models directly or indirectly controlled by them.[78] These credits are a key part of the investment portfolio that hyperscalers have in innovative tech start-ups. Consider for example, Microsoft's $19 billion plus investment in OpenAI. A key component of this investment is the cloud computing infrastructure offered by Microsoft's cloud service, Microsoft Azure.[79]

Hyperscalers are notoriously famous for offering 'free' initial credits, that may create a lock-in effect in the long run. In the early phase of a tech start-up, the firm may have a handful of employees, many of whom may have only a technical background, and may therefore, not consider the implications of cloud lock-in from a long run perspective.[80] Thus, the initial decision, with a myopic view to benefit from free cloud credits offered by the hyperscalers, can inadvertently contribute towards a long term lock-in for the firms.

When cloud infrastructure is a key component of the CVC[81], it has long term lock-in effect, as cloud migration is not an easy task. Additionally, it may be worthwhile to consider why AI-based startups are offered significantly higher number of credits vis-à-vis other start-ups. Google, for example, offers up to $200,000 to startups. However, for AI-based start-ups, it offers up to $350,000 worth of credits[82], almost double the number of credits offered to regular start-ups. These investments via cloud credits not only create a long term lock-in, they also lead to 'loyalty and partnerships, such as data sharing'.[83] As befittingly

[69] Autoriteit Consument and Markt 'Market Study Cloud Services' Case no. ACM/21/050317/ Document no. ACM/INT/440323, pp. 17 usw; CMA Market Study; French Competition Authority Market Study

[70] Autoriteit Consument and Markt 'Market Study Cloud Services' Case no. ACM/21/050317/ Document no. ACM/INT/440323, pp. 17-18; CMA, 'Cloud Infrastructure Services: Final decision report' (31 July 2025), p. 342, para 6.387.

[71] CMA, 'Cloud Infrastructure Services: Final decision report' (31 July 2025), p. 347, para 6.407 https://www.gov.uk/cma-cases/cloud-services-market-investigation. Notably, the CMA identified that 'the smallest customers' faced higher egress fee vis-à-vis other cloud customers, 'as a proportion of their annual cloud spend' to switch to a competing cloud service provider.

[72] CMA, 'Cloud Infrastructure Services: Final decision report' (31 July 2025), p. 32, para 2.18, and pp. 33-34, para 2.39, referring respectively to complex billing and pricing framework for Amazon Web Services and Google Cloud Services.

[73] CMA, 'Cloud Infrastructure Services: Final decision report' (31 July 2025), p. 331, para 6.342.

[74] *See* reference to market studies by OfCom, 2023 and Autorité de la concurrence, 2023 in OECD, 'Competition in the provision of Cloud Computing Services' *OECD Roundtables on Competition Policy Papers No. 323* p.18.

[75] Szymon Lubański, 'Google Cloud credits for startups: a comprehensive guide to scaling with advanced cloud services' (4 March 2025) *Vestbee Insights* https://www.vestbee.com/insights/articles/google-cloud-credits-for-startups-a-comprehensive-guide

[76] CMA, 'Cloud Infrastructure Services: Final decision report' (31 July 2025), p. 32, para 2.23.

[77] Consider for example how Microsoft Azure's free cloud credits may incentivize the benefitting firms to also use Microsoft's productivity software.

[78] Cecilia Rikap, 'Dynamics of Corporate Governance Beyond Ownership in AI' (15 May 2024) *Common-Wealth* https://www.common-wealth.org/publications/dynamics-of-corporate-governance-beyond-ownership-in-ai

[79] John Roach, 'How Microsoft's bet on Azure unlocked an AI revolution' (13 March 2023) Microsoft https://news.microsoft.com/source/features/ai/how-microsofts-bet-on-azure-unlocked-an-ai-revolution/?ocid=eml_pg394041_gdc_comm_mw&mkt_tok=MTU3LUdRRS0zODIAAAGKwmbrwlHO5mYvwKCSRwk2rcEO-79_q_J-nzO8jDiYkLCqxQDI3WXezvp1v-R1XS1chmfOLULFh7NnuL1mIejIT2WWNnZHWf1mc2zzg39WJ2aT7z8ppJQFXEi5

[80] The author would like to thank Konrad Kollnig for this observation.

[81] *See for example*, Amazon Web Services, 'AWS Cloud Credit for Research', https://aws.amazon.com/government-education/research-and-technical-computing/cloud-credit-for-research/, Google Cloud, https://cloud.google.com/startup and Microsoft, 'For startups ready to build fast, scale smart and sell more' https://www.microsoft.com/en-us/startups

[82] The next generation of startups are building on Google Cloud, https://cloud.google.com/startup

[83] Aline Blankertz, Brianna Rock and Nicholas Shaxson, 'Google's hidden empire: New data reveals the company's unexpected reach and the failure of antitrust authorities wielding Chicago-School economics to address vertical power' (6 November 2025) *SSRN* p. 17.

put by the management team at Microsoft, innovation today does not take place in the traditional R&D labs, instead it is industrialized and takes place on a virtual infrastructure, the cloud.[84] This is because a large part of the training of the large language models takes place on the cloud. Therefore, the implications of free cloud credits are not just limited to lock-in, it also has long-term implications for innovation.[85]

Moreover, these cloud credits also impede smaller cloud providers from competing meaningfully, as they are 'unable to match the significant amount of cloud credits' offered by the hyperscalers to start-ups.[86] In the DMA's Impact Assessment as well, the Commission refers in turn, to the study by the US House of Representatives Judiciary Committee, wherein the latter identified that 'free tier offerings for cloud services' are a commonly deployed lock-in strategy used by hyperscalers.[87]

4.3. Technical considerations in the cloud

Considering the hybrid cloud strategy, as well as for the cloud users to be able to successfully migrate from one cloud to another, different clouds must be able to communicate with each other. This requires standards that facilitate interoperability between the clouds. Standards may be open or closed. Open standards are frequently published under the GNU General Public License (GPL), or the relatively less open, the GNU Lesser General Public License (LGPL). Google's open source, Kubernetes's container platform, is available under the hybrid Apache license, that combines the features of open-source license with the closed source code.[88] Closed source license is subject to the interest and strategy of the owner and may (or may not be) available for licensing. An open-source license, on the other hand, is freely available to other developers, and depending on the exact terms and conditions in the license, such as GPL, LGPL, and hybrid Apache license, may permit different degrees of forking. This, in turn, offers variable degrees of freedom to developers to build their own independent model, while forking away from the original model.

The cloud environment presents a different scenario of mixed-closeness and openness, for example, when compared with the operating systems. In operating systems, the Apple iPhone presents one extreme example of an ecosystem, wherein technical limitations do not allow any external operating system or app store to function in the Apple environment. On the other hand of the spectrum lies the Linux-based Ubuntu operating system, that offers developers a large degree of independence to 'install unfiltered software' or even modify the Ubuntu operating system.[89] This mixed environment of openness and closeness may be attributed in part to disruptive innovations by Google, the last of the three hyperscalers.

Google had to facilitate easy portability or migration across the clouds to make Google Cloud Services attractive and to be able to enter the infrastructure layer in cloud, that was at the time dominated by AWS and Microsoft Azure. For this, Google created the original version of Kubernetes. To facilitate a wider adoption of the standard, overtime, Google gave away its code and governance of Kubernetes to the Cloud Native Computing Foundation.[90] This, in turn, has given way to different forked versions such as Google Kubernetes Engine (GKE), Azure Kubernetes Service (AKS) and Amazon Elastic Kubernetes Service (EKS).[91]

Thus, the environment as it emerges today, is neither a pure open-source nor a closed-source scenario. Rather, it exhibits mixed elements of the two extreme possibilities of open source and closed source.[92] This mixed view on openness is also endorsed by the CMA study as it observed that 'technical differentiation' of features as well as interfaces meant limited switch and/or adoption of a multi-cloud strategy by the users.[93] The CMA identified these as 'customer-led mitigations', developed by 'ISVs or the open-source community to support switching and multi-cloud'.[94] In addition, the CMA also took note of the provider-led mitigation measures.[95] However, these technical solutions, whether buy side or supply side, offer only a 'patchwork of mitigations'. The framework remains patchwork, as larger challenges such as different technical protocols, multi-cloud latency, non-transferability of skills across clouds, and opaqueness on technical practices, limit migration amongst different clouds or alternatively, the adoption of a multi-cloud strategy[96]

This mixed open and closed strategy, as the following sub-sections 4.4, 4.5 and section 5 *infra* highlight, helps develop an intricate network of inter-dependent and interoperable services, with cloud (at the infrastructure level) offering a strong foundation to develop and retain users (individual customers, start-ups as well as large scale undertakings) in the digital ecosystem of these hyperscalers.

4.4. Cloud as part of the ecosystem

Provision of cloud services cannot be seen in isolation. Rather, cloud services are part of an integrated portfolio offered by the hyperscalers. This ecosystem-based view can be argued on the grounds that familiarity and experience with other services in the digital ecosystem prompt the choice of and preference for certain cloud service providers vis-à-vis others. Microsoft, for instance, has substantially benefitted from the familiarity of its portfolio of services and applications amongst its user base.[97] As early as June 2021, the European Commission received complaints from European cloud infrastructure service providers and

[84] John Roach, 'How Microsoft's bet on Azure unlocked an AI revolution' (13 March 2023) Microsoft https://news.microsoft.com/source/features/ai/how-microsofts-bet-on-azure-unlocked-an-ai-revolution/?ocid=eml_pg394041_gdc_comm_mw&mkt_tok=MTU3LUdRRS0zODIAAAGKwmbrwlHO5mYvwKCSRwk2rcEO-79_q_J-nzO8jDiYkLCqxQDI3WXezvp1v-R1XS1chmfOLULFh7NnuL1mIejIT2WWNnZHWf1mc2zzg39WJ2aT7z8ppJQFXEi5

[85] CMA, 'Cloud Infrastructure Services: Final decision report' (31 July 2025), p. 5.118, pp. 241-242. The UK CMA also observed how better financial position of the hyperscalers offered them a possibility to direct AI ecosystem towards their cloud services.

[86] CMA, 'Cloud Infrastructure Services: Final decision report' (31 July 2025), p. 245 para 5.129.

[87] Commission Staff Working Document Impact Assessment Report, Accompanying the document Proposal for a Regulation of the European Parliament and of the Council on contestable and fair markets in the digital sector (Digital Markets Act), SWD (2020) 364 final, part 1/2, (Brussels 15.12.2020) at para 40 available here <https://digital-strategy.ec.europa.eu/en/library/impact-assessment-digital-markets-act>

[88] Autoriteit Consument and Markt 'Market Study Cloud Services' Case no. ACM/21/050317/ Document no. ACM/INT/440323, p. 19.

[89] Autoriteit Consument and Markt 'Market Study Cloud Services' Case no. ACM/21/050317/ Document no. ACM/INT/440323, p.21.

[90] Janakiram MSV, 'A Look Back At Ten Years of Microsoft Azure' (3 February 2020) *Forbes* https://www.forbes.com/sites/janakirammsv/2020/02/03/a-look-back-at-ten-years-of-microsoft-azure/

[91] Jacob Ben-David, 'The History of Cloud Computing: Two Decades in Review (Part 3)' *LinkedIn: Plus* https://www.linkedin.com/pulse/history-cloud-computing-two-decades-review-part-3-jacob-ben-david/

[92] It is interesting to mention here that the website of Kubernetes though suggests that Kubernetes, also known as K8 in technical literature, is an open-source system used for the 'deployment, scaling, and management of containerized applications'. https://kubernetes.io/

[93] CMA, 'Cloud Infrastructure Services: Final decision report' (31 July 2025), p. 326, para 6.234.

[94] CMA, 'Cloud Infrastructure Services: Final decision report' (31 July 2025), p. 324, para 6.314.

[95] CMA, 'Cloud Infrastructure Services: Final decision report' (31 July 2025), pp. 324, paras 6.315-6.323.

[96] CMA, 'Cloud Infrastructure Services: Final decision report' (31 July 2025), pp. 324-325, paras 6.324-6.325

[97] CMA, 'Cloud Infrastructure Services: Final decision report' (31 July 2025), p. 32, para 2.22.

Amazon, itself a hyperscaler, that Microsoft leveraged its dominance in 'software markets, including operating systems (Windows Client and Server) and productivity software (Office), to foreclose competition in cloud infrastructure services'.[98] As Microsoft changed its practices and averted full investigation, the question of whether and how to integrate this ecosystem perspective while assessing competition and contestability concerns in the cloud computing industry, remained unaddressed. In the follow-on Microsoft Teams decision, an abuse of dominance case under Article 102 TFEU, the Commission considered how Microsoft offered an 'ecosystem of business application software' and how these Microsoft SaaS suites offered better and enhanced functionality vis-à-vis on-premise software.[99] In Microsoft/Nuance, a merger decision, the complainants raised concern that Microsoft wanted to acquire Nuance 'to create a closed, Microsoft-only ecosystem' in the market for European healthcare software.[100] The UK's telecommunications regulator, Ofcom, in its cloud services market study, identified 'ecosystem' as the relevant framework to assess competition in the cloud.[101] The European Commission too while looking at cloud services as a potential core platform service situated them in the context of ecosystems. While cloud services provided by a large service provider may not raise competition concerns, these very same services, when offered by gatekeepers that enjoy incontestable 'entrenched market position', which also helps cross-subsidize different services in their ecosystem, can raise contestability and fairness-related concerns.[102] This ecosystem perspective on 'cloud computing' as a 'core platform service' in the Digital Markets Act, as well as non-economic consideration therein, thus, merit a nuanced discussion, and are accordingly, developed further in sections 5 and 6 *infra*.

4.5. Ecosystem as a pathway to dependence and lock-in in the cloud

Ecosystem-driven nature of the cloud can lead to 'path dependence', as the initial choice of digital services influences subsequent choices in the digital ecosystem. In its cloud services study, for example, the Dutch ACM identified that Microsoft Azure was the top cloud service provider, the choice of which was influence by Dutch CIOs' (Chief Information Officer) pre-existing relationship with Microsoft, and the use of Office packages by the firm.[103] This familiarity may differently influence choices at different layers of the cloud. For example, it may be more central to IaaS and PaaS, that are more central to the 'core of a company', as distinct from SaaS, wherein the type of SaaS may determine the degree and impact of path dependence in the choice of a given SaaS.[104] Additionally path dependence may also emerge as end-users may already be developing new applications interoperable with the infrastructure of their current cloud service providers. Limited effective interoperability with other cloud services, thereby, may act as a barrier to cloud migration, as it may hinder ongoing research and development.[105] In the market for training generative AI models, this may contribute towards even higher levels of path dependence. Consider OpenAI that has substantially leveraged on Microsoft's Cloud infrastructure to train its generative AI models, the GPTs. There seems to be a natural enduring dependence that may contribute to committed relationship between Microsoft and OpenAI. Viewed from this lens, ecosystems and lock-in resulting therefrom, does not merely impact competition at the infrastructure level, it also influences competition at the level of innovation and leveraging on the rents from this innovation, to develop a position of advantage in related and vertically integrated markets.

4.6. Early mover advantage

Amazon's first mover advantage, when coupled with the above-referred lock-in effects, offers Amazon a position of sustainable competitive advantage. Microsoft, the second big entrant in the industry, enjoys the second largest market share in public cloud.

The IaaS market is dominated by AWS and Microsoft with each having a [30-40]% market share in Europe in 2024.[106] The market for PaaS is also somewhat concentrated, with AWS and Microsoft, respectively enjoyed a market share of [10-20]% and [20-30]% in Europe during the same time period.[107] Google comes a distant third with a market share in the range of [5-10]% at the IaaS as well as the PaaS level.[108] The emergence and maturity of the cloud sector reveals that the hyperscalers enjoy a position of strength in sequence of the time in which they entered the industry, as discussed in section 3 *supra*.

Simply put, Amazon (more precisely, AWS) being the earliest entrant, enjoys the first mover advantage with the largest market share in majority of the global markets, with Microsoft (more precisely, Microsoft Azure) being its closest competitor.

An implication of the foregoing observations on the nature and structure of the market suggest, contestability concerns in the cloud merit urgent attention. Further, this contestability and fairness seem to be closely intertwined with sovereignty, an issue developed in the following section.

5. Sovereignty, contestability and fairness in the digital ecosystem

Cloud stores data, that can be oftentimes personal and sensitive in nature. Following high profile cases such as the 2013 Snowden revelations, the EU took a range of measure to ensure data sovereignty by limiting access to personal data under the General Data Protection Regulation (GDPR), which was soon followed by a range of influential decisions by the CJEU in Schrems I and Schrems II.[109]

Sovereignty in the digital space is a broad term which can have a range of meanings. This can include cloud, technological, data or infrastructure sovereignty, which is oftentimes collectively referred to as

[98] OECD (19 June 2025) 'Competition in the Provision of Cloud Computing Services – Note by the European Union' DAF/COMP/WD (2025)39, p. 5. The complaint was however subsequently withdrawn as Microsoft changed its licensing conditions to accommodate smaller cloud providers. Google has since also made a complaint to the Commission against Microsoft's conduct in the cloud sector. See discussion therein.

[99] Cases AT. 40721 - Microsoft Teams and AT. 40873 Microsoft Teams II, para 35.

[100] Case M. 10290 Microsoft/Nuance, para 274. The said claim by complainants was however, dismissed by the Commission.

[101] Ofcom, 'Cloud Services Market Study – Final Report' (2023) *Ofcom*

[102] Commission Staff Working Document Impact Assessment Report, Accompanying the document Proposal for a Regulation of the European Parliament and of the Council on contestable and fair markets in the digital sector (Digital Markets Act), SWD (2020) 364 final, part 1/2, (Brussels 15.12.2020) at para 35 available here <https://digital-strategy.ec.europa.eu/en/library/impact-assessment-digital-markets-act>

[103] Autoriteit Consument and Markt 'Market Study Cloud Services' Case no. ACM/21/050317/ Document no. ACM/INT/440323, pp. 26-27.

[104] *Ibid.*

[105] *See* for example, customer testimony in the UK CMA study, wherein the even though the customer wanted to migrate from the Microsoft ecosystem, however absences of open-source alternatives for their commercial off the shelf applications limited their mobility to open-source software, such as Linux. CMA, 'Cloud Infrastructure Services: Final decision report' (31 July 2025), p. 449, para. 7.258.

[106] https://www.gov.uk/cma-cases/cloud-services-market-investigation

[107] https://www.gov.uk/cma-cases/cloud-services-market-investigation

[108] https://www.gov.uk/cma-cases/cloud-services-market-investigation

[109] John David Michels, 'Sovereign Cloud for Europe: Independent Research Report Prepared for Broadcom' (February 2025) pp. 4-5.

digital sovereignty.[110] Thus, while this contribution refers to what may be precisely pinned down as cloud sovereignty, it may be trite to add that the terms digital sovereignty and cloud sovereignty are oftentimes used interchangeably. The following sub-section, thus, offers a working definition of cloud sovereignty (section 5.1), followed by a discussion on an ecosystem-driven view to fathom the need for sovereignty, contestability and fairness considerations in the cloud (section 5.2).[111] Insights therein, then form a basis to contend gatekeeper designation for cloud computing under the DMA (section 6.1).

5.1. Digital and cloud sovereignty

The discussion on digital sovereignty has gathered notable momentum in recent academic discourse. Is sovereignty a mere constitutional ideal or does it also have a meaning in the digital space? What exactly does one mean when one refers to digital sovereignty? Is the notion limited to national level (at the Member State level) or does it refer to supranational sovereignty (such as at the EU level)?[112] Is digital sovereignty an umbrella term, that includes cloud sovereignty, and if so, how do the two notions relate to one another? Before locating cloud sovereignty in an ecosystem (Section 5.2 *infra*), this sub-section addresses the foregoing concerns and locates cloud sovereignty along the AI value stack. Together, this normative foundation will then form the basis for gatekeeper designation for cloud under the DMA, as discussed in section 6 *infra*.

A constitutional view of sovereignty suggests that it is 'power-political, or governing, power [residing in the Head,] the most powerful actor on the scene'.[113] In a federal structure, such as in the US, the 'atom of sovereignty' is further split between state and national governments.[114] In the European Union, 'sovereignty is [.....] shared and divided' between the Union and the States, with 'the ultimate locus [of] "absolute" sovereignty [being] contested and unresolved'.[115] Common to these varying traditions and notions of sovereignty are the unifying characteristics of 'specific territory, a defined population, external independence and internal autonomy'.[116] History offers several examples, wherein Nation States successfully leveraged control over political geography, sea routes and information infrastructure to control the sovereignty of other Nation States.[117]

While Nation States may have demarcated territories, and well-defined population, the digital world is inherently borderless, with relevant geographic markets oftentimes global or in the EU, at least European Economic Area (EEA-wide) in scope.[118] In addition, digital technologies, such as generative AI, internet of things and quantum computing, have a stack-like nature. This stack-based nature helps 'design political geography [suited to] planetary-scale computation'. The emergence of cloud infrastructure has given way to 'quasi-sovereign polity' that performs the traditional role of the State and functions beyond sovereign national boundaries.[119] To argue thus, Bratton, takes inspiration for this stack-like approach from the German jurist and political thinker, Carl Schmitt. Locating its origins in '*nemein*', the Greek word referring to both, 'to divide' as well as 'to pasture', Schmitt refers to the 'nomos of the earth', which is a 'first measure of all subsequent measures'.[120] Schmitt offers a teleological meaning to the word 'nomos' to convey how it 'opens up a space', and offers a mental representation of a manner, a way of thinking that then 'lays the basis for all [subsequent] forms of order'.[121] To further elucidate this, Schmitt gives the example of 'land appropriation [as an] archetype constitutive legal process [as] it opens up legal space'.[122]

In the digital sphere, much like the geographical *nomos*, sovereignty can either be broadly or narrowly understood. A restricted interpretation of sovereignty means restricting access to local data by foreign government. A broader interpretation of the term, 'sovereignty' on the other hand, means offering high quality 'data residency options for both content data and metadata and security measures that limit provider

[110] *See* for example, Dennis Broeders and Monica Kaminska, 'EU digital sovereignty: When top-down meets bottom-up' p. 9 in Deniss Broeders (eds) Digital Sovereignty: From Narrative to Policy? The Hague Program on International Cyber Security (December 2022) ; Anupam Chander and Haochen Sun (2022), 'Sovereignty 2.0' *Vanderbilt Journal of Transnational Law*; Council of the European Union (2 December 2025, Brussels) AOB for the meeting of the Transport, Telecommunications and Energy Council on 5 December 2025: Summit on European Digital Sovereignty (Berlin, 18 November 2025) – Information from France and Germany https://data.consilium.europa.eu/doc/document/ST-16186-2025-INIT/en/pdf.

[111] For a detailed discussion on how sovereignty may be an implicit goal of the DMA, alongside, its more widely understood goals of fairness and contestability, see Kalpana Tyagi, 'Mapping Sovereignty and Competition Concerns Along the Generative AI Value Chain' European Competition and Regulatory Law ReviewVolume 10, Issue 2 (2026)pp. 125 - 144DOI: https://doi.org/10.21552/core/2026/2/6

[112] Luciano Floridi, 'The Fight for Digital Sovereignty: What It Is, and Why It Matters. Especially for the EU' p. 374.

[113] Diane P. Wood (2014), 'The Structure of Sovereignty' *Lewis & Clark Law Review Vol. 18 No. 1* pp. 217 https://chicagounbound.uchicago.edu/cgi/viewcontent.cgi?article=11410&context=journal_articles

[114] *See reference* to the Opinion of justice Kennedy in US Term Limits v. Thornton 514 US 779, 838 (1995) in Diane P. Wood (2014), 'The Structure of Sovereignty' *Lewis & Clark Law Review Vol. 18 No. 1* p. 217 https://chicagounbound.uchicago.edu/cgi/viewcontent.cgi?article=11410&context=journal_articles

[115] Robert Schütze(2016) 'Two-and-a-half Ways of Thinking about the European Union' *Politique Européenne Éditions L'Hartmattan 2016/3 (N°53)* p. 34 https://shs.cairn.info/revue-politique-europeenne-2016-3-page-28?lang=en&tab=resume

[116] Diane P. Wood (2014), 'The Structure of Sovereignty' *Lewis & Clark Law Review Vol. 18 No. 1* pp. 217 https://chicagounbound.uchicago.edu/cgi/viewcontent.cgi?article=11410&context=journal_articles

[117] For a rich discussion therein, *see reference to* Carl Schmitt work in Haroon Sheikh, 'European digital Sovereignty: A Layered Approach' (2022) Digital *Society* p. 4. In his work, Carl Schmitt connects Walter Raleigh's observation on control of the sea and trade routes to a control over the world, with Chritopher Columbus' discovery in the maritime domain, and how the discovery of this sea route, at the time, changed the 'nomos of the earth [which in the words of Schmitt is the] first measure of all subsequent measures'. Sheikh also refers to Shen Weiguang, a Chinese Statesman's work on 'information sovereignty' and how the US used 'SWIFT as a chokepoint' to facilitate alignment with its trade policy by other Nation States.

[118] *See* for example discussion on of merger-related case law in the EU, China and the US, wherein the competition authorities defined the relevant geographic markets as global or at least EEA-wide in scope in Kalpana Tyagi, *Promoting Competition in Innovation Through Merger Control in the ICT Sector: A Comparative and Interdisciplinary Study* (Springer 2019) *p.* 18, 67, 277, 298.

[119] Benjamin H. Bratton, 'Cloud Layer' in The Stack: On Software and Sovereignty (The MIT Press, 2016) https://academic.oup.com/mit-press-scholarship-online/book/18589/chapter-abstract/176753219?redirectedFrom=fulltext

[120] Carl Schmitt, 'The Nomos of the Earth in the International Law of the *Jus Publicum Europaeum*' [Der Nomos der Erde im Volkerrecht des Jus Publicum Europaeum] Translated and Annotated by G.L. Ulmen (Telos Press Publishing 2006) pp. 70-71 https://s3.amazonaws.com/arena-attachments/780536/d9298ae3fa958fa33ff47ca7de969b90.pdf. *See also reference to* Schmitt and Bratton's work in Haroon Sheikh, 'European digital Sovereignty: A Layered Approach' (2022) *Digital Society* p. 4.

[121] Carl Schmitt, 'The Nomos of the Earth in the International Law of the *Jus Publicum Europaeum*' [Der Nomos der Erde im Volkerrecht des Jus Publicum Europaeum] Translated and Annotated by G.L. Ulmen (Telos Press Publishing 2006) https://s3.amazonaws.com/arena-attachments/780536/d9298ae3fa958fa33ff47ca7de969b90.pdf

[122] *See reference to* Schmitt and Bratton's work in Haroon Sheikh, 'European digital Sovereignty: A Layered Approach' (2022) *Digital Society* pp. 5-6.

access to data, such as [through] end-to-end encryption'.[123] In an interconnected and inter-dependent world, absolute digital sovereignty, meaning complete independence to define and enforce digital rules is an extreme ideal, which may be neither feasible nor necessary for a sovereign state.[124] A more nuanced approach is to view sovereignty on a scale, with digital collaboration and dependencies between Nation States being defined by complementarities, capabilities and most pertinently, a value based alignment, an approach that is also pursued as an unambiguous policy aspiration by the European Union.[125]. This call is grounded in a policy rationale, namely that the EU must make autonomous choices grounded in 'fundamental values' and respect for these foundational values.[126] The call for digital sovereignty is grounded not only in the need to control the digital space and technological independence, it also finds a rationale in light of the need for alignment with the values of the European Union. This call is also a response to the development in digital space, such as for example, the evolving nature of the internet (or to borrow from Schmitt, the '*nomos*' of the internet) from being a free and open space to being a walled-garden[127] controlled by a handful of digital firms concentrated in a region outside the EU. The US proactively took pro-active measures '"to subsidize the development of Internet companies" [much like its] judges did to support industrial development'.[128] Thus, EU's call for sovereignty also needs to be viewed considering the industrial policy advantages received by the Silicon Valley-based startups, some of which over time culminated into the Magnificent Seven.

In the early days of the internet, Barlow's 'A Declaration of the Independence of the Cyberspace'[129] called for the freedom of digital space from government intervention. This view symbolized the open and libertarian nature of the internet.[130] At the time, internet startups flourished, and Schumpeter's 'waves of creative destruction' ensured that the monopolist received rents from his innovation, until another more innovative start-up displaced the incumbent with a better product and service.[131] Start-ups came from the proverbial garage, and one saw quick waves of innovation in search engines, networking platforms and other digital services. AltVista and Yahoo! were the dominant search engines, till Google replaced them to emerge as the world's leading general search engine.

Overtime, the sunk cost of meaningfully entering the digital markets has grown substantially, and it seemed unreasonable to expect that the 'next great search engine (if there will ever be one) [will be] built in a rented garage like Google'.[132] The nature and structure of digital markets has changed fundamentally, and as digital firms become ecosystems, they ride on and successfully conquer, every subsequent wave of innovation.[133] The challenge emerges as economies become increasingly digital, a large proportion of the national Gross Domestic Product (GDP) becomes digitally dependent on a handful of global players. Digital dependence on the digital gatekeepers means larger profits and high valuation of these digital conglomerates, together also known as the Magnificent Seven[134]. In Q1 2026, Alphabet, the parent company of Google, for example, crossed the market cap of $4 trillion, and earned revenues of $109.9 billion, with an 81 per cent year-on-year profit.[135] This exceeds the GDP of Germany[136], the largest Member State in the European Union.

In light of these macroeconomic developments, the call for digital sovereignty, thus, seems a natural evolution of the traditional notion of sovereignty, that was hitherto seen as an ideal, limited in principle to the confines of constitutional law.

Early on in the EU, the call for digital sovereignty first emerged in the context of data and infrastructure sovereignty. Occurrences like the EU's invalidation of the *EU-US Data Protection Shield* and EU and US' ban of Huawei's 5G networks on security grounds were grounded in the quest for 'digital sovereignty, that is, for the control of data, software (e.g. AI), standards and protocols (e.g. 5G, domain names), processes (cloud computing), hardware (e.g. mobile phones), services (e.g. social media, e-commerce), and *infrastructures* (e.g. cables, satellites, smart cities).[137]

This was accompanied by the realization that cloud was particularly crucial in this call for sovereignty as it formed the infrastructure, the backbone for the other technologies in Industry 4.0. To facilitate integration across different clouds, and as part of its 'sovereign cloud strategy'[138], the EU thus, developed the Gaia-X initiative. Gaiai-X offered a platform wherein 'cloud providers [from Europe as well as outside Europe could] build' an inter-connected cloud.[139] It offered a 'fully open, sovereign, standardized, and federated cloud toolbox'[140], for 'cloud and data service providers [to] interoperate [and ensure] transparency and data sovereignty'.[141] Hyperscalers too promptly responded to this market demand, by proposing, in addition to the above-referred

[123] John David Michels, 'Sovereign Cloud for Europe: Independent Research Report Prepared for Broadcom' (February 2025) p. 6.

[124] Lukas von Ditfurth, 'The European Union's Pursuit of Digital Sovereignty Through Legislation' (2025) 16 *JIPITEC* p. 292.

[125] Ursula von der Leyen, 'A Europe that strives for more: my agenda for Europe' (2019)

[126] Ursula von der Leyen, 'Shaping Europe's digital future' (19 February 2020)

[127] *See* for example, Salil K. Mehra (2011) 'Paradise is a Walled Garden? Trust, Antitrust and User Dynamism' *George Mason Law Review* https://papers.ssrn.com/sol3/papers.cfm?abstract_id=1813974

[128] Samuel Fratini, Emmie Hine, Claudio Novelli, Huw Roberts and Luciano Floridi, 'Digital Sovereignty: A Descriptive Analysis and a Critical Evaluation of Existing Models' (2024) *Digital Society Vol. 3 Issue 59* pp. 58-59. *See* also the references therein.

[129] John Perry Barlow, 'A Declaration of the Independence of Cyberspace' *Electronic Frontier Foundation* https://www.eff.org/cyberspace-independence

[130] D Broeders, F. Cristiano and M. Kaminska (2023) 'In search of digital sovereignty and strategic autonomy: normative power Europe to the test of its geopolitical ambitions' p. 2 *Journal of Common Market Studies* 10.1111/jcms.13462; Akash Kapur (29 January 2024) 'Can the Internet be Governed?' *The New Yorker* https://www.newyorker.com/magazine/2024/02/05/can-the-internet-be-governed

[131] *See* Josef Schumpeter, 'Capitalism, Socialism and Democracy'. Referred to as '*schöpferische Zerstörung*' in German, this creative destruction is the *tour de force* that in the words of Schumpeter, lead to waves of creation and destruction, and innovation in an economy.

[132] United States of America et al v. Google LLC (Case No. 20-cv-3010, 2024 WL 3647498 D.D.C. 5th August 2024) p. 164.

[133] *See* sub-section 4.4 'Cloud as a part of the Ecosystem' *supra* and sub-section 5.2 'Sovereignty, Contestability and Fairness in the Cloud' *infra* for a detailed account of ecosystem effects in the cloud.

[134] The Economist used this term to refer together to the group of tech giants, Alphabet, Amazon, Apple, Meta, Microsoft, Nvidia and Tesla, that together added $3.4 trillion (or 50%) of their combined market value in just one financial year, 2023-2024. *See* 'How the "Magnificent Seven" misleads: Forget the supergroup of stockmarket darlings' (27 March 2024) *The Economist* https://www.economist.com/finance-and-economics/2024/03/27/how-the-magnificent-seven-misleads

[135] Alphabet Announces First Quarter 2026 Results, https://s206.q4cdn.com/479360582/files/doc_financials/2026/q1/2026q1-alphabet-earnings-release.pdf

[136] Inlandsproduktberechnung – Erste Jahresergebnisse – Fachserie 18 Reihe 1.1 – 2025 https://www.destatis.de/DE/Themen/Wirtschaft/Volkswirtschaftliche-Gesamtrechnungen-Inlandsprodukt/Publikationen/Downloads-Inlandsprodukt/inlandsprodukt-erste-ergebnisse-xlsx-2180110.html

[137] Luciano Floridi, 'The Fight for Digital Sovereignty: What It Is, and Why It Matters. Especially for the EU' pp. 370-371.

[138] John David Michels, 'Sovereign Cloud for Europe: Independent Research Report Prepared for Broadcom' (February 2025) pp. 4-5.

[139] Autoriteit Consument and Markt 'Market Study Cloud Services' Case no. ACM/21/050317/ Document no. ACM/INT/440323, p. 14.

[140] Autoriteit Consument and Markt 'Market Study Cloud Services' Case no. ACM/21/050317/ Document no. ACM/INT/440323, p. 14.

[141] Questions related to Gaia-X, https://gaia-x.eu/faq/

IaaS, PaaS and SaaS, a new service, called, 'sovereignty-as-a-service' model.[142] Amazon, once again, was the first mover to respond to the EU's call for 'data sovereignty', as it launched its 'Digital Sovereignty Pledge' , wherein it promised to offer Amazon Web Services as 'sovereign-by-design'.[143] This was soon followed by Microsoft, with its 'Microsoft Cloud for Sovereignty program'[144] that in its current form, promises to offer 'end-to-end AI data-processing in Europe as part of EU Data Boundary' programme.[145] Google was the last amongst the three hyperscalers to offer its 'Digital Sovereignty Explorer' in March 2023.[146] These sovereignty-driven services promise protection of 'customers' interests [from potential] external threats, "disruptive geopolitical events" [and thereby guarantee] sovereignty'.[147] Gaia-X, thus, enforced 'compliance by design', and cloud companies, including the hyperscalers, provided that they met the requirements, could join the initiative.[148] This led to administrative concerns as to whether Gaia-X initiative was truly sovereign and whether hyperscalers may have again rigged the rulebook to engage in 'sovereignty washing', as compliance with 'data residency' requirements is not the same as ensuring 'data sovereignty'.[149] To address this gap, the Commission has introduced the Cloud Sovereignty Index, SEAL[150] that measures the degree of sovereignty along a range of parameters and ensure that users enjoyed greater control on their data stored on the cloud. This measure will henceforth be central to procurement of cloud services in the EU.

Connecting the cloud sovereignty debate with competition law and regulation, considerations of innovation, fairness, and contestability too come into play – issues that, together, on account of their non-quantifiable nature, be deemed as non-economic dimension of competition.[151] While economic parameters of competition can be easily quantified to develop a suitable theory of harm, non-price parameters of competition, such as innovation, product differentiation, data protection and privacy and sustainability are persistent challenge for competition authorities.[152] To this indicative list, one may add, new and emerging policy considerations such as 'strategic sovereignty, digital and technological sovereignty'.[153] Cloud sovereignty is not only a strategic and data consideration in light of the value of sensitive data stored on the cloud, in the opinion of the author, as discussed above, it is also a question of innovation and infrastructure sovereignty. The following discussion accordingly, integrates 'cloud sovereignty' in the discourse on contestability and fairness in the digital markets.

5.2. Sovereignty, contestability and fairness in the cloud

Sovereignty, as the foregoing discussion illustrates, is a key dimension of cloud, as cloud enables 'vertical scalability by consolidating "operations" [with hyperscalers] to maximize reach and efficiency'.[154] Cloud creates 'novel infrastructural dependencies', and this 'technical infrastructure', offers control over 'political and economic power struggles [that in turn] shape internet governance'.[155] Simply put, dependence on cloud, can change the very architecture of control, and internet governance framework. Another related aspect is the position of the cloud in the digital ecosystem. In the physical world, one uses physical infrastructure such as road, railways and public transport to travel from one place to another. In the digital world, cloud is the fundamental layer that enables migration, storage and management of data.[156] Cloud is situated in the upstream market at the infrastructural layer, which makes it a key input to engage in any data-driven activity or digital innovation. Viewed from this lens, cloud is not a product, rather 'it is a *production environment* for digital services'.[157] This fundamental position of the cloud makes in central to its role in innovation as well as a gatekeeper of digital self-sovereignty[158].

From the lens of innovation, today the nature of innovation too has changed considerably. Innovation is no longer confined to the R&D labs. Innovation in digital markets, thanks to large language models (LLMs), AI and quantum computing, has been virtualized [159], meaning access to digital infrastructure is the equivalent of access to infrastructure to engage in research and development (R&D). Consider for example, the

[142] Alexandre Costa Barbosa and Rafael Grohmann, 'Big Tech Sovereignty: Platforms and Discourse of Sovereignty-as-a-Service'

[143] Matt Garman, 'AWS Digital Sovereignty Pledge: Control without Compromise' (27 November 2022) *Amazon Web Services* https://aws.amazon.com/blogs/security/aws-digital-sovereignty-pledge-control-without-compromise/

[144] https://www.microsoft.com/en-us/ai/sovereign-cloud

[145] Doughlas Philips, 'Microsoft strengthens sovereign cloud capabilities with new services' (4 November 2025) *Microsoft Azure Blog* https://azure.microsoft.com/en-us/blog/microsoft-strengthens-sovereign-cloud-capabilities-with-new-services/

[146] Google Cloud, 'Announcing Google Cloud's new Digital Sovereignty Explorer' (23 March 2023) https://cloud.google.com/blog/products/identity-security/announcing-google-clouds-new-digital-sovereignty-explorer

[147] Alexandre Costa Barbosa and Rafael Grohmann, 'Big Tech Sovereignty: Platforms and Discourse of Sovereignty-as-a-Service' pp.3-4.

[148] Andreas Baur, 'European ambitions captured by American clouds: digital sovereignty through Gaia-X?' (17 June 2025) *Information, Communication and Society* https://www.tandfonline.com/doi/full/10.1080/1369118X.2025.2516545#d1e183

[149] Christine Horton, 'Gaia-X warns US hyperscalers about selling cloud sovereignty' (19 December 2025) *Channel Dive* https://www.channeldive.com/news/gaia-x-warns-us-hyperscalers-about-selling-sovereignty/807362/; John David Michels, 'Sovereign Cloud for Europe: Independent Research Report Prepared for Broadcom' (February 2025) p.10.

[150] More recently, the Commission has released a Sovereignty Effectiveness Assurance Level (SEAL), that offers a Minimum Assurance Level, that cloud service provider 'must reach for each Sovereignty Objective' to participate in tenders by the European institutions. *See* European Commission, Director General for Digital Services (2025) 'Cloud Sovereignty Framework Version 1.2.1 – Oct. 2025' https://commission.europa.eu/document/09579818-64a6-4dd5-9577-446ab6219113_en. The document includes many a sovereignty objective, such as Strategic Sovereignty, Legal and Jurisdictional Sovereignty, Data & AI Sovereignty, Operational Sovereignty, Supply Chain Sovereignty, Technology Sovereignty, Security & Compliance Sovereignty and Environmental Sustainability.

[151] In an early discussion, and pre-DMA era, Monti shared examples from EU competition law to explain its limits to pursue the policy goal of digital sovereignty. *See* Giorgio Monti, 'EU competition law and digital sovereignty' pp. 46-52 in Deniss Broeders (eds) Digital Sovereignty: From Narrative to Policy? The Hague Program on International Cyber Security (December 2022).

[152] Cf Alexander Iken, Terézia Kianičková, Marion Bailly, Andrea Usai, Gabor Koltay, Stephan Simon, 'Non-price Competition: EU Merger Control and Case Practice' in European Commission, *Competition Policy Brief* (April 2024) pp. 1-15.

[153] The author would like to thank Viktoria Morozovaite for highlighting the link between market power and sovereignty in the context of cloud computing. The author would also like to thank Tjaša Petročnik for bringing to her attention the issue of sovereignty as a non-price parameter of competition in the context of another research project.

[154] Corinne Cath, 'Cloud drift: how hyperscaler cloud computing shapes internet governance' *Information, Communication & Society* (4 May 2026) p. 3

[155] Corinne Cath, 'Cloud drift: how hyperscaler cloud computing shapes internet governance' *Information, Communication & Society* (4 May 2026) p. 3, p. 6

[156] Nathan Ensmenger, 'The Cloud is a Factory' in Thomas S. Mullaney, Benjamin Peters, Mar Hicks and Kavita Philip (Eds) *Your Computer is on Fire* (2021, The MIT Press) https://doi.org/10.7551/mitpress/10993.001.0001

[157] *See* reference to Agathe Balayn and Seda Gürses (30 September 2024) 'Misguided: AI Regulation Needs a Shift in Focus' *Internet Policy Review Vol. 13 No. 3* in Sara Chander and Seda Gürses (15 October 2024) 'From Infrastructural Power to Redistribution: How the EU's Digital Agenda Cements Securitization and Computational Infrastructures (and How We Build Otherwise)' *AI Now Institute* https://ainowinstitute.org/publications

[158] *See* for example, Q.A. Stokkink (2024) 'Systems for Digital Self-Sovereignty' Dissertation *TU Delft, Delft University of Technology* https://doi.org/10.4233/uuid:f3ed96a3-c436-4027-a3fc-5c22a9ee905d

[159] *See* discussion in Section 4.2 *supra.* Notably, see footnote 77 therein.

case of Google Deep Mind, wherein complex protein structures that would otherwise take hundreds of qualified scientists spend thousands of hours in research labs, could be discovered in a fraction of that time period, by using large langue models, a breakthrough discovery for which its inventors also received the Nobel Prize for Chemistry in 2024.[160] As R&D gets complex and inter-disciplinary, it calls for access to high quality and cutting edge digital infrastructure, and control over infrastructure means access to the possibilities to engage in research for innovation and disruptive breakthroughs. 'Big data analytics' is in fact one of the key application areas of IaaS.[161] When OpenAI uses the infrastructure of the hyperscaler, Microsoft Azure to train its generative AI models, GPTs including the ChatGPT, organizational capabilities are used at the IaaS level. ChatGPT is a SaaS, that is run and managed on the infrastructure (IaaS and PaaS) offered by Microsoft Azure. Additionally, and increasingly, IoT (internet of things) too is an important source of data. Making timely and meaningful inferences requires real-time processing and IoT app development, deployment and updates, which is a requirement that is met at the level of PaaS.[162] This data can then also qualify as an input to train the generative AI models.[163] Control over cloud by the hyperscalers thus, cannot be seen in isolation. Cloud, data, and other inputs at the infrastructure layer are, in fact, elements of an ecosystem'[164] which together create an interoperable infrastructure comprising of compatible hardware, software and qualified personnel trained to work in these ecosystems (in other words, learning effects). The issue is therefore, not just limited to market power and conduct in the relevant markets. It is also equally important to take into account the larger societal impact, which may not seem economic at the outset, however, they do carry significant non-economic considerations which in turn have long term economic implications on innovation, R&D, and growth of the economy.[165]

Control over cloud, the critical infrastructure offers Amazon, Microsoft and Google, significant market power. This market power when coupled with the ecosystem of services offered by these gatekeepers (referred so, under the DMA), who are also hyperscalers in the cloud (referred so in the market studies by the Dutch, UK and French competition authority), offers them a position of advantage to work independent of the larger societal concerns. It offers these platforms a power that is not just limited to the relevant market. Instead, the sphere of this market power extends to the individuals, and the society at large.[166] This power is not only about 'platforms exert[-ing] control over markets but also the power to create markets'.[167]

It is important to bridge this understanding of ecosystems between business strategy literature, wherein the notion is relatively well-established with its understanding in competition and regulation, where the definition is still evolving. Antitrust enforcers frequently use the term ecosystem in the context of digital markets that involve multi-sided platforms (MSPs).[168] These two concepts are often referred to interchangeably. In the Meta/Kustomer merger, the Commission observed that 'lock-in effect and network effects are […] crucial characteristics of ecosystems'[169], an observation that further underscores the inter-wined nature of platforms and ecosystems. Ecosystems may be platform-based, or they may be non-platform-based. What makes ecosystem based platforms special is that in an ecosystem-based platform, governance must always be 'centralised'.[170] In Bookings/eTraveli, the European Commission's 'first ecosystem prohibition decision', the ecosystem effects emerged as Bookings offered 'multiple complimentary activities – hotel bookings, flights, and car rentals – possibly a "travel ecosystem" which the acquisition of eTraveli was seen to cement further'.[171]

An ecosystem may be defined as the 'alignment structure [of the interests of different partners that must] interact [for] focal value proposition to materialize'.[172] While there are many competing notions and understandings of ecosystems, Jacobides, Baldwin and Clark's emphasis on 'networks with strong complementarities [as] ecosystems'[173] , offers a good foundation to locate cloud computing, and this is also the context in which cloud computing is referred to in the Digital Markets Act (DMA), and the accompanying Staff Working Documents (SWD), as discussed in Section 6 *infra*.

Before developing the legal framework, it may also be vital to bridge the normative gap, by adding to 'sovereignty', 'innovation' and 'ecosystem', two additional terms, 'fairness' and 'contestability', that are also the foundational principles of the DMA. As one may observe, these concepts are not only fluid, but some of them, and most notably, 'sovereignty' and 'fairness' also carry a non-economic dimension.

To swiftly respond to competition concerns in the digital markets, the European Union took the lead by adopting the DMA. Though the goals of the DMA have been widely debated and discussed in literature, a common thread that runs through this discussion is that the DMA seeks to promote 'contestable' and 'fair' markets[174]. Underpinned by faster innovation cycles, digital markets are a moving target. At the time the DMA entered force, GAMMA's position of strength in the digital markets was a key area of concern. Enforcement of the provisions of Article 102 of the Treaty on the Functioning of the European Union (TFEU) was relatively slow and remedies

[160] Jumper J, Evans R, Pritzel A, Green T, taurnov M, Ronneberger O, Tunyasuvunakool K, Bates R, Žídek A, Potapenko A, Bridgland A, Meyer C, Simon A, Kohl A, Ballard AJ, Cowie A, Romera-Paredes B, Nikolov S, Jain R, Adler J, Back T, Petersen S, Reiman D, Clancy E, Zielinski M, Steinegger M, Pacholska M, Berghammer T, Bodenstein S, Silver D, Vinyals O, Senior AW, Kavukcuoglu K, Kohli P and Hassabis D, 'Highly accurate protein structure prediction with AlphaFold' (2021) *Nature* <https://www.nature.com/articles/s41586-021-03819-2> accessed 21 December 2025. (Jumper et al, 2021)

[161] Chrystal R. China and Michael Goodwin, 'IaaS, PaaS, SaaS: What's the difference?' *IBM Think* https://www.ibm.com/think/topics/iaas-paas-saas

[162] Chrystal R. China and Michael Goodwin, 'IaaS, PaaS, SaaS: What's the difference?' *IBM Think* https://www.ibm.com/think/topics/iaas-paas-saas

[163] For a taxonomy of data, and discussion on how different types of data are used to train generative AU models, and how the digital gatekeepers enjoy *de facto* control over this data, *see* Kalpana Tyagi, 'Synthetic Data, Data Protection and Copyright in an Era of Generative AI' (2025) *JIPITEC*.

[164] Tamar Sharon and Raphaël Gellert, 'Regulating Big Tech Expansionism? Sphere Transgression and the Limits of Europe's Digital Regulatory Strategy' *Information, Communication & Society*

[165] Corinne Cath, 'Cloud drift: how hyperscaler cloud computing shapes internet governance' *Information, Communication & Society* (4 May 2026)

[166] Inge Graef and Friso Bosteon, 'A typology of platform power and its regulation' *Information Communication and Society* pp. 1-11.

[167] Inge Graef and Friso Bosteon, 'A typology of platform power and its regulation' *Information Communication and Society* p. 4.

[168] Giuseppe Colangelo (2025) 'Do ecosystems exist in EU competition law?' *European Law Review (forthcoming) Pre-print available at SSRN* p. 7 https://papers.ssrn.com/sol3/papers.cfm?abstract_id=5408647.

[169] Antoni Napieralski and Joanna Mazur, 'The European Commission's understanding of the term 'ecosystem': lessons for the future enforcement under the revised *Notice on the Definition of the Relevant Market*' (2025) *Journal of Antitrust Enforcement* p. 10

[170] Michael G. Jacobides, Carmelo Cennamo and Annabelle Gawer, 'Externalities and complementarities in platforms and ecosystems: From structural solutions to endogenous failures' (2024) Research *Policy* p. 53

[171] Cristina Caffarra, Annabelle Gawer and Michael G. Jacobides, 'Mapping Antitrust onto Digital Ecosystems' (April 2024) *CPI Antitrust Chronicle* p. 4

[172] Ron Adner (2017) 'Ecosystem as Structure: An Actionable Construct for Strategy' *Journal of Management Vol. 43 No. 1* p. 42 <DOI: 10.1177/0149206316678451>

[173] Marcel Bogers, Jonathan Sims and Joel West (2019) 'What *Is* an Ecosystem? Incorporating 25 Years of Ecosystem Research' *Academy of Management* DOI: 10.5465/AMBPP.2019.11080abstract

[174] *See* for example, OECD (19 June 2025) 'Competition in the Provision of Cloud Computing Services – Note by the European Union' DAF/COMP/WD (2025)39, p. 7.

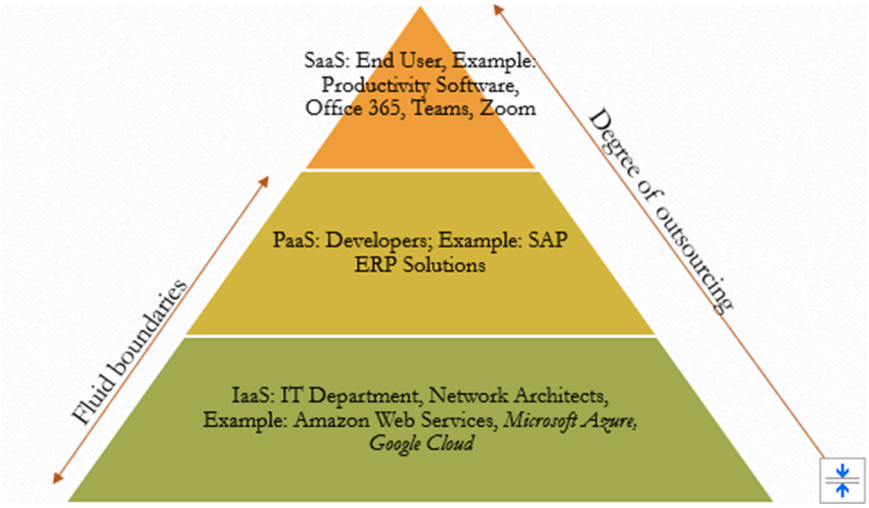

Fig. 2. Cloud 'as a service' model [Visual representation based on author's understanding of the Cloud computing services market].

somewhat ineffective when compared with the fast moving nature of these markets.[175] DMA and the Data Act are expected to contribute to remedy this market failure, by creating a 'fair' and 'contestable' market design.[176] Even though 'fairness' has oftentimes been 'criticised [as a criterion] for its substantive indeterminacy, it is nevertheless the cornerstone of the DMA's normative rationale', an observation that becomes evident from its purpose, origin and 'asymmetric design' of obligations.[177] The notion, in turn, has its roots in EU's ordoliberal thinking (with further follow-on roots in the German Freiburg school), the US' Harvard and Brandeisian schools of thought, that in their old virtuous tradition envisioned, 'targeting economic power and concentration, [and] protecting the idea of free and unrestrained' competition.[178] This understanding of 'fairness' is also visible in the obligations on the gatekeepers, that oftentimes seek to restore the bargaining leverage that digital conglomerates enjoy in the ecosystem.[179] 'Fairness' principle is also deeply embedded in the Data Act, that takes into account 'the public-private data ecosystem'[180] and this 'fairness' principle resonates in the call for fair [access to] data and fair competition[181]. In the context of the Data Act, 'fairness' takes two meanings – first, an allocative meaning of fairness, that 'allocation, by law, of (the use of and value generated from) data to those who generate that data', and second, redistributive approach, which intends to 'correct' an inbuilt market failure in the digital markets, by offering a level playing field to different players in the market.[182]

The DMA seeks to make markets fair and contestable. Crémer et al offer a visual model to explain the meaning of these terms, the authors identify 'contestability' as a scenario whereby a handful of market players, based on their market power, can freely determine terms that are unfavourable to their users and competitors.[183] The term contestability, owing its origins to Baumol's classic work, refers to a scenario wherein, in the words of Baumol, 'entry is absolutely free, and exit is absolutely costless'.[184] Digital markets today clearly face substantial barriers to market entry and exit, an observation that is particularly true for the cloud computing industry.

Having situated the challenges of the cloud infrastructural layer in an ecosystem setting, and offered a working framework for and economic and non-economic considerations of sovereignty, innovation, fairness and contestability; the following section reflects on the legal framework that can potentially address the foregoing non-economic as well as economic concerns in the cloud.

6. The legal framework

Cloud computing is complex, and EU offers a multifaceted legal framework to address sovereignty, contestability and fairness concerns in the cloud. Section 6.1 offers the overarching legal framework, followed by section 6.2 that concentrates on the DMA, and section 6.3 focusses on the

[175] Giogio Monti, 'The Digital Markets Act: Improving its Institutional Design' (2021) *European Competition and Regulatory Law Review* 5(2) https://core.lexxion.eu/list/articles/keyword/DMA?page=2; Natalia Moreno Belleso and Nicolas Petit, 'The EU Digital Markets Act (DMA): A competition Hand in a Regulatory Glove' (2023) *European Law Review*

[176] Inge Graef and Friso Bosteon, 'A typology of platform power and its regulation' *Information Communication and Society* pp. 7-8.

[177] Juliane K. Mendelsohn, 'Fairness in the Digital Markets Act' in Pieter Van Cleynenbreugel and Ljupcho Grozdanovski (eds.) *The Standards of Fairness in Digital Law: The Normative Foundations of the Data, Data Governance, Digital Services, Digital Markets and Artificial Intelligence Acts* (Edward Elgar 2025) p. 64.

[178] Juliane K. Mendelsohn, 'Fairness in the Digital Markets Act' in Pieter Van Cleynenbreugel and Ljupcho Grozdanovski (eds.) *The Standards of Fairness in Digital Law: The Normative Foundations of the Data, Data Governance, Digital Services, Digital Markets and Artificial Intelligence Acts* (Edward Elgar 2025) p. 65.

[179] Cf Giuseppe Colangelo (2023) 'In Fairness We (Should Not) Trust: The Duplicity of the EU Competition Policy Mantra in Digital Markets' 68 *Antitrust Bulletin*.

[180] Laura Dreschler and Charlotte Ducuing, 'The notion of fairness in the Data Governance Act and the Data Act' in Pieter Van Cleynenbreugel and Ljupcho Grozdanovski (Eds) *The Standards of Fairness in Digital Law: The Normative Foundations of the Data, Data Governance, Digital Services, Digital Markets and Artificial Intelligence Acts* (Edward Elgar 2025) p. 96.

[181] Laura Dreschler and Charlotte Ducuing, 'The notion of fairness in the Data Governance Act and the Data Act' in Pieter Van Cleynenbreugel and Ljupcho Grozdanovski (Eds) *The Standards of Fairness in Digital Law: The Normative Foundations of the Data, Data Governance, Digital Services, Digital Markets and Artificial Intelligence Acts* (Edward Elgar 2025) p. 104, 105. See also the references therein.

[182] Laura Dreschler and Charlotte Ducuing, 'The notion of fairness in the Data Governance Act and the Data Act' in Pieter Van Cleynenbreugel and Ljupcho Grozdanovski (Eds) *The Standards of Fairness in Digital Law: The Normative Foundations of the Data, Data Governance, Digital Services, Digital Markets and Artificial Intelligence Acts* (Edward Elgar 2025) p. 114-115

[183] Jacques Crémer, Gregory S. Crawford, David Dinielli, Amelia Fletcher, Paul Heidhues, Monika Schnitzer and Fiona M. Scott Morton (2023) 'Fairness and Contestability in the Digital Markets Act' p. 979 https://www.yalejreg.com/wp-content/uploads/Fairness-and-Contestability-in-the-Digital-Markets-Act.pdf.

[184] William J. Baumol (1982) 'Contestable Markets: An Uprising in the Theory of Industry Structure' 73 American Economic Review, as also discussed in Jacques Crémer, Gregory S. Crawford, David Dinielli, Amelia Fletcher, Paul Heidhues, Monika Schnitzer and Fiona M. Scott Morton (2023) 'Fairness and Contestability in the Digital Markets Act' p. 991 https://www.yalejreg.com/wp-content/uploads/Fairness-and-Contestability-in-the-Digital-Markets-Act.pdf.

Data Act. The focus remains on the DMA and the Data Act, as these legal instruments are best suited to address the economic and non-economic concerns, as discussed in sections 3 to 5 *supra*, in the cloud computing sector. Furthermore, these legislative instruments also directly impact contestability and fairness in IaaS and PaaS (see section 2 *supra*), the infrastructural layer in cloud computing.

6.1. Overarching legal framework

The EU has a complex interplay of different legislative frameworks applicable to cloud computing. Notable in this regard is the relationship between the Data Act and the DMA on the one hand, and the interplay between the Data Act, the DMA and the GDPR on the other. Common to the Data Act and the DMA is that they are regulations grounded in an economic rationale and are applicable to personal as well as non-personal data.[185] The EU GDPR, on the other hand, is grounded in a fundamental rights framework, and offers a safeguard for the right to data protection.[186]

Additionally, other areas can also be enablers of competition in the cloud. Three notable examples emerge, which merit mention to make a complete discussion. First, procurement can be an important enabler of competition in the cloud. Microsoft and AWS, for instance, have won some of the largest contracts in the US in recent times, which has contributed to their continued position of strength in the global cloud computing industry. For example, in October 2019, Microsoft won the US Government's JEDI Cloud Contract, that will offer the US Department of Defence (since renamed as the US Department of War[187]) IaaS and PaaS cloud computing services.[188] In case the US Government exercises all the options agreed to under this 'fixed-price, indefinite-delivery/indefinite-quantity contract', it may earn Microsoft a total of ten billion US dollars over a ten year period.[189] Procurement of public contracts can influentially shape the conditions of competition in cloud.[190] In light of this, the Commission recently came up with the sovereign cloud index, as also referred to in section 5 *supra*. Considering the complex analysis required therein, this issue merits critical examination and can substantially benefit from further research.

Another valuable instrument is the Digital Services Act. The Digital Services Act offers a harmonized framework of obligations in the digital environment, keeping into consideration the need for the protection of fundamental rights.[191] Article 3(g) categorizes intermediaries into a 'mere conduit', a 'caching' service, or a 'hosting service'. Depending on the category and the nature of the intermediary, the DSA offers a graded liability framework. Recital 13 of the DSA clarifies that when cloud computing services offer an infrastructure, 'such as the underlying infrastructural storage and computing services of an internet-based application, website or online platform', then they *cannot* be deemed as an online platform. In such a scenario, cloud computing is exempt from liability 'to the extent that their services qualify as …. "hosting" services'.[192] Considering that cloud is not seen as a mere conduit or a cache, but as a hosting service, it must comply with higher level of requirements, as cloud service providers are deemed an important player to 'tackle illegal content online', in light of their role in storing and offering access to content.[193] To appreciate the dynamics of online content hosting and access thereto, one must also be cognisant of the provisions in the EU Copyright in the Digital Single Market Directive (EU CDSM)[194]. This interplay again, can be an interesting area for further research, particularly in the context of regulating illegal content as well as access to training data for generative AI models, as available on the cloud.

Third, considering Microsoft's incumbency advantage in productivity software, its licensing practices may also influence the choice of a cloud service provider.[195] Microsoft for instance limits the availability of certain products on AWS and Google.[196] For Microsoft, this means a positive spill-over for all the models of cloud computing – namely, SaaS, and IaaS and PaaS, with the latter two also being are more central to training generative AI models. The Commission's recent decision in the Microsoft Teams I and II case also carries relevant threads for a nuanced analysis of the ecosystem effects.[197] However, this decision relates to the SaaS layer of cloud computing, and is therefore, not developed at length in this article.

Filtering out the foregoing relevant legal frameworks, this

[185] Kalpana Tyagi, 'Synthetic Data, Data Protection and Copyright in an Era of Generative AI' (2025) *JIPITEC* p. 178

[186] Kalpana Tyagi, 'Synthetic Data, Data Protection and Copyright in an Era of Generative AI' (2025) *JIPITEC* 178.

[187] The US Department of Defence has been renamed as the Department of War. Bernd Debusmaan Jr., 'Trump rebrands Department of Defense as Department of War' (5 September 2025) *BBC* https://www.bbc.com/news/articles/cgr9r4qr0ppo

[188] US Department of War, 'Contracts For October 25, 2019' https://www.war.gov/News/Contracts/Contract/Article/1999639/.

[189] US Department of War, 'Contracts For October 25, 2019' https://www.war.gov/News/Contracts/Contract/Article/1999639/.

[190] CMA, 'Cloud Infrastructure Services: Final decision report' (31 July 2025), pp. 248-249, p. 214 https://www.gov.uk/cma-cases/cloud-services-market-investigation

[191] Cf Recital 9 and Article 1, Digital Services Act. The first sentence of recital 9 of the DSA states as follows: This Regulation fully harmonises the rules applicable to intermediary services in the internal market with objective of ensuring a safe, predictable and trusted online environment, addressing the dissemination of illegal content online and the societal risks that the dissemination of disinformation or other content may generate, and within which fundamental rights enshrined in the Charter are effectively protected and innovation is facilitated.

[192] Recital 28, DSA. The relevant sentence from the recital reads as follows. 'Since 2000, new technologies have emerged that improve the availability, efficiency, speed, reliability, capacity and security of systems for the transmission, "findability" and storage of data online, leading to an increasingly complex online ecosystem. In this regard, it should be recalled that providers of services establishing and facilitating the underlying logical architecture and proper functioning of the internet, including technical auxiliary function, can also benefit from the exemptions from liability set out in this Regulation, to the extent that their services qualify as "mere conduit", "caching" or "hosting services". Such services may include, as the case may be, wireless local area networks, …. **cloud infrastructure services**, or content delivery networks, that enable, locate or improve the functions of other intermediary services….'. Recital 29 of the DSA further clarifies thus: '…. Examples of **'hosting services'** include categories of services such as **cloud computing,** web hosting, ….' [emphasis added]

[193] Cf Recitals 50-56, 62, 120 and Article 6, 15 and generally, Section 2 Additional provisions applicable to providers of hosting services, including online platforms.

[194] João Pedro Quintais and Sebastian Felix Schemer. 'The Interplay between the Digital Services Act and Sector Regulation: How Special is Copyright?' (2022) *Journal of Risk Regulation*

[195] *See* Chapter 7. Licensing in CMA, 'Cloud Infrastructure Services: Final decision report' (31 July 2025), p. 390 usw https://www.gov.uk/cma-cases/cloud-services-market-investigation

[196] *See* Chapter 7. Licensing in CMA, 'Cloud Infrastructure Services: Final decision report' (31 July 2025), p. 390 usw, pp. 453-455, wherein the CMA observes that 'modernisation attempts by AWS and Google have had a limited effect on moving customers away from Microsoft software products' https://www.gov.uk/cma-cases/cloud-services-market-investigation

[197] See Microsoft Teams, AT. 40721 and Microsoft Teams, II, AT. 40873. Kalpana Tyagi, 'Competition in Software-as-a-Service: Commission's settlement decision in Microsoft Teams I and II' (*forthcoming*, 2026), copy available on request. *See* also deiscussion in sections 4 and 5 *supra*.

contribution will now zoom in on the DMA and the Data Act.[198] An ex-ante regulatory approach offers a more flexible framework to address contestability concerns in cloud.[199] Competition law may be best suited to '*protect* competition', while the DMA, 'also seeks to *promote* competition by lowering barriers to entry'.[200] 'Fairness', 'contestability', and non-economic considerations, such as 'sovereignty'[201] also help shape 'enforcement priorities' in competition and regulation[202].

6.2. DMA and cloud computing

At the interface of cloud computing and the DMA, two key questions, as discussed next, emerge. The first question is as to why even though 'cloud computing' qualifies as a CPS and the hyperscalers are also the gatekeepers under the DMA, does cloud computing, at least so far, remain uncaught by the DMA? Second and related consideration is what obligations in the DMA will be applicable to cloud and whether they will be sufficient to facilitate contestability in cloud computing.[203] A follow-on question is that competition concerns that may remain unaddressed under the current form and framework of the DMA, can they be better addressed under the EU Data Act (section 6.3)?

6.2.1. Qualifying cloud as CPS in the DMA

Article 2(2)(i) of the DMA qualifies 'cloud computing services' as a CPS. The three hyperscalers, namely, Microsoft, Amazon and Google are also gatekeepers under the DMA. This leads to the question why any cloud computing service is yet to be qualified as a CPS, even though several academic scholars, including in their submission to the 2025 consultation on the revision of the DMA, underscored the need to qualify cloud computing as a CPS.[204]

As per article 3(1)(b) to qualify as a 'gatekeeper', an undertaking must offer a core platform service that is an 'important gateway for business users to reach end users'.[205] If quantitative thresholds as prescribed in Article 3(2) are fulfilled, then an undertaking is presumed to have met the respective qualitative requirements in Article 3(1). Amazon and Microsoft evidently meet the turnover requirement of Euro 7,5 billion in the preceding three financial years, and market capitalisation of Euro 75 billion in the preceding year. The key challenge is as regards meeting the requirements in Article 3(2)(b), and for a period of three consecutive financial years (Article 3(2)(c)). As per the quantitative thresholds under Article 3(2)(b), this requirement under Article 3 (1)(b) is deemed to have been met where the undertaking offers a core platform service 'that in the last financial year has at least 45 million monthly active end users established or located in the Union and at least 10,000 yearly active business users established in the Union'. To calculate these numbers, the appropriate methodology is provided for in Annex E of the DMA. The Annex to the DMA offers guidance to determine the number of active end users and business users for a CPS. As regards cloud computing, the methodology to calculate the end users and the business users is deemed unclear as the annex is silent on the determination of the 'relationship between business and end users', how the two must interact, and how should this 'interaction be intermediated' by cloud computing services'.[206]

As the interpretation that the CPS be an important gateway for business users to reach end users has been central to the Commission's recent designation decisions[207], foregoing factor has been a key hindrance to the designation of cloud as a CPS.

'Multi-sidedness' of platforms has been seen as a pre-requisite to qualify as CPS. Recitals 2, 13 and 25 of the DMA bring to light the need for the CPS to be multi-sided, as such an arrangement endows the platform with certain natural advantages such as scale economies, near zero marginal costs, lock-in, strong network effects, and data-driven advantages. The focus on the 'multi-sided' nature of the CPS is also visible in the Commission's Impact Assessment, wherein it evaluated whether digital streaming services be considered as digital services. The response thereto was in the negative, grounded in the rationale that these services were not 'multi-sided', and thereby, could not qualify as a CPS.[208] Considering that cloud services are neither multi-sided, nor do they function as an intermediary, there has been a consistent hesitation on the part of the Commission to qualify them as CPS.[209]

If one were to accept a strict multi-sided view on designation and the quantitative thresholds,[210] then cloud does not qualify as a CPS under the DMA.

However, such a restrictive approach, as is the thesis of this research contribution, is deterring and defeats the core objective of the DMA, which is to promote 'fairness' and 'contestability' in the digital markets. A restrictive 'quantitative' view of the DMA, in the opinion of the author,

[198] In its 2025 report, the UK's CMA recommended remedying competition concerns in the cloud through designation of Microsoft and AWS with a strategic market status (SMS) by the CMA Board by using its powers under the DMCC Act. Even though the CMA had the possibility to impose remedies based on the investigations, it chose to refer the matter to the CMA Board for designation under the DMCC Act https://www.gov.uk/cma-cases/cloud-services-market-investigation; Peter Whelan, 'Software licensing and the UK's Cloud Services Market Investigation: A Missed Opportunity to Remedy Anticompetitive Practices?' p. 21.

[199] https://www.gov.uk/cma-cases/cloud-services-market-investigation

[200] Friso Bosteon, 'Understanding the Digital Markets Act' (2023) *The Antitrust Bulletin* p. 4.

[201] See section 5.2 *supra.*

[202] Malaga, 'Transparent markets as fair markets? Defining 'fair' conditions for the provision of online intermediation services through rights: the case of the DMA' in Pieter Van Cleynenbreugel and Ljupcho Grozdanovski (Eds) *The Standards of Fairness in Digital Law: The Normative Foundations of the Data, Data Governance, Digital Services, Digital Markets and Artificial Intelligence Acts* (Edward Elgar 2025) p. 242.

[203] At the time of drafting this research contribution, the Commission launched three related markets investigations on cloud computing services under the Digital Markets Act. These considerations are also at the heart of the Commission's market investigations. *See* European Commission, 'Commission launches market investigations on cloud computing services under the Digital Markets Act' (Brussels, 18 November 2025) *European Commission* https://ec.europa.eu/commission/presscorner/detail/en/ip_25_2717

[204] The urgency and the need to qualify cloud computing as a cps has also been underscored by several academic contribution in the ongoing consultation on the revision of the DMA. Cf Oles Andriychuk, Rupprecht Podszun, Kena Zheng, Anush Ganesh, Sarah Hinck, and Jasper van den Boom, 'Consultation on the 2025 Review of the Digital Markets Act (DMA)'.

[205] Article 3(1)(b) DMA

[206] Konstantina Bania and Damien Gerardin, 'The regulation of cloud computing: why the European Union failed to get it right' *Information & Communications Technology Law* 33:1 p. 106.

[207] For a thorough discussion on the first round of designation that qualified six gatekeepers for a total twenty-two CPS, *see* Friso Bosteon and Giorgio Monti, 'The rhyme and reason of gatekeeper designations under the Digital Markets Act' (2025) *Journal of Antitrust Enforcement. See* also Alba Ribera Martínez, 'The Requisite Legal Standard of the DMA's Designation Process: The European Commission's Discretionary Powers Explained' *Kluwer Competition Law Blog* https://legalblogs.wolterskluwer.com/competition-blog/the-requisite-legal-standard-of-the-dmas-designation-process-the-european-commissions-discretionary-powers-explained/

[208] *See* for example, reference to 'Commission Staff Working Document – Impact Assessment Report Accompanying the Proposal for a Regulation of the European Parliament on contestable and fair markets in the digital sector (Digital Markets Act)', SWD (2020) 363 final (DMA Impact Assessment) as discussed in Konstantina Bania and Damien Gerardin, 'The regulation of cloud computing: why the European Union failed to get it right' *Information & Communications Technology Law* 33:1 p. 104.

[209] Ibid, p. 105; https://copenhageneconomics.com/insight/6-reflections-on-the-recent-designation-of-gatekeepers-under-the-dma/

[210] Lazar Radic (14 April 2026) 'Cloud Logic: The DMA's Search for a Gatekeeper' *Truth on the Market* https://truthonthemarket.com/2026/04/14/cloudy-logic-the-dmas-search-for-a-gatekeeper/

limits its ability to situate cloud as part of a larger ecosystem controlled by hyperscalers, that qualify as gatekeepers under the DMA, and impact sovereignty in the digital ecosystem (section 5 *supra*).

A follow on question emerges. If clouds do not qualify as multi-sided platforms, then why did they first find a mention as a CPS in the DMA? At the outset, it is important to underscore that the Commission refers to 'cloud services' in the context of ecosystems. It seems that cloud services are something distinct from online platforms, that 'act as intermediaries', which the DMA seeks to regulate.[211] To appreciate this, it may be helpful to once more turn to the Commission's IA. The term 'cloud services' appears about twenty-six times in the IA, and each time the discussion is made, the reference to cloud is made in the context of an ecosystem.[212] Gatekeepers are often 'vertically integrated players that operate a large ecosystem (e.g. cloud services)'[213].

All three hyperscalers are platform based ecosystems, and are accordingly, in certain settings, qualified as 'online platform ecosystem'.[214] 'Architectural concentration' helps large digital platforms act as gatekeepers in the ecosystems, a position of strength that is further reinforced by the atypical economic features of the platform economy.[215] Limited multi-homing, lack of interoperability and restricted switching possibilities further strengthen these ecosystem effects[216] – a fact that attracts detailed discussion in the Commission's impact assessment.

In the IA, the Commission observed that following key practices limit contestability in the cloud – first, limited interoperability and data portability, and customer lock-in due to high switching costs; second, bundling different services, including services in which the cloud provider is also a gatekeeper and third, the cloud service provider 'copying and using a software that other cloud providers have developed and used'.[217] Restrictive practices by cloud providers 'contribute[-s] to further concentration on the market', such that the less integrated market players or actors present in only niche segments are unable to meaningfully compete in the market[218].

An ecosystem, unlike the 'fully hierarchical [traditional] organisational model of an integrated firm', is comprised of multiple members, offering complementary services, with each player in the ecosystem exhibiting varying degrees of 'decisional independence'.[219] To understand harm in the digital economy, a wider ecosystem perspective, taking account of the infrastructural advantages may better and 'adequately embrace the contextual and infrastructural dimensions of data, algorithms, knowledge [….], technological capabilities, expertise and resources…'[220] and offer a better framework to account for the economic and non-economic harms in the digital markets.

Thus, the architecture of the industry is such that certain firms 'have significant agency in shaping institutional arrangements'[221], that help them capture a larger share of the value generated by the ecosystem of services. These firms, when they control a key resource, or occupy a central position in the ecosystem, such as the hyperscalers, become gatekeepers of the digital ecosystem.

These observations in the IA, when seen in light of our discussion in section 5 *supra*, and reference to literature on ecosystems, helps explain why cloud finds mention as a CPS in the DMA.

It is important to emphasise that this detailed view can, however, only be taken into account through qualitative designation of the gatekeepers, as it offers the space and flexibility to account for the nuanced dynamics of the cloud as part of an ecosystem.

The following sub-section, accordingly, offers a balanced view on the 'quantitative' versus 'qualitative' approach, and the need to turn to the latter, as in the opinion of the author, a 'qualitative' approach also does justice to the larger policy objectives of the DMA, namely, to ensure 'fair', and 'contestable' digital markets, that in turn, can also better account for the 'sovereignty' concerns in the cloud ecosystem[222].

6.2.1.1. A Qualitative approach to designate cloud as CPS. Having understood the underlying rationale for the placement of cloud as CPS in the DMA, the next consideration is whether the DMA offers the agility to qualify cloud computing service as a CPS? This question is also at the heart of the Commission's ongoing market investigations into cloud computing as well as its ongoing assessment of whether a qualitative designation route may be well suited to qualify AWS and Azure.[223]

DMA offers two possibilities for gatekeeper designation – a quantitative route and a qualitative route. As per Article 3 of the DMA, an undertaking that meets the qualitative requirements of having a significant impact on the internal market (Art. 3(1)(a)), offering a CPS which is an important gateway to reach end users (Art. 3(1)(b)) and enjoys or is expected to enjoy an entrenched and durable position (Art. 3(1)(c)),

[211] Konstantina Bania and Damien Gerardin, 'The regulation of cloud computing: why the European Union failed to get it right' *Information & Communications Technology Law* 33:1 p. 108; *See* also Jasper van den Boom, Sarah Hinck, Oles Andriychuk and Rupprecht Podszun, 'Digital Regulation Synthesis: Comparative Analysis of the DMA, Sec. 19a and the DMCCA' p. 32, wherein the authors argue Section 19a GWB may be better equipped to cover cloud-like services, that are yet to be designated as a CPS under the DMA.

[212] Commission Staff Working Document Impact Assessment Report, Accompanying the document Proposal for a Regulation of the European Parliament and of the Council on contestable and fair markets in the digital sector (Digital Markets Act), SWD (2020) 364 final, part 1/2, (Brussels 15.12.2020) at para 35 available here <https://digital-strategy.ec.europa.eu/en/library/impact-assessment-digital-markets-act>

[213] Ibid, at para 50 available here <https://digital-strategy.ec.europa.eu/en/library/impact-assessment-digital-markets-act>

[214] Cf Commission Staff Working Document Impact Assessment Report, Annexes Accompanying the document Proposal for a Regulation of the European Parliament and of the Council on contestable and fair markets in the digital sector (Digital Markets Act), SWD (2020) 363 final, part 2/2, (Brussels 15.12.2020) pp. 46, 77, 88, 89 available here <https://digital-strategy.ec.europa.eu/en/library/impact-assessment-digital-markets-act>

[215] *See* reference to J.F. Moore, 'Business ecosystems and the view of the firm' (2006) *The Antitrust Bulletin* 51(1) pp. 31-75 and M.G. Jacobides, 'What drives and defines digital platform power: understanding bottlenecks and gatekeepers – with an Apple/Tinder case study', *Evolution Ltd White Paper* (2021) in M.G. Jacobides and I. Lianos p. 1204.

[216] M.G. Jacobides and I. Lianos, 'Ecosystems and competition law in theory and practice' (2021) *Industrial and Corporate Change* p. 1204.

[217] Commission Staff Working Document Impact Assessment Report, Accompanying the document Proposal for a Regulation of the European Parliament and of the Council on contestable and fair markets in the digital sector (Digital Markets Act), SWD (2020) 364 final, part 1/2, (Brussels 15.12.2020) p. 44, para 386 (g) on p. 115 available here <https://digital-strategy.ec.europa.eu/en/library/impact-assessment-digital-markets-act>

[218] Commission Staff Working Document Impact Assessment Report, Accompanying the document Proposal for a Regulation of the European Parliament and of the Council on contestable and fair markets in the digital sector (Digital Markets Act), SWD (2020) 364 final, part 1/2, (Brussels 15.12.2020) p. 44 available here <https://digital-strategy.ec.europa.eu/en/library/impact-assessment-digital-markets-act>

[219] Ioannis Lianos, Klaas Hendrik Eller and Tobia Kleinschmitt, 'Towards a Legal Theory of Digital Ecosystems' Centre *for Law, Economics and Society Research Paper Series 2/2024* pp. 11-12.

[220] Tjaša Petročnik, 'Health data and 'big tech' firms: Towards a 'less economic' approach to EU competition law' (2025) *PhD Thesis,* Tilburg University P. 542. See also the references therein.

[221] Cristina Caffarra, Annabelle Gawer and Michael G. Jacobides, 'Mapping Antitrust onto Digital Ecosystems' (April 2024) *CPI Antitrust Chronicle* p.5.

[222] *See* Section 4 and 5 *supra.*

[223] European Commission, 'Commission launches market investigations on cloud computing services under the Digital Markets Act' (Brussels, 18 November 2025) *European Commission* https://ec.europa.eu/commission/presscorner/detail/en/ip_25_2717

shall be qualified as a gatekeeper. These requirements for designation 'are not expressed in figures'.[224]

Thus far, seven gatekeepers (Alphabet, Amazon, Apple, Booking, ByteDance, Meta and Microsoft) have been subject to the DMA as regards 23 CPS offered by them. [225] Commission has usually followed the quantitative route for designation.

Article 3(8) offers the possibility for a qualitative designation.[226] The Commission has designated gatekeepers on qualitative basis, when the quantitative criteria were not met.[227] The Commission for example followed a market investigation under Article 16(1) and 17(1) to ascertain whether Apple be designated as a gatekeeper under Article 3 (8) of the Regulation as regards it operating system iPadOS.[228] This was the first time, and so far the only time, that the Commission has used the qualitative procedure.[229] Commission's detailed reasoning and approach therein, such as its detailed discussion on end-user lock-in, business user lock-in, network effects, scale effects and entrenched and durable position[230], can be instructive while designating cloud as CPS.

Once designated, the presumption is rebuttable. Undertakings have successfully managed to rebut the gatekeeper qualification on the grounds that despite meeting the quantitative requirements, the qualitative threshold were not met. In ByteDance, the General Court (GC) viewed the difference between 'qualitative and quantitative arguments in the DMA's context as a purely artificial separation'.[231]

Before turning to iPadOS qualitative designation, it may also be useful to refer to the GC's recent annulment of the Commission decision to designate Meta as a gatekeeper as regards Facebook marketplace.[232] In the case at hand, the GC upheld the Commission's designation of Meta for its interpersonal communications service, Messenger. The GC, however, annulled the designation for Marketplace on the following two grounds. First, the Commission, in the opinion of the GC, should have assessed the factual situation at the time of the designation and not mechanically rely on the data in the preceding three financial years.[233] Second, the Commission did not sufficiently substantiate its reasoning, which in turn would have helped the applicant to better understand the Commission's 'justification for classifying Marketplace as an OIS [and facilitate] the Courts of the European Union to exercise their power of review'.[234] Thus, it was the lack of sufficient reasoning that led the Court to conclude the designation as unfounded. This implies that a qualitative route, if followed, must be complemented by robust reasoning and grounds.

In Facebook Marketplace, the GC also opined that Article 17(3) DMA is applicable in case undertakings offer CPS, that meet the thresholds set out in Article 3(2) DMA.[235] On the other hand, Article 17(1) DMA (which is relevant in the case of current ongoing investigations in cloud computing), has a different scope.

In the situation referred to in Article 17(1) of the DMA, it is necessary to examine whether an undertaking should be designated pursuant to Article 3(8) of the DMA or to identify the CPSs to be listed in the designation decision pursuant to Article 3(9) of the DMA, despite the fact that the undertaking or the CPSs in question do not satisfy the thresholds set out in Article 3(2) of the DMA. The reference to Article 3 (9) of the DMA in Article 17(1) of that regulation thus refers to situations where some of an undertaking's CPSs meet those thresholds, while others do not. In those cases, the Commission has the power to open a market investigation on the basis of Article 17(1) of the DMA in order to assess whether those services meet the requirements of Article 3(1), DMA.[236]

The Commission in its annual report on the DMA recognises that AWS and Azure do not meet the quantitative thresholds of Article 3(2), DMA. The question is whether in light of the fact that cloud is 'the backbone of many digital services', businesses and development of AI technologies, can Amazon through AWS and Microsoft through Azure qualify 'as important gateways for business users to reach end users' as understood in Article 3(1), DMA.[237]

Chapter IV of the DMA deals with market investigation. The Commission can undertake a market investigation to ascertain 'whether an undertaking providing core platform services' should be designated as a gatekeeper under Article 3(8) or in order to identify the core platform services to be listed in the designation decision' under Article 3(9).[238] Within the framework of these market investigation powers, the Commission is currently investigating the cloud computing industry.[239]

The market investigation is a tool to assess, whether 'undertakings providing core platform services [enjoy] extreme scale or scope economies, very strong network effects, data-driven advantages, an ability to connect many business users with many end users through the multi-sidedness of those services, lock-in effects, lack of multi-homing, conglomerate corporate structure or vertical integration.'[240] These

[224] Case T-1077/23 *Bytedance Ltd. V. European Commission* Judgement of the General Court (Eight Chamber, Extended Composition) (17 July 2024) para 41.

[225] European Commission, 'Report from the Commission to the Council and the European Parliament: Annual Report on the Implementation of Regulation (EU) 2022/1925 of the European Parliament and of the Council on contestable and fair markets in the digital sector and amending Directives (EU) 2019/1937 and (EU) 2020/1828 (Digital Markets Act)' Brussels 21.05.2026 COM (2026) 247 final, p. 3.

[226] Article 3(8), Recital 74, Regulation (EU) 2022/1925.

[227] Friso Bosteon and Giorgio Monti, 'The rhyme and reason of gatekeeper designations under the Digital Markets Act' (2025) *Journal of Antitrust Enforcement*, p. 2, 12, 14.

[228] Case DMA. 100047 – Apple – iPadOS, Commission Implementing Decision of 29.4.2024 closing the market investigation opened by Decision C(2023) 6076, pursuant to Article 17 of Regulation (EU) 2022/1925 of the European Parliament and of the Council on contestable and fair markets in the digital sector and amending Commission Decision C(2023) 6100 of 5 September 2023 designating Apple as a gatekeeper pursuant to Article 3 of that Regulation (Brussels, 29.04.2024) C(2024) 2500 final.

[229] Tadeusz Gielas (3 May 2024) 'European Commission makes first 'qualitative' designation under Digital Markets Act' *Pinsent Masons: Out-Law News* https://www.pinsentmasons.com/out-law/news/european-commission-qualitative-designation-digital-markets-act

[230] Case DMA. 100047 – Apple – iPadOS, Commission Implementing Decision of 29.4.2024 closing the market investigation opened by Decision C(2023) 6076, pursuant to Article 17 of Regulation (EU) 2022/1925 of the European Parliament and of the Council on contestable and fair markets in the digital sector and amending Commission Decision C(2023) 6100 of 5 September 2023 designating Apple as a gatekeeper pursuant to Article 3 of that Regulation (Brussels, 29.04.2024) C(2024) 2500 final, paras 37-109.

[231] Alba Ribera Martínez (2024) 'Rebutting Gatekeeper Presumptions in the Digital Markets Act: Case T-1077/23 *Bytedance Ltd v European Commission*' *Journal of European Competition Law & Practice Vol. 15 No. 8*. It may be important to add here that the observation was made as regards rebutting the gatekeeper presumption. In the opinion of the author, this view, however, should be offered a symmetric semantic meaning. In other words, reliance on qualitative criteria should be just as important in gatekeeper designation.

[232] Court of Justice of the European Union, Press Release No 77/26 (Luxembourg 3 June 2026) Digital Markets Act: the General Court annuls the decision designating Meta as a gatekeeper as regards Marketplace https://curia.europa.eu/site/upload/docs/application/pdf/2026-06/cp260077en.pdf

[233] Judgment of the General Court 03/06/2026, Case T-1078/23 *Meta Platforms v Commission* ECLI: EU:T:2026:357, para 229.

[234] Ibid, para 262.

[235] Ibid, para 169.

[236] Ibid, para 168.

[237] European Commission, 'Report from the Commission to the Council and the European Parliament: Annual Report on the Implementation of Regulation (EU) 2022/1925 of the European Parliament and of the Council on contestable and fair markets in the digital sector and amending Directives (EU) 2019/1937 and (EU) 2020/1828 (Digital Markets Act)' Brussels 21.05.2026 COM (2026) 247 final.

[238] Article 17, Market investigation for designating gatekeepers, DMA.

[239] https://ec.europa.eu/commission/presscorner/detail/en/ip_25_2717

[240] Cf Recital 25, DMA

factors when further complemented by 'very high market capitalisation, a very high equity value over profit or a very high turnover derived from end users of a single core platform service' alludes to the leveraging and potential tipping towards such undertakings.[241] Additionally market investigation also offers a possibility to make recommendations 'to modify essential elements of this Regulation'.[242]

A qualitative assessment by the Commission be better suited to account for the qualitative considerations, such as the ecosystem effects, within which cloud's position of strength can be better situated. While the 'ontology of gatekeeper status' is somewhat 'elusive', 'ecosystems with multiple, dominant gatekeeper CPSs', qualify under the DMA.[243] The hyperscalers are all ecosystems with control over multiple bottleneck facilities, including the cloud, which is also a 'chokepoint [and helps] incumbents entrench their position and stifle innovation in the related AI markets'.[244] A qualitative approach to qualify clouds as CPS can also better account for innovation in generative AI.[245] The Commission is currently investigating whether AWS and Azure could qualify as CPS. Google with its Kubernetes standard can meaningfully benefit from the DMA's qualitative criteria for designation, should the Commission choose to open investigations for potential classification of Google Cloud Services as a CPS.

The qualitative route offers the flexibility to take into account, in addition to size and number of users, factors such as network effects, customer lock-in, switching costs, conglomerate structure, vertical integration and other structural barriers, as developed at length in *supra* sections 2 to 5. A detailed reasoning in the designation decision, will help overcome the pitfalls such as the Commission's designation of the Facebook Marketplace, while picking up best practices from the Commission's designation of iPadOS, as discussed above. Taking into account these considerations and thorough analysis following the qualitative route, in the opinion of the author, will also make DMA more robust to take sovereignty and innovation-driven considerations in the designation decision.

6.2.2. *Obligation on cloud under the DMA*

Once cloud is classified as CPS under the DMA, the follow-on question is what obligations may be relevant as regards cloud. It must, also be kept in sight that the obligations vary by the CPS. Particularly, as regards, cloud computing services, the obligations are very limited in scope and confined to the requirements under Article 5(2) [further limited to 5(2) (b), (c) and (d)], 5(6), 5(7), 5(8)], and Article 6(2), 6(5), 6(6), 6(9), 6(10) and 6(13).[246] The following discussion develops these obligations, and whether they may be sufficient to address concerns in cloud.

Article 5(2) requires that the gatekeeper must receive user's consent, prior to data combination. Article 5(2)(b) and (d) restrict combination of 'personal data from the CPS with data from third parties and other services' offered by the gatekeeper.[247] Article 5(2)(c) prohibits 'cross-use [of] personal data from CPS' for other services provided by the gatekeeper.[248] The gatekeeper is however, allowed to present users with choice, and if the user continues to offer their consent within the meaning of the EU GDPR. It may be useful to look at Meta's breach of its obligations under Article 5(2) through the introduction of 'Consent or Pay', available between March 2024 and November 2024, until the new model was made available.[249] For this consent to function meaningfully users must have freely offered their choice, and this also meant that users continued to have available alternatives to the CPS provided by the gatekeeper.[250] As regards cloud, the impact of the obligations under Article 5(2) may be somewhat limited by the fact that the said provision currently only covers combination of personal data. However, cloud has business and non-personal technical data as well, which continues to remain outside the scope of the Article 5(2).[251]

As per article 5(6), the gatekeeper is restrained from restricting end-users to approach relevant public authorities for failure on the part of the gatekeeper to comply with its regulatory obligations. Article 5(7) restricts tying of CPS, such as payment services and web browsers.

As per Article 5(8), gatekeepers cannot mandate business users or end users subscribe to a core platform service offered by a gatekeeper as a condition to continue using their cloud services. In other words, the gatekeeper cannot tie together different CPS. This could, for example, cover scenarios wherein a gatekeeper conditions access of its generative AI service alongside its cloud service.[252]

As per Article 6(2), the gatekeeper can not use the business user data derived from the use of the CPS to compete against that business user.

Article 6(5) prohibits self-preferencing. This as discussed by the author in an earlier contribution, can be a viable and profitable strategy in generative AI and cloud computing.[253]

Article 6(6) mandates device neutrality, that the gatekeeper can prohibit switching or multihoming. Article 6(9) mandates effective data portability obligations. Article 6(10) obliges the gatekeeper to offer business users with real time access to data provided for or generated during the use of the CPS. Article 6(13) prohibits gatekeeper from imposing disproportionate terms and conditions for termination of

[241] Cf Recital 25, DMA

[242] Cf Recital 69, 78 DMA

[243] Friso Bosteon and Giorgio Monti, 'The rhyme and reason of gatekeeper designations under the Digital Markets Act' (2025) *Journal of Antitrust Enforcement* p. 26. *See* also the Commission's designation decision, and General Court's findings therein in *ByteDance* (*Case T-1077/23, Bytedance v Commission, EU: T:2024:478*).

[244] Article 19, 'A Review of the Digital Markets Act: Unlocking contestability and fairness in cloud and AI' p. 17

[245] The author would like to thank Simonetta Vezzoso for making this observation.

[246] Antonio Manganelli and Daniel Schnurr, 'Competition and Regulation of Cloud Computing Services: Economic Analysis and Review of EU Policies' (2024) *CERRE Report* pp. 42-49

[247] Friso Bosteon, 'Understanding the Digital Markets Act' (2023) p. 20. The obligations in Article 5(2)(b) and (d) are inspired from the German Bundeskartellamt' s decision in Facebook, and the Facebook/Oculus and the Italian Autorità Garante della Conconrrenza e del Mercato's (AGCM) decision in Facebook case.

[248] Friso Bosteon, 'Understanding the Digital Markets Act' (2023) p. 20. The obligations in Article 5(2)(c) are inspired from the Belgian Competition Authority's decision in *National Loterij*, Autorité de la concurrence (AdlC) in *Engie* and AGCM's decision in *Enel*.

[249] European Commission, 'Commission finds Apple and Meta in breach of the Digital Markets Act' (3 April 2025, Brussels) https://ec.europa.eu/commission/presscorner/detail/en/ip_25_1085. *See* also Alba Ribera Martínez (28 April 2025) 'The DMA's Teeth: Meta and Apple Fined by the European Commission' *Kluwer Competition Law Blog* https://legalblogs.wolterskluwer.com/competition-blog/the-dmas-teeth-meta-and-apple-fined-by-the-european-commission/.

[250] Alessia D'Amico, Dionysios Pelekis, Cristiana Teixeira Santos and Bram Duivenvoorde (2024) 'Meta's Pay-or-Okay Model: An analysis under EU Data Protection, Consumer and Competition Law' *Technology and Regulation* https://research-portal.uu.nl/en/publications/metas-pay-or-okay-model-an-analysis-under-eu-data-protection-cons/

[251] Article 19, 'A Review of the Digital Markets Act: Unlocking contestability and fairness in cloud and AI', p. 21.

[252] Article 19, 'A Review of the Digital Markets Act: Unlocking contestability and fairness in cloud and AI' p. 22.

[253] For a critical analysis on self-preferencing and generative AI, see Kalpana Tyagi, 'Mapping Sovereignty and Competition Concerns Along the Generative AI Value Chain' European Competition and Regulatory Law Review Volume 10, Issue 2 (2026)pp. 125 - 144 DOI: https://doi.org/10.21552/core/2026/2/6

services.

Additionally, Article 14 of the DMA requires that gatekeepers inform the Commission about proposed concentrations. This may, for example, have helped identify the Google/Wiz merger, referred to in section 2, *supra*.

It is evident that even if the Commission were to designate Microsoft Azure, and Amazon Web Services as CPS, the designation, and hence, the obligations will be limited to these two hyperscalers. Moreover, considering the innovative nature of Google Cloud Services, such as the introduction of Kubernetes, GCS may even under a qualitative assessment - should such an investigation be initiated - may escape designation as a CPS. Additionally, the obligations on cloud as CPS are very limited in nature, and it is uncertain whether they may meaningfully promote fairness in the infrastructure layer. Considering this restrictive scope of the DMA, one may need to look at the other legislative frameworks that can potentially address the contestability and access concerns in cloud computing. The EU Data Act has a more dedicated discussion on cloud service providers, which may more effectively facilitate switching and portability by users, and thereby impact contestability in the market, an issue developed further in the following subsection.

6.3. Data Act

The EU Data Act may be considered as *lex specialis* to the DMA, as it entered force after the DMA. The Data Act entered effect on 12th September 2025. The Act is a 'horizontal piece of legislation [with the objective of] enhance[-ing] fair access to and use of data across all sectors of the economy'.[254] It has several sections dedicated specifically to the cloud computing services unlike the DMA which is a more general regulation that seeks to facilitate fairness in the digital markets. The Data Act carries obligations on switching, portability, and identification of jurisdictions whose legislations may impact access to data stored in the cloud.

The Act recognises the need for effective and smooth switching of data from one service provider to another, without undue obstacles and data transfer costs as key to prevent the 'lock-in situation for customers'.[255]

Starting 2027, cloud operators are restrained from charging switching costs and data egress fees for multi-cloud users. This is stipulated in Article 25 of the Data Act that calls for full abolition of switching charges, while offering a three year transition period.

Switching provisions are complemented by openness and interoperability, which should be enabled from the outset in the design of cloud services.[256]

Interoperability is defined in Article 2(40) of the Act thus:

> 'interoperability' means the ability of two or more data spaces or communication networks, systems, connected products, applications, data processing services or components to exchange and use data in order to perform their functions.

Chapters VI and VIII are the relevant chapters as regards cloud and may be deemed as *lex specialis* to the DMA, which is a rather general regulation aimed at facilitating fairness and contestability in the digital markets.[257] Chapter VI deals with 'Switching between data processing services', and chapter VIII deals with 'interoperability'. Articles 23-32 and 34-35 of the Act respectively contain relevant provisions for the providers of data processing services as regards switching and interoperability.

Data processing service providers are defined in Article 2(8) of the Act as

> [A] digital service that is provided to a customer and that enables ubiquitous and on-demand network access to a shared pool of configurable, scalable and elastic computing resources of a centralised, distributed or highly distributed nature that can be rapidly provisioned and released with minimal management effort or service provider interaction.

The term is thus, broadly defined, and includes all models of services in cloud computing, including IaaS, PaaS and SaaS, as discussed in section 2 *supra*. The definition is open-ended, and can account for new technological innovations in the field.

Article 2(32) defines 'digital assets', which means inputs such as metadata, virtualization technologies and all other elements that the user may require to switch data to a new service provider. Customers are defined in Article 2(30), and switching[258] is explained in Article 2(34) of the Act.

Articles 23-26[259] offer rules on the removal of 'contractual, technical and organizational' barriers that prevent users from moving to competing cloud service providers. The Act requires users not be charged any egress fees. Likewise, cloud providers must offer meaningful data portability and interoperability.[260] Articles 23 and 26 offer the relevant requirements for interoperability. The Data Act makes a distinction between the interoperability obligations as applicable for IaaS, PaaS and SaaS services. Cloud service providers must facilitate 'functional equivalence' in case of IaaS switching by the customer. As regards PaaS and SaaS, the Act requires 'open interfaces' and 'mandatory compatibility'. These call for mutually agreed upon interoperability standards to be developed in collaboration with standard setting bodies.

Rectial 85 to the Data Act underscores how 'unbundling' may be an important enabler to facilitate customer switching. Articles 30 lays out the technical requirements to facilitate switching and interoperability. It requires that the data processing service provider must offer clear and adequate information, documentation, technical specifications and other relevant information that meaningfully facilitate migration across different infrastructure cloud service providers. Article 34(2) permits that in case of a multi-cloud environment, an egress fee may be charged, but that this fee must be proportionate, and deducted 'only for the purpose of passing on egress costs [actually] incurred' by the service providers.

While the Impact Assessment to the DMA, as discussed in section 5.1 *supra* identified bundling as a concern in cloud computing, it is in fact, Data Act, that facilitates this unbundling more effectively. Data Act is not only *lex specialis* to the DMA, as the reference to relevant provisions above elucidate, it also complements many a policy objective of the DMA. These include measures to prevent customer lock-in, facilitate mobility across different cloud service providers by supporting portability, interoperability, while simultaneously keeping a check on international data transfers.

It may also be useful to highlight how the Digital Omnibus may impact the functioning of the Data Act. EU's rules and regulation are becoming increasingly complex, an observation made by Mario Draghi in his report. In light of 'the increasing complexity and fragmentation of the EU regulatory framework', there was a clear need to substantively and institutionally 'consolidate protections'.[261] The Commission presented its EU Digital Omnibus Package on 19th November 2025, that proposes to simplif the complex digital rules and regulations. Although

[254] Frequently Asked Questions, Data Act, p. 5.
[255] Cf Recital 78, Data Act
[256] Cf Recital 80, Data Act
[257] Antonio Manganelli and Daniel Schnurr, 'Competition and Regulation of Cloud Computing Services: Economic Analysis and Review of EU Policies' (2024) *CERRE Report* p. 53.
[258] On the need for and benefits of switching, see Recitals 81 and 85, Data Act.
[259] Data Act
[260] Articles 23, 24, 28, 29, 30, Data Act.
[261] Inge Graef and Friso Bosteon, 'A typology of platform power and its regulation' *Information Communication and Society* p. 11.

the Omnibus will principally simplify the complex legislative frameworks such as the GDPR and the AI Act, it also has some implications for the Data Act. Notably, the Omnibus proposes to repeal the Regulation on a framework for the free movement of non-personal data in the European Union (Regulation (EU) 2018/1807), as the subject matter covered in the said Regulation, it is proposed, be covered by the Data Act. The Data Act, much like the said Regulation, shall include a new chapter prohibiting localization requirements for non-personal data.[262] Commission's Impact Assessment Statement accompanying the proposal underscores the need to simplify rules on cloud switching to 'harness the Data Act's full potential'[263], including how 're-negotiation' of contracts signed before the Data Act entered force, may in certain cases help 'compliance with the provisions of cloud switching'[264]. The Omnibus also offers a relaxed framework for personalized data processing services, provided these contracts were entered into before 12th September 2025. Furthermore, it exempts Small Mid-Caps (SMCs) and Small and Medium Enterprises (SMEs) that offer data processing services, contractually entered before 12th September 2025 (except for IaaS), from additional requirements applicable on larger service providers.[265] However, these providers are permitted to charge early termination penalties in case of fixed-term contracts. The draft 'Recommendation on non-binding model contractual terms on data access and use and non-binding standard contractual clauses for Cloud Computing Contracts under the Data Act'[266], proposes standard templates that can be more pro-competition and facilitate easier data portability and cloud migration.

As regards enforceability, the Member States are required to designate a relevant competent authority responsible for the enforcement of the Act, which may be an existing or a newly created public sector body.

7. Conclusions, recommendations and further research

Cloud, that started as part of the enterprise strategy to outsource non-core functions, has today emerged as the critical foundational layer of the internet and generative AI. It is a critical infrastructure that brings together concerns on sovereignty, contestability, and fairness in the digital ecosystem. Taking cognisance of market developments, industry demands and academic commentaries, the Commission recently opened market investigations on whether to qualify Microsoft Azure and Amazon Web Services as gatekeepers.[267] This contribution discussed whether a qualitative approach may better capture these services as CPS. However, even if such a designation were to follow, the obligations will be limited in scope. Data Act, by offering a rulebook for cloud services, facilitates interoperability, and thereby, switching and portability in the cloud.

In practice, not even one per cent of customers switch their cloud service provider in a given year.[268] An issue that remains unaddressed in the Data Act, and may in fact be the real hindrance to switching is the lack of choices.[269] Further, even though the hyperscalers have already waived, or are in the process of phasing out the egress fees, the real cost of switching lies elsewhere. It is the 'reskilling' of the workforce, and 're-architecting' the applications developed for the incumbent cloud, that may create a real lock-in effect. Expereince in productivity software well illustrates how learning effects can create enduring lock-in effects.[270]

While the Digital Markets Act and Data Act may by facilitating customer switching ensure interoperability and portability, and thus, resolve some of the issues as discussed at length in this contribution to a certain extent, considering that the real barriers to contestability is the lack of a viable choice of alternative cloud providers in the market and the learning effects, these measures may only be a piecemeal solution to a complex cloud ecosystem problem. Gaia-X, the EU's digital sovereignty initiative, that offers a platform to inter-connected cloud[271], too is only a part of the puzzle. Competition and contestability in cloud can be safeguarded only with a truly sovereign cloud, which in part also means creation of markets, an issue that has caught the Commission's attention in the European Technological Sovereignty Package[272]. The package comprises of legislative proposals for Chips, Cloud and AI Development, EU Open Source Strategy and a Strategic Roadmap for Digitalisation and AI in Energy. To critically evaluate the merits of the Sovereignty Package calls for an inter-disciplinary discussion, and thus, is accordingly developed at length in a follow-on contribution[273].

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data availability

No data was used for the research described in the article.

[262] Huub de Jong (18 December 2025) 'Digital Omnibus; barely any relief for cloud' *Turing Law* https://www.turing.law/digital-omnibus-barely-any-relief-for-cloud/.

[263] Impact Assessment p. 14

[264] Impact Assessment p. 24

[265] *See* European Commission, 'Digital Omnibus Regulation Proposal' (19 November 2025) https://digital-strategy.ec.europa.eu/en/library/digital-omnibus-regulation-proposal. *See* also, Impact Assessment, pp. 136-137. 139.

[266] European Commission, 'Draft Recommendation on non-binding model contractual terms on data access and use and non-binding standard contractual clauses for cloud computing contracts' (19 November 2025) https://digital-strategy.ec.europa.eu/en/library/draft-recommendation-non-binding-model-contractual-terms-data-access-and-use-and-non-binding

[267] European Commission, 'Commission launches market investigations on cloud computing services under the Digital Markets Act' (Brussels, 18 November 2025) *European Commission* https://ec.europa.eu/commission/presscorner/detail/en/ip_25_2717

[268] https://www.gov.uk/cma-cases/cloud-services-market-investigation

[269] Koenraad Schelfaut, Mauro Capo and Surya Mukherjee, 'Sovereign Cloud Comes of Age in Europe: How to take back control of data and stay compliant in the cloud' *Accenture* (2023). In the Study, Accenture takes a broader view of sovereignty and defines it on p. 6 as a 'range of solutions that enable organisations to take control of the location, access and processing of their data in a cloud environment'. The Study notably identifies following two as the top challenges for sovereign cloud adoption by undertakings in Europe. First, 'numerous regulations/guidelines on cloud data, making it complex to implement', as identified by 59% of the respondents. Second, over 52% of the respondents identified 'lack of viable alternatives to global hyperscalers' limiting the possibility of sovereign cloud adoption.

[270] John David Michels, 'Sovereign Cloud for Europe: Independent Research Report Prepared for Broadcom' (February 2025) p. 18.

[271] Autoriteit Consument and Markt 'Market Study Cloud Services' Case no. ACM/21/050317/ Document no. ACM/INT/440323, p. 14.

[272] European Commission (3 June 2026) 'Strengthening Europe's Tech Sovereignty' https://digital-strategy.ec.europa.eu/en/policies/eu-tech-sovereignty

[273] Kalpana Tyagi (2026) 'The Geo (and innovation) economics of Generative AI: The (global) return of the Innovation Industrial Policy for Digital Sovereignty'. (Forthcoming, copy available on request)