# Competition in Virtual Worlds and Generative AI - Calls for contributions

**Part 2: Virtual Worlds**

# Executive summary

The AI-Blockchain Taskforce of the INATBA presents hereby an in-depth exploration of the evolving landscapes of Virtual Worlds and Generative AI, addressing the challenges and opportunities these technologies present to competition, innovation, and regulation. This diverse group of experts, including Mariana de la Roche (Validvent), Erwin Voloder (EBA), Tomaz Sedej (Hyperledger), Prof. Dr. Kalpana Tyagi (Maastricht University), and Stefania Tonutti (Vechain), contribute a rich tapestry of perspectives on the subject, acknowledging the incomplete coverage of all posed questions due to the complexity and breadth of the topics discussed.

The AI-Blockchain Taskforce of INATBA, through its detailed exploration of the intersections between generative AI, virtual worlds, and the underlying blockchain technology, offers key insights into the evolving digital landscape. Our position presented in this reply emphasizes the critical role of high-quality, diverse datasets, ethical considerations, legal compliance, and the transformative potential of blockchain technology in enhancing data provenance and transparency.

In the sphere of Generative AI, the taskforce points out the indispensable nature of diverse datasets and the importance of embedding ethical and legal considerations from the outset. The introduction of blockchain technology is praised for its ability to ensure a transparent, immutable record of data transactions and copyrights, potentially revolutionizing the way AI systems handle data provenance. This is particularly significant in navigating the barriers to entry and expansion within the AI domain, including the challenges of securing access to varied datasets and the substantial computational resources required for developing and deploying AI models.

The analysis of Virtual Worlds reveals a competitive landscape influenced by access to data, proprietary hardware, intellectual property rights, and control mechanisms over connectivity and platform fees. The taskforce forecasts significant shifts in this area, driven by regulatory changes, technological advancements, and user demands. Blockchain technology emerges as a crucial enabler, anticipated to redefine data provenance, user interactions, and content monetization, steering the ecosystem towards more open, interoperable platforms where innovation and user empowerment take precedence.

Antitrust Considerations in the context of the Treaty on the Functioning of the European Union- TFEU form a significant part of the discussion, addressing the need for antitrust tools and practices to evolve in response to the digital economy's complexities. The unique characteristics of digital platforms and virtual worlds necessitate a deep understanding and approach to antitrust enforcement. The taskforce delves into potential practices that could be considered abusive in virtual worlds, such as self-preferencing and discriminatory

practices, urging regulators to closely monitor these activities to protect competition and innovation.

The Recommendations section calls for ongoing interdisciplinary collaboration, stressing the importance of embracing ethical considerations, ensuring user empowerment, and promoting technological sustainability. The task force's insights underscore the key role of blockchain technology in driving future competition and innovation in virtual worlds and generative AI, advocating for a future that balances the benefits of these technologies with the challenges they present.

This detailed submission from the AI-Blockchain Taskforce of INATBA not only contributes to the understanding of the complexities surrounding generative AI and virtual worlds but also underscores the imperative for adaptive regulatory frameworks, ethical technology development, and the potential for blockchain to serve as a cornerstone for a fair, transparent, sustainable and equitable digital future for everyone. However, it's important to acknowledge that not all questions posed in the initial call for contributions were directly addressed in our submission. This selective approach was intentional, as some questions overlapped with themes explored in other responses, allowing for a more focused discussion on specific areas. Furthermore, we prioritized responding to questions that aligned closely with our collective expertise within the AI-Blockchain Taskforce of INATBA. This strategy ensured that our insights and recommendations were grounded in a deep understanding of the subject matter, contributing meaningful perspectives to the evolving discourse on generative AI, virtual worlds, and blockchain technology.

# Respond to the Competition in Virtual Worlds and Generative AI - Calls for contributions

The reply to the Competition in Virtual Worlds and Generative AI - Calls for contributions is a collective effort of the INATBA AI & Blockchain Taskforce, in particular to the members: Mariana de la Roche (Validvent), Erwin Voloder (EBA), Tomaz Sedej (Hyperledger), Prof. Dr. Kalpana Tyagi (Maastricht University), and Stefania Tonutti (Vechain).

## Part 1: Generative AI

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

In the development of generative AI systems, integrating a comprehensive set of inputs is essential not only to harness the technological potential of these systems but also to navigate the intricate landscape of legal, ethics and copyright considerations. The insights from Kalpana Tyagi's exploration of remunerating human authors and the complexities of Text and Data Mining (TDM) exceptions provide a crucial context for understanding these needs. Her analysis underlines the importance of embedding copyright awareness and legal compliance from the ground up in AI systems, ensuring that innovation does not come at the expense of creators' rights and/or IP rights. This also reflects a complex interplay between IP and competition, as access to data is the prerequisite to engage in TDM. While data is not IP-protected, works that contain data are copyright (IP) protected. The EU-based firms, when confronted by limited access to data and IP-protected works, may find it a limitation to engage in meaningful innovation. Can some ex-post competition law tools, such as the essential facilities doctrine remedy the situation, or does one need to look at ex-ante regulatory instruments, such as some potential intervention under the Digital Markets ACt (DMA) for remedy? Here's how these insights inform the critical components necessary for building, training, deploying, and distributing generative AI systems:

1. High-quality, diverse datasets are foundational, and ensuring legal compliance becomes a critical input. This involves securing permissions, utilizing public domain content, or relying on data explicitly licensed for AI training to ensure the development of AI systems safeguards against copyright infringement and respects the original creators' rights. This compliance supports ethical AI development and aligns with global legal standards, highlighting the importance of lawful data usage from the outset. Incorporating blockchain technology can enhance this process by providing a transparent and immutable record of data transactions, permissions, and copyright information.

   By leveraging blockchain, developers can automate the enforcement of copyright permissions through smart contracts, ensure the integrity and traceability of data

used in training, and facilitate the transparent remuneration of original content creators. This compliance not only supports ethical AI development but also aligns with global legal standards, highlighting the importance of lawful data usage from the outset. Blockchain emerges as a potent tool for enhancing trust, transparency, and accountability in the complex ecosystem of generative AI.

Moreover, the deployment of adequate computational resources must consider not only the technical demands but also the ethical implications of data processing. Infrastructure that supports secure and privacy-compliant practices is essential, underlining the need for computational power to be employed in a manner that respects data privacy and adheres to copyright regulations. This ensures AI systems are developed within a principled framework that values both power and responsibility. Guidelines and policies governing the use of AI, particularly in conjunction with blockchain technologies, are essential for ensuring AI technologies respect intellectual property rights.

This includes supporting frameworks that promote equitable remuneration for content creators and address the ethical considerations of using copyrighted materials in AI training and output generation. Algorithms designed for AI training need to navigate the complex landscape of TDM exceptions and fair use principles, especially in jurisdictions with varied legal frameworks. This integration of legal considerations into the algorithmic design phase is crucial for developing AI in a way that respects copyright boundaries and promotes the responsible creation of AI-generated outputs.

Ongoing monitoring and evaluation of AI systems are required to ensure continuous compliance with copyright laws and ethical standards. Given the evolving nature of technology and legal interpretations, this component underscores the necessity for AI systems to adapt to new legal challenges and ethical expectations, ensuring sustainable and responsible innovation in the field of generative AI.

2. Selecting and designing AI models requires a balance between efficiency and ethical considerations, with a focus on transparency in data processing and outcomes. Incorporating mechanisms for traceability allows for auditing the data sources and the logic behind AI-generated content, ensuring models are capable of identifying data origins and are transparent about their processing methods. This is vital for addressing derivative works and maintaining the originality of AI outputs within the bounds of copyright laws. In this context, the approach adopted by Demia, which provides data qualification on a platform for climate auditors, offers an insightful parallel. Demia's platform enhances trust in data by offering rankings based on data quality and data collection methods, facilitating the identification of the most reliable and pertinent information for climate auditing purposes. A similar solution could be applied to ensure data provenance and trust in datasets used for training generative

AI. By integrating a ranking system that evaluates the quality, reliability, and copyright status of data, AI developers can further ensure the ethical use of data, enhancing transparency and trust in AI-generated outputs. This approach not only supports the responsible development of AI but also aligns with broader efforts to establish and maintain high standards of data integrity and copyright compliance in AI applications. Furthermore, scalable and secure deployment platforms are necessary for hosting AI models, incorporating access management mechanisms that respect copyright and potentially leverage blockchain technologies for transparency. This ensures that AI services are delivered in a manner that protects intellectual property and supports fair compensation for content creators, promoting responsible use and distribution of AI-generated content.

3. Development tools, including APIs and SDKs, must enable responsible integration of AI functionalities, ensuring applications built on these technologies adhere to legal and ethical standards. These tools are bridges to end-user applications, emphasizing the importance of copyright awareness and facilitating the ethical use of AI-generated content across various platforms.

   Designing user interfaces and experiences that transparently communicate the origins and ethical considerations of AI-generated content enhances trust and understanding among users. This focus on transparency and ethical disclosure in user interaction emphasizes the balance between innovation and respect for copyright and creator rights in the digital content ecosystem.

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

The provision, distribution, or integration of generative AI systems and components, including AI models, faces multifaceted barriers from different dimensions and challenges such as technical, legal, economic, and ethical. Access to diverse, high-quality datasets could be limited by complex copyright laws and privacy regulations, requiring significant legal maneuver to navigate. The technical expertise and substantial computational resources needed for developing effective AI models underscore the barriers in design and scalability, compounded by the high costs associated with GPUs and cloud services. Moreover, establishing a secure and scalable deployment infrastructure demands vast investment and sophisticated know-how, particularly in addressing data security and user privacy concerns. The development of accessible APIs and SDKs for seamless integration adds to the challenge, necessitating continuous support and updates. Regulatory and ethical considerations present a moving target, with varied laws across jurisdictions complicating compliance efforts. The competitive AI market and intellectual property issues could further stifle entry

and innovation, while public skepticism about AI ethics, lack of education and potential biases and misconceptions threatens adoption rates.

Blockchain technology could address these barriers in several innovative ways. By providing a transparent and immutable ledger, blockchain can enhance data collection and legal compliance, securely tracking data usage and permissions to navigate copyright and privacy concerns more effectively. For model architecture and computational resources, blockchain could enable more distributed forms of computation, potentially lowering costs and democratizing access to necessary infrastructure. It can also offer secure, decentralized deployment infrastructures, mitigating concerns around data security and enhancing user privacy through cryptographic guarantees. In terms of APIs and SDKs, blockchain platforms can facilitate reliable and interoperable integration tools, streamlining the incorporation of AI functionalities into diverse applications. It may also level the competitive playing field by providing a platform for shared intellectual property and collaborative development, alongside building trust through transparency and verifiable actions in AI deployment via incentives mechanisms. Thus, blockchain stands as a potential underlying technology in overcoming the barriers to entry and expansion in the generative AI ecosystem, offering solutions that not only solve technical and economic challenges but also address legal, ethical, and trust-related issues.

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

The competitive landscape is shaped by several key drivers that determine a company's success in this field. Sustainability, in particular, emerges as a central theme, reflecting a growing demand for AI solutions that are not only technologically advanced and economically viable but also environmentally responsible and ethically aligned. Here are the main drivers of competition from our perspective:

1. Offering customizable and flexible AI solutions that can be tailored to specific industry needs or integrated into existing systems is a significant driver of competition. A successful player in the generative AI space must demonstrate the ability to adapt its offerings to diverse requirements, ensuring broad applicability and user satisfaction. This will completely reflect on the scalability and efficiency of AI systems. Companies that can provide AI solutions that are easily scalable to different sizes and types of businesses, and that operate efficiently in terms of computational resources, have a competitive edge. Efficiency also pertains to the reduction of energy consumption, aligning with sustainability goals by minimizing the environmental footprint of AI operations.
2. Companies that prioritize ethical considerations in the development and deployment of AI systems are more likely to succeed. This includes adherence to fairness,

accountability, transparency, and privacy standards, along with active efforts to mitigate biases in AI models. Ethical AI practices not only comply with increasing regulatory demands but also build trust with users and customers, contributing to a sustainable AI ecosystem which also pushes forward adoption and scalability. Building a robust ecosystem through strategic partnerships with other technology providers, research institutions, and industry stakeholders is a key driver of competition and trust. Collaborations can accelerate innovation, extend market reach, and provide integrated solutions that meet the complex needs of customers, facilitating the sustainable development and distribution of AI systems.

3. Directly addressing the sustainability of AI systems, successful companies will be those that adopt practices minimizing environmental impact, such as optimizing data center energy efficiency, using renewable energy sources, and designing AI models that require less computational power. Furthermore, sustainability involves considering the social impact of AI, ensuring that technology contributes positively to society and does not exacerbate inequalities.
4. Navigating the complex regulatory landscape and ensuring strict compliance with data protection and copyright laws are crucial for the success of AI companies. Effective data governance practices that respect user privacy and intellectual property rights while facilitating lawful access to high-quality data sets for AI training will differentiate successful players in the market.

The drivers of competition in the generative AI sector revolve around a mix of technological excellence, efficiency, ethical practices, and a strong commitment to sustainability. Companies that excel in these areas are likely to lead the market, offering AI systems that are not only advanced and useful but also responsible and sustainable, aligning with the broader societal goals and regulatory frameworks providing and generating solutions that make the world more sustainable and equitable.

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

1. Competition issues in generative AI systems can emerge from monopolization of data, proprietary nature of AI technologies, and network effects. Data monopolization arises when a few companies dominate the market because of their extensive data repositories necessary for training advanced AI models. Such monopolization could stifle innovation by smaller entities lacking access to such datasets. Components related to data monopolization:

- **Access to datasets:** Large datasets are essential for training generative AI models. Organizations with access to large amounts of data have a considerable advantage, as data quality and variety can significantly affect AI systems performance.

- **Data Acquisition Tools:** Tools used to collect, process, and analyze data can be a part of this issue, especially if they are proprietary or if access to them is restricted by incumbent players.

- **AI Training Platforms:** Platforms that provide the infrastructure and computational resources for training AI models are paramount. If a small number of entities control these platforms, they can limit access for smaller players.

2. The **proprietary nature of AI technologies** might lead to market concentration, where only a few players can afford the investment required for developing state-of-the-art AI models. Components Related to Proprietary AI Technologies:

- **AI Models and Algorithms:** Proprietary models and algorithms developed by big tech firms can lead to market concentration and hinder competition from entities that cannot develop or access similar technologies.

- **Development Frameworks**: If software frameworks and tools for AI applications building are controlled by few dominant entities, this can create high entry barriers and diminish competition.

- **Patents and Intellectual Property:** Excessive patenting and IP protection can inhibit competitors from developing similar or derivative technologies.

3. Finally, **network effects** in platforms integrating generative AI could solidify the market position of incumbents, making it difficult for new entrants to compete.

- **Platform Ecosystems:** Platforms with large user bases that integrate generative AI technologies can benefit from network effects. More users on the platform increase the value of the service, and attract even more users, creating a positive feedback loop and strengthening the platform's position.

- **Marketplaces for AI Components:** Online marketplaces for transacting with AI models and components can also be subject to network effects. Control or dominance of these marketplaces by a few dominant entities can impact competition, as it determines which AI components are easily accessible and widely used.

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

AI models will be monetized through a variety of innovative and evolving mechanisms, reflecting the dynamic interplay between technology and market demands. These

monetization strategies will leverage the unique capabilities of AI and blockchain to create value for users, developers, and businesses. Among the components of generative AI systems, certain areas are poised to capture significant portions of this monetization, influenced by the integration of AI with blockchain technologies, the emphasis on sustainable and ethical AI development, and the shift towards virtual worlds and new social paradigms.

1. **AI-as-a-Service (AIaaS)**: Businesses will increasingly offer AI-powered services on a subscription or pay-per-use basis, enabling customers to access advanced AI capabilities without the need for significant upfront investment in technology and infrastructure. This model will particularly benefit from the scalability and efficiency of AI systems, allowing companies to serve a wide range of customers with customizable solutions. Companies may offer basic AI functionalities for free while charging for premium features, such as advanced analytics, higher processing speeds, or enhanced customization options. This tiered approach can attract a broad user base while ensuring revenue generation from more demanding users. We have already successful examples such as ChatGPT.

2. **Data Monetization:** Leveraging the vast amounts of data generated and processed by AI systems, companies can monetize this asset through targeted advertising, data analytics services, or by selling anonymized data sets to third parties interested in insights and trends. However, we hope to see AI growing beyond E-Commerce.

3. **Blockchain-based Models:** Incorporating blockchain, companies can utilize DeFi and NFTs to create new monetization avenues. For instance, creators can issue NFTs representing ownership or usage rights for AI-generated content, artworks, or models, facilitating a marketplace for digital assets within the AI ecosystem. This generates new incentives models for data collection and data sharing, which will also include blockchain Integration that includes platforms that offer secure, transparent data management and transactions, smart contract development for automating operations, and mechanisms for creating and trading AI-generated digital assets.

4. **AI Models and Algorithms:** The core AI models and algorithms, especially those offering unique capabilities or enabling significant efficiencies, will capture a substantial share of monetization. Their value lies in their ability to generate novel, high-quality outputs across various applications, from content creation to decision support systems.

5. **Customization and Integration Services:** As businesses seek to integrate AI into their operations seamlessly, services offering customization and integration will become highly valuable. These services will allow companies to tailor AI solutions to their specific needs, optimizing workflows and enhancing productivity.

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

Open-source generative AI systems and components, including AI models, present a distinct competitive landscape against proprietary AI systems. This competitive scenario is shaped by several key factors, each contributing to the effectiveness of open-source systems in various contexts.

Open-source generative AI systems are key in democratizing AI technology, offering widespread accessibility and encouraging a collaborative approach to innovation. This democratization accelerates technological advancements, as it allows a global community of developers to contribute to, refine, and evolve AI models rapidly. Such collective effort not only enhances the innovation pace but also ensures a diverse range of applications and improvements that might not be as quickly realized within proprietary systems.

Moreover, open-source models offer unparalleled transparency, a critical factor for trust and ethical considerations in AI development. Users can inspect, verify, and modify the source code, which is instrumental in addressing bias, ensuring fairness, and meeting regulatory and ethical standards. This transparency also fosters a deeper understanding and exploration of AI technologies among researchers, educators, and practitioners, further contributing to the field's advancement.

However, despite these strengths, open-source AI systems face challenges, particularly in terms of resource allocation, support, and commercial application. Proprietary AI systems, backed by substantial corporate investment, often lead in bringing cutting-edge innovations to market, supported by comprehensive infrastructure, professional development, and marketing efforts. They also provide robust customer support and service level agreements (SLAs), essential for enterprise-level applications and services where reliability and support are paramount.

Yet, the agility and adaptability of open-source systems cannot be understated. They allow for rapid prototyping, customization, and integration with other technologies, offering flexibility that is highly valued in research, development, and innovative application contexts. Furthermore, the integration of open-source AI with emerging technologies like blockchain showcases the potential for novel applications and business models that blend transparency, security, and decentralized governance.

Open-source generative AI systems compete effectively with proprietary systems by fostering innovation through collaboration, ensuring transparency, and enabling ethical AI development. While they may not always match the resource-backed advancements and support services of proprietary systems, their contributions to the AI field are invaluable. They

represent a complementary force, driving the advancement of AI technologies and applications through community-driven development, openness, and flexibility. The future of AI competition and development is likely to be shaped by a symbiotic relationship between these two paradigms, leveraging the strengths of each to push the boundaries of what AI can achieve.

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

In the context of generative AI systems and components, including AI models, data plays a key role that cannot be overstated. Its characteristics such as volume, variety, veracity, and velocity are crucial in training AI models to ensure they can generate high-quality, innovative, and diverse outputs. However, beyond these foundational aspects, the provenance of data—its origin, history, and the legitimacy of its use—emerges as a critical consideration, particularly in ensuring ethical compliance, maintaining user trust, and safeguarding intellectual property rights. This is where blockchain technology becomes pivotal, offering a transformative solution for data provenance and integrity.

Blockchain's role in enhancing data provenance is instrumental for generative AI by providing a decentralized and immutable ledger that records the origins and lifecycle of data used in training AI models. Blockchain integration enables a transparent and verifiable trail of data transactions, ensuring that AI developers and users can trace the source of data, verify its authenticity, and confirm that its use complies with legal and ethical standards. Such transparency is essential not only for ethical AI development but also for addressing concerns related to copyright infringement, data privacy, and security.

Moreover, blockchain facilitates the secure and transparent exchange of data, allowing creators to share their data under clearly defined terms and conditions encoded in smart contracts, while also generating incentives for data sharing. This ensures that data usage rights are respected and creators are fairly compensated, fostering a more collaborative and trust-based ecosystem for generative AI development.

Reviewing the integration and implications of blockchain in ensuring data provenance and enhancing the trustworthiness of AI systems is at the core of the AI-Blockchain INATBA Task Force. The task force is dedicated to exploring how blockchain can address the challenges of data management in AI, particularly focusing on aspects such as data integrity, copyright protection, and ethical use. By leveraging blockchain's capabilities, the task force aims to develop guidelines, standards, and best practices that facilitate the responsible and sustainable development of generative AI technologies. This initiative underscores the commitment to harnessing blockchain's potential to revolutionize data provenance in AI, ensuring that generative AI systems are built on a foundation of trust, transparency, and ethical integrity.

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

Interoperability holds a crucial role in the development and provision of generative AI systems and components, including AI models, acting as a catalyst for innovation, resource optimization, and the growth of a vibrant AI ecosystem. It ensures seamless integration and communication between diverse AI technologies, which is essential for building complex, innovative applications that draw on the strengths of various AI models. However, the lack of interoperability presents significant challenges, potentially leading to a fragmented AI market characterized by isolated platforms and systems. Such fragmentation can stifle the collaborative spirit that drives technological advancement in the AI field, creating substantial barriers to entry for new players. Smaller companies and startups, in particular, may find it difficult to compete if they are forced to navigate a landscape dominated by proprietary systems that do not communicate with each other. This scenario not only limits the potential for innovation but also risks consolidating market power in the hands of a few dominant players, undermining effective competition. Therefore, fostering interoperability is not just about enhancing the functionality and efficiency of AI systems but also about ensuring a competitive market landscape where innovation can flourish unhindered by artificial barriers.

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

In the evolving field of generative AI, vertically integrated companies are distinctively positioned to leverage their comprehensive control over the technology stack, from the development of underlying AI models to the creation of user-facing applications. This integrated approach allows them to streamline the design, training, and deployment processes, ensuring a high degree of consistency, interoperability, and efficiency across all components of generative AI systems. Such a model facilitates not only the integration of various technological elements but also accelerates innovation, customization, and the realization of data-driven insights, ultimately contributing to cost efficiency and competitive advantage in the market. The following sections delve into the benefits of vertical integration in the provision, distribution, and integration of generative AI systems and components, highlighting how this strategic approach can drive success in the industry.

1. **Technical integration and interoperability:** Vertically integrated companies have the advantage of owning and controlling the entire technology stack involved in generative AI systems. This includes developing the underlying AI models, designing the training infrastructure, creating the user-facing applications and optimizing the integration between these components. With control over the entire technology stack,

these companies can establish a unified development environment that facilitates collaboration and communication among different teams working on various components to ensure consistency in coding standards, version control and deployment procedures. Vertical integration also allows these players to design the architecture of their generative AI systems to maximize interoperability and extensibility. By defining standardized APIs and communication protocols between different modules, they enable seamless interaction and data exchange to allow for efficient coordination and integration of functionalities. It further allows them to conduct comprehensive end-to-end testing and validation of their generative AI systems, ensuring that all components work together harmoniously and meet performance requirements. This involves simulating real-world scenarios, stress-testing different components and verifying compatibility across diverse hardware and software environments.

Through continuous monitoring and feedback loops, vertically integrated companies can identify opportunities for optimization and improvement across the entire technology stack (e.g. refining AI models based on real-world data, optimizing algorithms for speed and efficiency and enhancing user interfaces for intuitive interaction). Such iterative refinement ensures that the generative AI system remains competitive and adaptable to evolving user needs and market demands. Vertically integrated companies are further able to ensure cross-platform compatibility of their generative AI solutions, allowing users to access and interact with the system seamlessly across different devices and operating systems. This involves optimizing user interfaces, data formats and communication protocols to accommodate various hardware configurations and software environments.

2. **Innovation velocity:** Companies have the advantage of taking a holistic approach to innovation across the entire value chain of generative AI systems. Controlling the research, development, production and distribution processes allows them to align innovation efforts more effectively with strategic goals and market demands. With full control over the technology stack vertically integrated companies can implement rapid iteration cycles allowing for quick experimentation, prototyping and refinement of AI models, algorithms and user interfaces. This agility enables them to respond swiftly to changing market dynamics, user feedback and technological advancements. Vertically integrated companies can establish closed feedback loops between different components of the generative AI system and facilitate seamless communication and knowledge transfer cross-functionally across teams.

   By directly owning user-facing applications and plug-ins, vertically integrated companies can gather real-time feedback from end-users enabling them to identify unmet needs, pain points and opportunities for improvement. This user-centric approach to innovation ensures that new features, functionalities and enhancements are aligned with user preferences and expectations and drive higher levels of user

engagement and satisfaction. Agile development methodologies are often the norm within vertically integrated companies (e.g. Scrum, Kanban) which emphasize iterative development, cross-functional collaboration and continuous improvement respectively. These methodologies enable teams to work in short sprints, prioritize tasks based on value and urgency and adapt quickly to changing requirements – resulting in faster time-to-market for new innovations. With greater control and autonomy over the innovation process, vertically integrated companies can afford to take more risks and experiment with novel ideas, technologies and business models. This culture of experimentation fosters creativity, resilience and importantly, a willingness to challenge the status quo.

3. **Customization and personalization:** Vertically integrated companies have direct access to granular user data and insights gathered from their user-facing applications and plug-ins such as information on user preferences, behavior patterns, interaction history and demographic profiles. Rich data enables companies to gain deep insights into individual user needs and preferences and facilitate highly customized and personalized experiences. By leveraging advanced AI algorithms and machine learning techniques they can also develop dynamic user profiles that evolve and adapt over time based on user interactions and feedback. These profiles capture a comprehensive understanding of each user's preferences, interests, affinities and engagement patterns, allowing for more accurate and targeted personalization. AI-powered recommendation engines can deliver tailored content recommendations to users based on their unique preferences and interests, encompassing a wide range of content types curated to match each user's individual tastes and preferences.

   With control over the design and development of user-facing applications, vertically integrated companies can offer customizable user interfaces that allow users to personalize their experience according to their preferences. This may include options to customize layout, color schemes, font styles and feature settings empowering users to create a personalized environment that suits their individual preferences and needs. Moreover, contextual information covering aspects like user location, device type or past interactions (among others) can be delivered in a relevant and timely manner. This may involve adapting content, recommendations and user experiences dynamically based on the user's current context and situational needs to enhance the overall relevance and effectiveness of personalization efforts. By analyzing user data and behavior patterns, vertically integrated companies can optimize user journeys and workflows to provide a seamless and intuitive user experience. This involves identifying pain points, bottlenecks and opportunities for improvement in the user journey and implementing targeted interventions to keep users engaged and on the platform.

4. **Data advantage:** Vertically integrated companies have access to a wide range of data sources spanning the entire value chain of generative AI systems spanning user

interaction data collected from their user-facing applications and plug-ins as well as proprietary data sets used for training and refining AI models. By leveraging this comprehensive data access, these companies can gain deeper insights into user behavior, preferences and trends to develop more personalized and effective AI-driven solutions. Possession of high quality data sets comes via direct ownership and control of data collection processes, which allows vertically integrated companies to train their AI models more effectively. Moreover, the sheer volume of data available to these companies enables them to uncover subtle patterns, correlations and insights that may not be apparent with smaller data sets.

By owning and controlling the entire data pipeline (from collection to analysis to utilization), vertically integrated companies can capitalize on synergies and integration opportunities across different data sources and applications. Additionally, integrated data architectures enable these companies to leverage data from one application or domain to enhance the performance and functionality of other applications or domains, driving innovation and efficiency across the organization. With access to up-to-date information on user interactions, market trends, and competitive landscapes, these companies can respond quickly to changing conditions, optimize resource allocation and capitalize on emerging opportunities. Moreover, real-time data insights enable continuous monitoring and evaluation of AI system performance, facilitating iterative refinement and improvement over time. Vertically integrated companies can further monetize their data assets through various channels, including targeted advertising, premium subscription services and data licensing agreements. By leveraging their data advantage, these companies can offer value-added services and insights to customers, partners and third-party developers to create new revenue streams and business opportunities. It also allows them to reinvest in research and development to continuously iterate and refine their product offering.

5. **Cost efficiency**: Vertically integrated companies benefit from economies of scale by consolidating various operations and resources across the value chain. By centralizing research, development, production and distribution processes these companies can achieve higher levels of efficiency and productivity. Cost savings may come by way of bulk purchasing, resource sharing and optimized resource allocation. Vertical integration enables companies to optimize resource utilization by leveraging shared infrastructure, technologies and expertise across different components of the value chain. For example, by using the same AI models, algorithms and data infrastructure across multiple user-facing applications and plug-ins – these companies can reduce duplication of efforts and minimize resource wastage, resulting in cost savings and improved operational efficiency.

   Vertically integrated companies typically have greater control over the supply chain, allowing them to streamline procurement, production and distribution processes. By

vertically integrating suppliers, manufacturers and distributors – these companies can eliminate intermediaries, reduce transaction costs and negotiate favorable terms and pricing, resulting in cost efficiencies throughout the supply chain. Vertical integration may also drive down transaction costs associated with outsourcing, subcontracting or coordination with third-party vendors as critical functions and capabilities with an organization can be internalized where and when needed. These companies may also leverage cost efficiencies to offer more competitive pricing strategies and in doing so attract customers and gain market share. Although this isn't always the case as 'premium pricing' especially for ecosystems with high vendor lock-in (such as Apple) are also market realities in the technology space.

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

We acknowledge the complexity and significance of this issue within the rapidly evolving AI landscape. Given the multifaceted nature of this inquiry, encompassing strategic, economic, and regulatory dimensions, we believe it necessitates a comprehensive and nuanced analysis beyond the scope of our current research capabilities. As such, we will not provide a detailed response at this moment. Further research, including market analysis and comparative studies, is required to adequately address this question, ensuring a thorough understanding of the implications for competition and innovation in the generative AI sector.

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

The rapid advancement and integration of generative AI systems and components, including AI models, indeed necessitate a reevaluation and adaptation of EU legal antitrust concepts. As we keep exploring the complexities of digital platforms, virtual worlds, and the transformative potential of blockchain technology, it becomes evident that the current antitrust framework may not fully address the new dynamics these technologies introduce into the market.

Generative AI's impact on competitive practices, market structures, and consumer behaviors challenging existing definitions of market power and anti-competitive behavior. Particularly, the concentration of market power in entities with access to vast datasets and cutting-edge AI could raise barriers to entry and potentially lead to abuse of dominance or unfair competition practices and market manipulation. Additionally, the collaborative nature of AI development highlights the need for a deep understanding of how collaboration differs from anti-competitive agreements within the realm of innovation in particular when facing new societal and collaborative models such as DAOs.

To ensure that EU antitrust laws continue to foster a competitive and innovative digital economy, a detailed review and further research beyond the scope of this consultation are imperative. Such efforts should aim to develop new guidelines and legislative measures and guidelines tailored to the unique challenges and opportunities presented by generative AI. This includes redefining market power in the context of data-driven competition and considering the implications of AI-driven personalization on consumer choice and market dynamics.

Adapting EU legal antitrust concepts in response to the emergence of generative AI is crucial for maintaining a balanced digital marketplace that promotes competition, innovation, and consumer welfare. This adaptation process will require ongoing dialogue among stakeholders, including policymakers, industry leaders, and academic experts, to ensure that the regulatory framework remains effective and relevant in the rapidly evolving digital landscape.

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

Given the extensive discussions on the rapid evolution of digital platforms, virtual worlds, and generative AI technologies, it's evident that the emergence of new business models and technologies not only will trigger but necessitates the adaptation of EU antitrust investigation tools and practices. The current antitrust framework might face significant challenges in addressing the complexities introduced by these advancements.

The rise of platform economies, data-driven business models, and the integration of services across digital ecosystems have created market dynamics that traditional antitrust tools may not fully capture. For instance, the value derived from data aggregation, the network effects of platform-based services, and the leveraging of market power across different sectors require a nuanced understanding of market dynamics that current tools may not adequately provide.

Generative AI and blockchain technologies introduce novel ways of creating and distributing content, predicting user behavior, and automating decision-making processes. These technologies can potentially obscure anti-competitive practices, facilitate tacit collusion through algorithmic pricing, or create new forms of market dominance based on data control and AI-driven insights.

To effectively address these challenges, the EU antitrust investigation tools and practices need to evolve in several key areas:

- Regulators will need enhanced capabilities to access and analyze large datasets and complex algorithms that underpin digital platforms' operations. This may involve developing new technical expertise or employing advanced data analytics tools to scrutinize algorithmic decision-making processes and identify potential anti-competitive behaviors.

- The nature of digital markets, characterized by rapid innovation and cross-platform competition, necessitates more dynamic approaches to defining relevant markets. This might include considering multi-sided markets, network effects, and the role of data in establishing market power. The pace of technological change calls for more adaptable regulatory frameworks that can quickly respond to new challenges. This might involve the use of interim measures, behavioral commitments, or sandbox environments to test the impacts of regulatory interventions in real-time.

- Addressing the multifaceted issues presented by digital platforms may require a blend of economic, technological, and legal expertise. Antitrust authorities may need to incorporate insights from data science, behavioral economics, and cybersecurity to fully understand the competitive implications of new technologies.

- Given the global reach of many digital platforms, enhancing international cooperation among antitrust authorities will be crucial. This involves sharing best practices, aligning investigative approaches, and possibly harmonizing regulatory standards to address anti-competitive practices effectively in a digitalized global economy.

**Additional considerations regarding Generative AI and Open Source technologies:**

Open-source development impacts the field of generative AI by providing a platform for the widespread distribution and enhancement of AI tools and frameworks. This approach facilitates a collective effort where developers across the globe can contribute to and benefit from the shared pool of knowledge and technology. It enables a rapid cycle of innovation, as improvements and new features can be iteratively added by contributors. Additionally, open-source AI projects offer transparency, allowing for a broad examination of the algorithms' workings, which is crucial for identifying and addressing biases, ensuring ethical use, and improving model robustness.

Accessibility to generative AI technologies is notably increased through open-source initiatives. Startups, researchers, and educational institutions that might not have substantial resources to invest in proprietary solutions can leverage open-source models and software, leveling the playing field and fostering diversity in AI research and application. This accessibility promotes a more equitable distribution of technological benefits and encourages a wider array of use cases and innovations across various industries.

However, while open-source development accelerates the spread and enhancement of generative AI, it also requires effective management and governance to ensure the quality and security of the contributions. The collaborative nature of open-source projects demands robust coordination and oversight mechanisms to integrate contributions productively and maintain the integrity of the AI systems. Furthermore, the reliance on community contributions poses challenges in sustaining long-term project development, particularly in securing funding and resources for infrastructure, documentation, and support services.

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## Part 2: Virtual Worlds

**1) What entry barriers or obstacles to growth do you observe or expect to materialize in Virtual World markets? Do they differ based on the maturity of the various markets?**

The main entry barriers and/or obstacles to growth that could materialize across Virtual World markets could be divided into three main streams: technology (software and hardware), economics (incentives, user experience, business models) and ethical constraints.

1. **Technology**

- Spatial Computing: encompasses technologies like augmented reality (AR), virtual reality (VR), and mixed reality (MR) enabling immersive digital experiences that blend the physical and virtual worlds. While spatial computing has made significant strides, particularly in entertainment, training and enterprise applications, there are existing limitations potentially hindering its scalability and in doing so the scalability of their deployment in virtual worlds. High-quality VR experiences often require expensive hardware including powerful GPUs, headsets and motion tracking systems. The affordability and accessibility of VR equipment remain barriers to widespread adoption especially for mainstream consumers. Apple's new VisionPro (currently only available to US customers) is priced at over 3,500 USD and potential customers requiring corrective lenses may have to pay more for a custom setup that is compatible with their prescription). Additionally, developing compelling VR content requires specialized skills and resources including 3D modeling, animation and spatial audio design. The complexity of content creation contributes to a limited library of high-quality VR experiences potentially hindering user engagement and retention. Despite growing interest, AR and VR adoption rates remain relatively low outside of niche markets. Educating consumers about the benefits and applications of spatial computing is essential for driving adoption and overcoming skepticism.

- Blockchain and distributed ledger technology: offer decentralized solutions for virtual world ecosystems enabling secure ownership of virtual assets, transparent

transactions and community governance yet face ongoing issues related to scalability, interoperability (including standardization) and regulatory uncertainty. Existing blockchain platforms struggle with scalability, throughput, and latency issues, limiting their suitability for large-scale virtual environments with high transaction volumes. Scalability solutions like sharding (e.g. with Ethereum's upcoming Dencun Upgrade) and layer 2 protocols provide a degree of relief (including through the use of Rollups) but these efforts are not both enterprise scalable and cost effective for a persistent, compute heterogenous virtual environment. The virtual worlds built in blockchain-native environments still run on centralized servers and have low-quality rendering, unlike the high quality graphics and rendering of most video games in widespread production today. Virtual worlds often operate on proprietary platforms or game engines, posing challenges for integrating blockchain solutions seamlessly. Standardization efforts and interoperability protocols aim to address this issue but face coordination challenges across diverse stakeholders. From a regulatory perspective, there are diverse frameworks for blockchain and digital assets across the globe and especially with regards to taxation (of in-world assets/transactions) and the enforceability of intellectual property rights may foment additional pressures.

- Artificial intelligence: enhances virtual world experiences through intelligent automation, dynamic content generation and personalized interactions. However, AI deployment in virtual worlds presents unique challenges. AI algorithms require access to user data to personalize experiences and improve performance, mandating the need to balance privacy concerns with the need for personalized AI-driven interactions is a critical challenge for virtual world developers. AI systems may also exhibit bias or unintended behavior due to biased training data or algorithmic design flaws and they often require significant computational resources for training and inference, limiting their scalability in resource-constrained environments like virtual worlds. Optimizing AI models for performance and efficiency is crucial to minimize hardware requirements and support real-time interactions.

- Advances in graphics rendering technology: have enabled increasingly realistic and immersive virtual world experiences. However, achieving photorealistic graphics in real-time also poses significant technical and computational challenges that are non-negligable. One issue deals with rendering complexity. Rendering complex scenes with high-resolution textures, dynamic lighting and realistic physics simulations requires substantial computational power and memory bandwidth. This is paired with current hardware limitations and the heterogenous use of hardware devices which may lack the processing power and graphics capabilities to render high quality virtual environments such as lower end mobile phones and entry-level gaming consoles. Additionally, emerging display technologies like VR headsets with high refresh rates, wide field of view and eye-tracking capabilities offer enhanced immersion and realism. However, their integration into mainstream consumer products requires

overcoming technical and cost barriers alongside addressing ergonomic concerns for prolonged use. Today, gamers who spend prolonged periods of time wearing gaming headsets have reported ‘gamer head’ which is a pronounced depression on the top of the skull resulting from the continuous wearing of large headphones over time.

- On a hardware level, the semiconductor industry faces significant challenges in scaling chip nanometers to smaller sizes, as dictated by Moore's Law. As transistor sizes approach the atomic scale, fundamental physical limitations (e.g. quantum tunneling and leakage currents) become more pronounced. These limitations hinder further reductions in transistor size and threaten to impede traditional scaling trends. Smaller transistors generate more heat per unit area due to higher power densities, exacerbating thermal management challenges. Heat dissipation becomes increasingly difficult as chip sizes shrink leading to performance degradation and reliability issues. Advanced lithography techniques, such as extreme ultraviolet (EUV) lithography, are necessary for printing smaller feature sizes on semiconductor wafers but require precision optics, complex manufacturing processes and expensive equipment which drive up production costs and yield challenges. Exploring novel materials and semiconductor architectures is essential for overcoming physical limits imposed by silicon-based technologies. For example, materials such as gallium nitride (GaN), graphene and carbon nanotubes show promise for high-performance computing applications but require further research and development to achieve commercial viability. Then there are rising manufacturing costs to consider. Although shrinking transistor sizes reduce power consumption per transistor, enabling higher computational densities and energy efficiency – power consumption per unit area remains a concern – particularly for mobile and battery-powered devices where energy efficiency is paramount. In an effort to address the limitations of traditional silicon-based chips, researchers are exploring alternative technologies and computing paradigms which may offer promise also in the context of scaling virtual worlds:

    - Quantum computing offers the potential for exponential increases in processing power by harnessing quantum phenomena such as superposition and entanglement. Quantum computers excel at solving certain types of problems such as optimization, cryptography and molecular simulation, but face significant technical challenges related to qubit stability, error correction and scalability.

    - Neuromorphic computing emulates the structure and function of the human brain, enabling energy-efficient and parallel processing of sensory data. Neuromorphic chips leverage spiking neural networks and synaptic plasticity to perform tasks like pattern recognition, sensor fusion and real-time control. While still in the early stages of development, neuromorphic computing shows

promise for applications in artificial intelligence, robotics and autonomous systems.

- The rise of decentralized computing paradigms including edge computing and distributed computing offers alternative approaches to traditional centralized data centers. Edge computing leverages localized processing and storage resources to reduce latency and bandwidth requirements for real-time applications. Distributed computing frameworks like Apache Spark and Hadoop enable parallel processing and distributed data analysis across clusters of interconnected nodes, enhancing scalability and fault tolerance. In the future it may be possible to link disparate virtual world environments across a sea of devices, each one optimized to auction off unspent cycles through near field or other means of compute diffusion to VR/XR headsets or other nearby spatial computing devices and scale compute in a decentralized fashion. Underpinning such a system through the use of blockchain would further reinforce data fidelity and transfer, alongside the cyber resilience of such a system.

2. **Economics:**

- High upfront costs: associated with hardware such as VR headsets, gaming consoles, or high-performance PCs present a significant barrier to entry for many potential users. Lowering the cost of entry through price reductions, hardware subsidies or alternative access models (through subscription services or cloud gaming platforms) could broaden the user base and drive adoption. Crucially, the access to high-speed internet connectivity and compatible hardware devices varies globally – limiting the reach of virtual worlds to regions with reliable infrastructure. Bridging the digital divide through infrastructure investments, connectivity initiatives and device subsidies can extend access to underserved populations and foster inclusivity. This is also true within the European Union. Although broadband connectivity exists in all Member States, the distribution is heterogenous, with an inter-regional 'digital divide' witnessed between the Nordics and western Europe and then between western Europe and southern Europe more generally. It would be necessary to invest into updating and homogenizing the infrastructure across the EU as a prerequisite step to ensuring a future where the ubiquitous uptake of virtual worlds could scale in principle. On an educational/digital literacy level, setting up and configuring VR hardware, installing software applications and navigating virtual environments may be daunting for novice users. Streamlining the onboarding process, providing intuitive user interfaces and offering interactive tutorials or guided experiences can lower the barrier to entry and enhance user retention.

- Network effects: play a crucial role in driving user adoption and engagement within virtual worlds. As more users join a virtual platform the value of the network increases

through network effects, leading to enhanced social interactions, content discovery and community engagement. Developers can also leverage network effects to incentivize user recruitment, promote user-generated content and foster community collaboration.

- Switching costs: Warren Buffet famously coined the term 'economic moat' to explain both the barriers to entry for new players in a given market but also to explain the barriers to switching from one provider, ecosystem or otherwise, to another. In the context of virtual worlds, users may incur switching costs when transitioning between virtual world platforms including (but not limited to) relearning interface conventions, transferring virtual assets or rebuilding social networks. This is a well-documented problem also in the gaming space. Companies have an incentive to encourage vendor lock-in, especially for the underlying meta-data (and associated IP) of in-game/in-world assets as is common practice even among games from the same parent company. It is impossible to transfer an asset from one game to another even if both are licensed under the same issuer (e.g. Overwatch vs/ World of Warcraft under Blizzard entertainment).

- Monetization Strategies: virtual worlds may employ various monetization models, including subscription fees, microtransactions, advertising and virtual asset sales. Balancing user value proposition with revenue generation is essential to sustain virtual economies while maintaining user satisfaction and loyalty requiring also an alignment from the developer communities building and populating these virtual environments on how monetization strategies should align with user preferences, ethical considerations and any regulatory requirements.

- Gamification techniques: such as quests, achievements, leaderboards and rewards can incentivize user engagement and promote desired behaviors within virtual worlds. By incorporating game mechanics into non-game contexts, developers may enhance user motivation, productivity and enjoyment thereby fostering a sense of accomplishment and progression.

- Social proof: refers to the tendency of individuals to conform to the actions and opinions of others in social settings. Leveraging social proof mechanisms such as user reviews, ratings, testimonials and social endorsements can influence user perceptions, preferences, and decisions within virtual communities. How such mechanisms are designed and ultimately diffused into virtual worlds will have a profound effect on their levels of credibility, correlation to trust and ability to drive a sense of community cohesion. This will be instrumental in driving user retention and word-of-mouth referrals in the off-line world.

- Loss aversion: describes the psychological bias towards avoiding losses over acquiring equivalent gains. Virtual worlds can exploit loss aversion tendencies by

offering limited-time events, exclusive rewards or scarcity-based mechanics to create a sense of urgency and fear of missing out (FOMO). By framing virtual experiences as opportunities to avoid losses rather than pursue gains, developers can stimulate user engagement and conversion behavior**.**

## 3. Ethics

Spatial computing technologies (e.g. AR and VR) collect vast amounts of user data including location information, biometric data and behavioral patterns. Ensuring user privacy and data protection is essential to prevent unauthorized access, data breaches and surveillance. Therefore platforms or service providers developing virtual world environments face challenges related to data minimization, purpose limitation, and user consent to safeguard user privacy rights. In Europe this requires a closer look at the intersection of the General Data Protection Regulation (GDPR) and potential for data minimization techniques (at minimum). Immersive experiences in virtual worlds may induce altered states of consciousness or dissociative effects, posing risks to user well-being and mental health. Obtaining informed consent from users, especially vulnerable populations like children or individuals with pre-existing condition is crucial to mitigate potential harms and ensure autonomy and agency. By the same token, the excessive use of spatial computing devices and prolonged exposure to virtual environments can lead to addiction, social isolation and cognitive impairment.

Blockchain technology can be a key enabler of addressing (at least in part) many of the ethical considerations which may affect current and future virtual worlds. Blockchain offers transparency and auditability by recording transactions on a distributed ledger accessible to all network participants. Decentralized governance possible through blockchain can empower users and foster community-driven decision-making. Blockchain-based virtual economies would be able to prioritize economic equity, equitable distribution of resources and fair wealth distribution. On artificial intelligence, algorithms in virtual worlds may exhibit bias or discrimination based on race, gender or other protected characteristics leading to unfair outcomes and social harm.

As such the implementation of bias detection to combat misinformation/disinformation and diverse training data sets is required to mitigate both algorithmic bias and promote equitable AI-driven experiences. AI systems should be transparent and explainable – enabling users to understand how decisions are made and which factors influence algorithmic outputs. It would also be beneficial to ensure principles such as beneficence, non-maleficence, and justice guide ethical decision-making to promote the responsible use of AI in virtual worlds. There are also open questions to the ethical implications of graphics rendering technology in virtual worlds including the creation of highly realistic depictions of violence, trauma or

sensitive subject matter. Balancing realism with responsible content moderation, age-appropriate ratings, and trigger warnings could help promote ethical content creation and user safety. Importantly, virtual worlds should respect cultural diversity and avoid perpetuating stereotypes, cultural appropriation or offensive content. Embracing cultural sensitivity, inclusivity, and diversity in virtual world design fosters positive social interactions, cross-cultural understanding and community cohesion.

**2) What are the main drivers of competition for Virtual World platforms, enabling technologies of Virtual Worlds and/or services based on Virtual Worlds (e.g. access to data, own hardware or infrastructure, IP rights, control over connectivity, vertical integration, platform and payment fees)? Do you expect that to change and, if so, how?**

The competitive landscape of Virtual World platforms, their enabling technologies, and associated services is significantly influenced by a myriad of factors, including but not limited to, access to data, ownership of proprietary hardware or infrastructure, intellectual property rights, control over connectivity, vertical integration, as well as platform and payment fees. These elements crucially determine a platform's capacity for innovation, scalability, and user engagement. Data access empowers platforms to customize experiences and refine services, while proprietary hardware ownership enhances seamless, quality user interactions. Intellectual property rights protect unique content and technologies, offering a competitive shield. Control over connectivity, especially internet access points, boosts platform reliability and performance. Vertical integration streamlines the entire user journey, potentially reducing costs by unifying control over hardware to content consumption. The architecture of platform and payment fees directly impacts market attractiveness for both users and creators, influencing the overall competitive stance.

This dynamic, however, is poised for transformation, propelled by regulatory shifts, technological breakthroughs, and evolving user demands. Tightening data protection regulations could recalibrate competitive advantages by reshaping data usage norms. Moreover, the trend towards embracing open standards and enhancing interoperability among platforms might erode the monopoly of proprietary ecosystems, fostering a landscape ripe for innovation and competition. The emergence of new technologies like augmented reality and advanced AI stands to redefine competitive parameters further by amplifying platform capabilities and enriching user experiences.

In this evolving scenario, blockchain technology merits specific attention for its potential to revolutionize aspects like data provenance and integrity, offering a robust, transparent ledger system that ensures data authenticity and compliance with ethical standards. Its capacity to facilitate secure, transparent exchanges, and its role in underpinning DeFi models and NFTs introduces new paradigms for user interaction, content monetization, and digital asset management. As blockchain technology integrates more deeply into the virtual worlds

ecosystem, it could significantly alter competition dynamics by empowering users, enhancing data security, and fostering a more equitable digital economy. This shift towards more open, interoperable ecosystems highlights a future where innovation, user empowerment, and technological sustainability emerge as primary drivers of competition, reshaping the virtual worlds landscape in profound ways.

**3) What are the current key players for Virtual World platforms, enabling technologies of Virtual Worlds and/or services based on Virtual Worlds, which you consider or expect to have significant influence on the competitive dynamics of these markets?**

A diverse ecosystem of players—from large corporations and Big Tech firms to startups, independent developers, gaming companies, content studios, corporate enterprises, and educational institutions—is actively shaping the future of digital interaction and immersive experiences. These entities leverage their unique strengths, ranging from vast user bases and financial resources to innovative technologies and creative content, to drive the development and adoption of virtual environments. The following sections delve into how these varied players are contributing to the virtual world space, highlighting their initiatives, products, and the impact they have on users and creators alike.

1. **Large Corporates/Big Tech Firms:**

- Meta (formerly Facebook): Meta's strategic vision for the Virtual World space extends beyond social networking to immersive experiences and the metaverse. With the launch of projects like Facebook Horizon, Meta aims to create a connected virtual universe where users can interact, socialize and explore. Leveraging its vast user base and financial resources, Meta invests in research, development and acquisitions to accelerate Virtual World innovation.

- Alphabet (through Google): Google's foray into Virtual Worlds encompasses various initiatives, including Google Earth VR, Google Arts & Culture, and Google Meet. Google Earth VR enables users to explore the world in immersive 3D, while Google Arts & Culture offers virtual tours of museums and cultural landmarks. Google's expertise in mapping, data visualization and cloud computing underpins its Virtual World offerings.

- Microsoft: Microsoft's Virtual World efforts revolve around mixed reality experiences, collaborative platforms, and enterprise solutions. With products like Microsoft Mesh and AltspaceVR, Microsoft enables users to interact, collaborate and socialize in virtual environments. Microsoft's Azure cloud platform provides scalable infrastructure and developer tools for Virtual World development, empowering creators to build immersive applications and experiences.

2. **Startups and Independent Developers:**

- Spatial: Spatial is a startup that specializes in augmented reality (AR) collaboration tools for remote teams. Its Spatial app enables users to meet, brainstorm and collaborate in virtual workspaces using AR headsets or mobile devices.

- Decentraland: Decentraland is a blockchain-based virtual world where users can buy, sell and monetize virtual land and assets. Built on the Ethereum blockchain, Decentraland leverages decentralized finance (DeFi) and non-fungible tokens (NFTs) to create a decentralized virtual economy. Decentraland's community-driven governance model and open-world environment empower users to create, explore, and trade within the 'metaverse.'

- AltspaceVR: AltspaceVR is a social VR platform that enables users to host events, attend live performances and socialize with others in virtual spaces. Acquired by Microsoft in 2017, AltspaceVR continues to offer immersive experiences across various domains including gaming, entertainment and education. AltspaceVR's emphasis on community-building, user-generated content and cross-platform compatibility fosters social interaction and cultural exchange in Virtual Worlds.

3. **Gaming Companies and Content Studios:**

- Epic Games: Epic Games is a leading game developer known for its Unreal Engine and popular titles like Fortnite. Through its Unreal Engine platform, Epic Games empowers developers to create immersive experiences across gaming, film, architecture and Virtual Worlds. Fortnite's metaverse aspirations and Epic's investment in virtual concerts, events and experiences demonstrate its commitment to Virtual World innovation.

- Roblox Corporation: Roblox Corporation operates Roblox, a user-generated content platform and virtual gaming ecosystem. With millions of user-created experiences and games, Roblox fosters creativity, collaboration and social interaction among its global user base. Roblox's developer tools, monetization options and virtual economy empower creators to build, share and monetize their creations within the metaverse.

- Linden Lab: Linden Lab is the creator of Second Life, a pioneering Virtual World platform launched in 2003. Second Life offers users a persistent, user-generated world where they can socialize, create content and transact with virtual goods and services. Linden Lab's expertise in virtual economies, content creation tools, and community management shapes Second Life's vibrant ecosystem and cultural impact.

4. **Corporate Enterprises and Educational Institutions:**

- Corporate Enterprises: Corporate enterprises across industries leverage Virtual Worlds for remote collaboration, training and customer engagement. Companies like HTC Vive, Spatial.io, and vSpatial provide virtual meeting solutions, immersive training simulations and augmented reality experiences for enterprise clients.

- Educational Institutions: Educational institutions embrace Virtual Worlds for distance learning, virtual classrooms and immersive training experiences. Universities and schools use platforms like EngageVR, Virbela, and Mozilla Hubs to deliver lectures, conduct experiments and facilitate group discussions in virtual environments. Virtual Worlds enhance student engagement, knowledge retention and accessibility to expand access to quality education and experiential learning opportunities.

**4) Do you expect existing market power to be translated into market power in Virtual World markets?**

Yes, it is anticipated that existing market power will indeed be translated into market power in Virtual World markets, particularly as we witness the emergence of new types of services anchored not only in innovative technologies and platforms, such as Virtual Worlds, but also in evolving social and legal paradigms.

The advent of these technologies is facilitating a significant shift in societal paradigms, giving rise to new rights and desires. "Living" within virtual worlds opens up opportunities for all citizens to exercise these emerging rights, which will consequently necessitate regulation through newly developed laws. Products and services will be increasingly tailored to cater to these new needs, transcending traditional boundaries. This evolving landscape suggests that new disciplines and branches of law will be essential to govern the complexities of this burgeoning world, pointing towards a future where current market leaders may leverage their resources, expertise, and influence to establish and maintain significant market power in the virtual realm.

Moreover, going forward, the integration of generative AI and VR in education promises to transform traditional learning environments by providing immersive, personalized, and interactive experiences that cater to the unique needs of individual learner. This technological convergence allows for the creation of dynamic educational content that adapts in real-time to the student's learning pace, style, and interests, in turn making education more engaging and effective. For instance, AI can tailor lessons based on a student's proficiency and preferences, while VR can transport students to historical sites or simulate complex scientific experiments, enhancing their understanding through experiential learning.

**5) Do you expect potential new entrants in any Virtual World platforms, enabling technologies of Virtual Worlds and/or services based on Virtual Worlds in the next five to ten years and if yes, what products and services do you expect to be launched?**

In the next five to ten years, it's anticipated that new entrants will significantly impact Virtual World platforms, enabling technologies, and related services. This is partly due to the ongoing advancements and innovations in digital technologies that open up unprecedented opportunities for applications across various industries. An exemplary case is the Digital Surgery projects implemented by Charité Berlin, which showcases the innovative integration of virtual and mixed realities into the medical field, particularly in surgical training and operations.

The Charité project has embarked on different pioneering initiatives, among them VolumetricOR and Digital Surgery, which illustrate the transformative potential of virtual world technologies in enhancing surgical education and practice. VolumetricOR utilizes photorealistic virtual reality to simulate surgical interventions, offering a three-dimensional, immersive learning environment that goes beyond traditional observation-based training methods. Trainees can experience surgical workflows from any perspective as if physically present in the operating room, bridging the gap between theoretical knowledge and practical application.

Digital Surgery, on the other hand, focuses on the development of an intelligent learning system leveraging mixed reality for the training of complex surgical gestures and tool usage. This approach aims to improve the quality of education, reduce training costs, and minimize the use of animal experiments, marking a significant advancement in surgical training practices.

These initiatives by Charité not only underscore the potential for Virtual World technologies to revolutionize medical education and practice but also hint at the broader applicability across other sectors. As such, it's reasonable to anticipate that new entrants will emerge in the Virtual Worlds space, offering innovative products and services that exploit the capabilities of virtual, augmented, and mixed realities. These could range from educational and training applications, like those developed by Charité, to entertainment, architectural visualization, remote collaboration tools, and more, all harnessing the immersive and interactive nature of Virtual World technologies to create novel user experiences.

The work of Charité serves as a core example of the profound impact that Virtual World technologies can have on professional training and operations. It exemplifies how specialized knowledge and procedures can be democratized and made more accessible through digital innovation. As the technology matures and becomes more integrated into various fields, it's expected that similar initiatives will proliferate, driving forward the development of Virtual World platforms and their enabling technologies. This expansion

promises not only to enhance existing practices but also to unveil new possibilities for engagement, learning, and collaboration in virtual environments.

Beyond health, the Bonn University has a project in which they are using the Graeco-Roman Mediterranean's visual culture to inform contemporary digital imagery, highlighting a broader trend where historical insights can inspire and shape future digital developments. Drawing from this approach, we anticipate that new entrants might introduce products and services that blend advanced digital technologies with ancient wisdom and visual practices, thereby offering novel user experiences that are both enriching and grounded in a deep cultural understanding.

For instance, future Virtual World platforms might incorporate AI-driven interpretations of ancient storytelling techniques, virtual reality experiences that bring ancient worlds to life, or augmented reality applications that overlay historical insights into our modern environment. These innovations could extend to educational platforms that use immersive technologies to teach history and culture, collaborative environments for exploring ancient art and architecture, and digital marketplaces for virtual assets inspired by historical artifacts.

The diverse initiatives undertaken by Charité Berlin, ranging from VolumetricOR and Digital Surgery in the medical field to the exploration of Graeco-Roman visual culture by Bonn University, shows the potential of Virtual World technologies. These projects underscore not just the technological innovation but also the holistic integration of digital realms into various aspects of human endeavor—from enhancing the precision and effectiveness of surgical training to enriching our understanding and appreciation of cultural heritage.

The successful integration of virtual and mixed realities across these domains showcases a future where the barriers between disciplines are blurred, fostering a cross-pollination of ideas and practices that drive forward both technological advancement and societal enrichment. As we envision a future where new entrants continuously emerge in the Virtual Worlds space, it's clear that the scope of impact extends far beyond the confines of any single field. The potential for these technologies to democratize access to specialized knowledge, revolutionize professional training, and open new avenues for cultural exploration is immense.

This narrative not only anticipates a future enriched by digital innovation but also serves as a call to action for stakeholders across industries to embrace the possibilities of Virtual World technologies. By fostering an ecosystem that encourages the development and integration of these technologies, we can unlock new dimensions of engagement, learning, and collaboration that transcend traditional boundaries. The exploration of ancient visual culture as a source of inspiration for contemporary digital imagery is an example to the potential applications, suggesting that the fusion of past wisdom with modern technology can yield experiences that are as educational as they are immersive.

This broad spectrum of applications from health to culture not only illustrates the versatility of Virtual World technologies but also highlights the broader ecosystem of projects and ideas that will shape our digital future. As such, embracing these technologies could hold the promise of a more connected, educated, and enriched society.

**6) Do you expect the technology incorporated into Virtual World platforms, enabling technologies of Virtual Worlds and services based on Virtual Worlds to be based mostly on open standards and/or protocols agreed through standard-setting organizations, industry associations or groups of companies, or rather the use of proprietary technology?**

The technology incorporated into Virtual World platforms, enabling technologies of Virtual Worlds, and services based on Virtual Worlds are likely to be a combination of both open standards/protocols and proprietary technology. While open standards and protocols agreed upon through standard-setting organizations, industry associations, or collaborative efforts among companies can foster interoperability, innovation and inclusivity within the Virtual World ecosystem – proprietary technology may also play a significant role in driving differentiation, monetization and competitive advantage for certain players.

1. **Open Standards and Protocols:**

   Open standards and protocols promote interoperability among different Virtual World platforms, devices, and services, allowing users to seamlessly interact and exchange content across ecosystems. Standards such as VRML (Virtual Reality Modeling Language), WebXR, and MPEG-V (Moving Picture Experts Group - Virtual Worlds) facilitate the creation, rendering, and distribution of immersive content that can run across various VR/AR devices and web browsers. Collaborative efforts to develop open standards and protocols also encourage innovation, knowledge sharing and industry-wide collaboration. Organizations like the Khronos Group, W3C (World Wide Web Consortium), and IEEE (Institute of Electrical and Electronics Engineers) contribute to the development of open standards for VR/AR, 3D graphics and spatial computing to drive technological advancements and best practices in the field.

   Open standards promote accessibility and inclusivity by lowering barriers to entry for developers, content creators and users. By adhering to open standards, Virtual World platforms can support a diverse range of devices, operating systems, and input modalities – ensuring broad compatibility and equal access for all users. The development of open standards and protocols involves collaboration among industry stakeholders including technology companies, standards organizations, academic institutions and individual developers. Their uptake is contingent on the widespread adoption and implementation of these diverse industry players. Companies can incorporate standards into their products, platforms and services to ensure

compatibility, interoperability, and compliance with industry norms. Developers can further leverage open APIs, SDKs (Software Development Kits) and reference implementations to build applications that adhere to established standards. This reduces both development time and effort while ensuring broad compatibility with existing ecosystems.

2. **Proprietary Technology:**
   Proprietary technology allows companies to differentiate their Virtual World offerings, create unique experiences, and capture market share. Companies like Meta (formerly Facebook), with its Oculus VR platform, and Sony, with its PlayStation VR ecosystem, develop proprietary hardware, software, and content to provide immersive experiences tailored to their platforms. For example, Meta's Oculus VR platform offers proprietary features such as Oculus Insight tracking, Oculus Touch controllers, and Oculus Link compatibility, which enhance immersion and performance for users. Proprietary technology enables companies to implement monetization strategies that drive revenue and sustain ongoing development efforts. Companies leverage proprietary platforms to offer premium content, subscription services, in-app purchases, and virtual goods to users. By controlling the distribution channels and payment mechanisms within their ecosystems, companies can capture a share of the value generated by Virtual World experiences. In considering issues such as control and security, companies may favor proprietary technology for the greater control it may afford them over their virtual world ecosystems – allowing them to enforce content moderation policies, protect intellectual property rights, and ring-fence user data management and security measures.

**7) Which data monetisation models do you expect to be most relevant for the development of Virtual World markets in the next five to ten years?**

In the next five to ten years, data monetization in Virtual World markets is expected to evolve significantly, with blockchain integrations playing a key role. The adoption of blockchain technology is set to introduce more secure, transparent, and equitable models for data monetization, capitalizing on its decentralized nature to foster trust and user empowerment. One of the key monetization models likely to gain prominence involves the use of NFTs, which can represent ownership of unique virtual assets, experiences, or content within Virtual Worlds. NFTs enable creators to monetize their digital creations directly, offering a new revenue stream and incentivizing innovation.

Additionally, blockchain-based incentive models are poised to redefine how data is valued and exchanged in Virtual Worlds. These models can reward users for their contributions, whether it's through creating content, participating in the ecosystem, or sharing data, using cryptocurrencies or utility tokens. Such incentive mechanisms not only encourage active

participation but also ensure that value generated within virtual environments is fairly distributed among all stakeholders.
Furthermore, tokenization, particularly of intellectual property rights within Virtual Worlds, is anticipated to emerge as a significant facet of data monetization models. By tokenizing IP rights, creators can securely and transparently sell or license their digital assets, artworks, or other IP-protected content through blockchain technology. This process not only simplifies transactions but also ensures that creators retain control over their works and receive fair compensation. Tokenized IP rights can facilitate a more dynamic and participatory digital economy, where users can trade, collect, or invest in digital assets with verified ownership and provenance. This innovative approach to monetizing IP rights through tokenization will likely encourage more creators to participate in Virtual World ecosystems, enriching the diversity and quality of content available.

Overall, the integration of blockchain technologies, including NFTs, tokenization and incentive models, will likely underpin the most relevant data monetization strategies in Virtual World markets, facilitating novel ways to generate value and foster a vibrant, sustainable virtual economy.

**8) What potential competition issues are most likely to emerge in Virtual World markets?**

The landscape of virtual worlds is at a critical juncture, with dominant platforms poised to extend their market power into these burgeoning digital realms. These entities, leveraging proprietary technologies, APIs, and file formats, are creating closed ecosystems that may deter interoperability and mobility, thereby amplifying network effects that further entrench their dominance. This scenario raises concerns about the potential for monopolistic or oligopolistic market structures, which could stifle competition and innovation within Virtual World markets. Furthermore, the strategic moves by Big Tech firms, exemplified by Meta's foray into the metaverse and Apple's stringent App Store policies, underscore the ongoing scrutiny over anti-competitive practices. Coupled with extensive data collection and the increasing trend towards data monetization, these platforms are set to leverage user data to fortify their competitive advantage, raising significant privacy and regulatory implications.

As the virtual world space continues to evolve, issues of interoperability, content moderation, intellectual property rights, and innovation are becoming increasingly prominent. The dominance of incumbent platforms may not only limit competition but also pose challenges to content diversity and user rights. The regulatory landscape, particularly in jurisdictions like the EU with stringent data protection laws, is poised to play a crucial role in shaping the development of virtual worlds. The potential for competition authorities to intervene in cases of market dominance abuse highlights the need for a balanced approach that fosters innovation while ensuring fair competition and protecting user interests.

This evolving scenario suggests a future where the dynamics of platform dominance, data control, and market power in the physical world are likely to be mirrored, if not amplified, in virtual worlds. As such, stakeholders across the spectrum, from developers to regulators, must navigate these challenges thoughtfully to ensure that virtual worlds remain vibrant, competitiveand accessible spaces for innovation and interaction. See below for a more elaborated overview of each of the issues mentioned above:

1. **Platform Dominance and Market Power:** Dominant virtual worlds platforms may establish closed ecosystems with proprietary technologies, APIs, or file formats making it difficult for users and developers to migrate their content or assets to competing platforms. Network effects inherent in virtual worlds platforms may amplify the advantages of market leaders, creating barriers to entry for new competitors and reinforcing the dominance of incumbent platforms.Platforms may leverage their dominant position to aggregate content, services, or digital assets within their ecosystem, enhancing user engagement and retention while reducing the visibility and reach of competing platforms. High market concentration among a few dominant platforms may lead to monopolistic or oligopolistic market structures, reducing competitive pressure and innovation in the Virtual World markets.

   The dominance of incumbent platforms may deter new entrants from investing in the Virtual World markets due to the high costs of competing with established players and overcoming network effects or switching barriers. Dominant platforms may engage in vertical integration by acquiring or controlling complementary services or content, further entrenching their market power and limiting competition. The combination of the above points may lead competition authorities to investigate allegations of abuse of dominance by virtual worlds platforms, including practices such as predatory pricing, exclusive dealing or discriminatory treatment of competitors or users. This will indelibly involve assessing the definition of ‘markets’ in virtual worlds by potentially analyzing the scope of competition, substitutability between platforms and the existence of barriers to entry or expansion for potential competitors.

   Big Techs are already under scrutiny for anti-competitve practices including Facebook’s acquisition of Oculus VR which raised concerns about the potential for the social media giant to leverage its dominance in social networking to control virtual reality platforms and ecosystems. Another notable example are Apple's App Store policies, including its 30% commission on in-app purchases and restrictions on alternative app distribution channels which have been criticized for limiting competition and innovation in the market for virtual worlds applications and content distribution. Or Apple’s most recent anti-trust penalty for abusing its dominant position as a distributor of music streaming apps, incurring a €1.84 billion fine in the EU.

2. **Data Access and Control:** Virtual worlds platforms often collect extensive user data, including demographic information, behavior patterns and interaction histories within the virtual environment, through tracking mechanisms such as cookies, analytics tools and in-game telemetry. Platforms may also integrate user data from various sources, including social media profiles, device identifiers and third-party services to create comprehensive user profiles for targeted advertising, content personalization and product recommendations. Platforms utilize real-time analytics and machine learning algorithms to analyze user behavior, predict preferences, and optimize user experiences in the virtual environment in turn generating valuable insights for advertisers and content creators.

   One important consideration is the increasing trend towards data monetization which is likely to increase not decrease in the medium to long term. Virtual worlds platforms may inevitably seek ways to monetize user data through targeted advertising, sponsored content and data licensing agreements with third-party advertisers, marketers, and data brokers. This will generate significant revenue streams from data-driven business models. Access to vast datasets and advanced analytics capabilities provide dominant platforms with a competitive advantage in targeting advertising, optimizing engagement and retaining users – creating barriers to entry for smaller competitors lacking comparable data resources. Virtual worlds platforms participate in complex data value chains where user data is collected, processed and monetized by multiple stakeholders including platform operators, advertisers, developers, and data intermediaries. This complex interaction will shape market dynamics and competition in virtual worlds related markets.

   For virtual worlds platforms operating in the EU the General Data Protection Regulation (GDPR) imposes strict requirements on the collection, processing and protection of personal data. Platforms must obtain explicit consent from users for data collection and processing activities including the purposes for which the data will be used to ensure transparency and control over personal information. GDPR also mandates that platforms collect and process only the minimum necessary data for specified purposes and limit data access and retention to what is essential for providing services to users. Users have rights to access, rectify and delete their personal data held by platforms as well as the right to data portability which enables them to transfer their data to other services or platforms.

   In the future, competition authorities may investigate allegations of abuse of dominance by virtual worlds platforms concerning data access and control practices, such as leveraging user data to foreclose competition or harm rivals. Platforms with access to vast amounts of user data may possess significant market power, enabling them to exclude competitors, dictate terms to users and third parties and distort competition in the Virtual World markets. Virtual worlds platforms and associated

service providers will face transparency requirements to provide clear and accessible information to users about their data collection, processing and sharing practices including privacy policies, data protection notices and user-friendly consent mechanisms. Transparency requirements may further extend to algorithmic decision-making processes used by platforms for content curation, recommendation systems and targeted advertising, enabling users to understand and challenge automated decisions affecting them.

Platforms may be required to conduct regular audits and assessments of their data practices, including data protection impact assessments (DPIAs) and privacy audits to ensure compliance with legal obligations and industry standards. From a cross-border context, some jurisdictions also impose restrictions on cross-border data transfers, requiring platforms to store and process user data within national borders or obtain specific authorization for international data transfers. This may complicate data access and control practices in Virtual World markets, as evidenced in the on-going data-driven disputes between the EU and US.

3. **Interoperability and Portability:** Interoperability relies on the adoption of open standards and protocols that enable seamless communication and data exchange between different virtual worlds platforms, ensuring compatibility and interoperability across heterogeneous environments. Platforms may offer application programming interfaces (APIs) that allow third-party developers to integrate their applications, services or content with the platform while common data formats and interchange formats may enable the exchange of user generated content, virtual assets and metadata between platforms. On the other hand, closed and proprietary platforms may create barriers to entry for new entrants or smaller players in virtual world markets – limiting competition and innovation by restricting interoperability and data portability between platforms. Interoperability promotes user choice and mobility by reducing lock-in effects, allowing users to switch between platforms or migrate their content and assets without significant switching costs allowing interoperable platforms to benefit from network effects that amplify the value of the ecosystem. On the other hand, closed ecosystems and proprietary formats that hinder interoperability and data portability may raise concerns under competition laws including allegations of abuse of dominance, anti-competitive tying arrangements or foreclosure of rival platforms.

   The European Commission's antitrust investigation into Microsoft's bundling of Internet Explorer with the Windows operating system raised concerns about anti-competitive tying practices that limited interoperability and choice in web browsers, resulting in regulatory interventions to promote interoperability and competition in the browser market. Another example includes the Open Document Format (ODF) vs. Office Open XML (OOXML) debate over document format standards which highlighted the importance of interoperability in office productivity software

markets. It brought efforts to promote open standards such as ODF to enhance competition and user choice.

4. **Content Moderation and Curation:** Dominant virtual worlds platforms may wield significant control over content moderation and curation potentially abusing their market power to stifle competition, suppress rival content or favor their own services and offerings. High barriers to entry may deter new entrants from challenging dominant platforms as they lack the resources and user base necessary to implement effective content moderation and compete with established platforms' curated content offerings. Dominant platforms may also benefit from network effects where the size and activity of their user base reinforce their market position, making it challenging for smaller competitors to attract users and content creators away from established platforms. Automated content moderation algorithms may exhibit biases based on factors such as demographics, language or cultural background leading to discriminatory outcomes and unequal treatment of users and content creators. Platforms may face criticism for censoring certain types of content or viewpoints deemed controversial or politically sensitive, raising concerns about freedom of expression, diversity of opinion and platform neutrality in content moderation decisions. Dominant platforms may engage in exclusionary practices such as suppressing rival content or privileging affiliated content to maintain their market dominance and thwart competition from emerging platforms or alternative viewpoints.

   Malicious actors may exploit content moderation loopholes or vulnerabilities to manipulate platform algorithms, artificially inflate engagement metrics or spread disinformation to undermine the integrity and trustworthiness of virtual worlds platforms. Platforms may face challenges in detecting and combating fake engagement tactics such as bot-driven likes, views, or comments which distort content visibility, mislead users and create unfair advantages for certain content creators or advertisers. In certain cases, dominant platforms may extract monopoly rents from content creators, developers or advertisers by imposing arbitrary content moderation policies, opaque monetization practices or unfair revenue-sharing arrangements.

5. **Intellectual Property Rights and Innovation:** There is a concern that dominant virtual worlds platforms may wield significant control over the creation, distribution and monetization of content through their proprietary IPR regimes allowing them to potentially leverage their market power and extract rents, stifle competition or favor their own content offerings. In parallel, high barriers, including the costs and complexities of securing and enforcing intellectual property rights may deter new entrants from challenging dominant platforms, limiting competition and innovation in virtual worlds markets. Users and content creators may become locked into dominant platforms' ecosystems due to the platform's control over proprietary

content formats, tools or distribution channels making it difficult for competitors to attract and retain users. Dominant platforms may engage in monopolistic practices, such as acquiring exclusive content rights or entering into anti-competitive licensing agreements to foreclose rival platforms' access to popular content, limit consumer choice and maintain their market dominance. Platforms may offer preferential treatment or exclusive deals to certain content creators, developers or rights holders in a bid to exclude competitors from accessing or distributing high-demand content and undermining fair competition in virtual worlds markets.

Fragmentation of content rights across multiple platforms may hinder interoperability, content portability and user mobility between virtual worlds. Excessive enforcement of intellectual property rights including overly broad copyright claims or aggressive content takedown policies may restrict users' rights to fair use, transformative works or derivative creations and stifle creativity, remix culture and innovation in virtual worlds. Platforms' policies on user-generated content ownership, licensing and monetization may impact users' incentives to create and share content with restrictive IP regimes discouraging participation, collaboration and community engagement in virtual worlds environments.

**9) Do you expect the emergence of new business models and technologies to trigger the need to adapt certain EU legal antitrust concepts?**

The relationship between antitrust enforcement and the burgeoning digital economy is becoming increasingly complex, especially under the framework of the Treaty on the Functioning of the European Union (TFEU). Articles 101 and 102 TFEU are key for shaping the competitive landscape, addressing anti-competitive agreements and abuse of dominance, respectively. As digital platforms continue to dominate and expand their influence, the application of these articles is crucial in preventing abuses of market power that could stifle competition, innovation, or consumer welfare. With the digital realm's unique characteristics, such as platform ecosystems acting as gatekeepers and the integration of services and data, regulators are faced with the challenge of adapting traditional antitrust principles to the virtual world. This necessitates a nuanced understanding of how virtual worlds operate, the role of data, and the potential for exclusionary practices or unfair competition. The following exploration delves into these challenges, offering insights into how antitrust laws under the TFEU are applied and may evolve in the context of virtual worlds and digital platforms.

1. **Antitrust Enforcement under the TFEU:** Articles 101 and 102 of the Treaty on the Functioning of the European Union (TFEU) govern anti competitive agreements and abuse of dominance, respectively.

    a. **Abuse of Dominance (Article 102 TFEU):** With the proliferation of dominant digital platforms, regulators should closely monitor whether these entities

abuse their market power to the detriment of competition, innovation or consumer welfare. Examples of abusive practices in virtual worlds may include self-preferencing, discriminatory practices, tying and bundling and exclusivity agreements that foreclose rivals from accessing essential inputs or markets. Regulatorsshould also consider the unique characteristics of platform ecosystems, where platforms may act as gatekeepers controlling access to users, data or services. The integration of services, data leveraging and algorithmic decision-making within these ecosystems can raise concerns about exclusionary conduct, lock-in effects and unfair competition. As digital platforms increasingly rely on algorithmic pricing and personalized services, regulators may need to assess whether these practices result in discriminatory or anticompetitive outcomes. Algorithms that collude to fix prices, segment markets or engage in price discrimination may infringe competition law and require intervention by antitrust authorities. Regulators may also consider how the conduct of dominant digital platforms affects innovation and entry barriers in the market. Practices that deter or exclude potential competitors such as acquiring nascent rivals, patent strategies or data hoarding may harm competition and impede innovation.

b. **Anticompetitive Agreements (Article 101 TFEU):** Regulators should scrutinize collusive practices among market players including horizontal agreements between competitors and vertical agreements between companies in different levels of the supply chain. In the digital space, collusion can take various forms, such as price-fixing cartels, market-sharing agreements, bid-rigging schemes or concerted actions to exclude rivals or restrict competition. There is a need to closely monitor information exchange and standard-setting activities that may facilitate collusion or anticompetitive coordination among industry players. Moreover, although standard-setting organizations (SSOs) play a crucial role in promoting interoperability and compatibility their activities must also comply with competition law to prevent anti competitive outcomes that harm consumers or restrict innovation.

**Recommendations:** Defining relevant product and geographic markets in the digital sector presents unique challenges due to the dynamic nature of technology, rapid innovation cycles and global reach of online platforms.

- Regulators may need to employ innovative methodologies, such as multi-sided market analysis, user-based segmentation or qualitative assessments of platform dynamics, to accurately delineate digital markets and to assess the competitive effects of platform ecosystems and cross-market interactions.

Many digital platforms operate as two-sided or multi-sided markets serving distinct groups of users such as consumers, advertisers, developers or merchants.

- Regulators should analyze the interdependencies, network effects, and feedback loops within these platforms to understand market dynamics and assess competitive constraints effectively. This will help clarify the application of competition rules to platform ecosystems including virtual worlds markets in terms of platform self-referencing, data leveraging and potential interoperability barriers.

  Network effects and switching costs can create barriers to entry and expansion in digital markets, reinforcing the market power of dominant players.

- Regulators may need to consider the role of network effects, data advantages, and platform lock-in effects when assessing market power and abusive conduct in digital markets. This may include developing new indicators for assessing market power in digital markets, including measures of data access, user engagement and platform control over essential facilities.

  Regulators may face challenges in obtaining access to proprietary data and algorithms held by dominant digital platforms, hindering their ability to conduct effective investigations and enforcement actions.

- Promoting data access and transparency through regulatory interventions via data portability requirements or algorithmic transparency obligations can help enhance competition and facilitate antitrust enforcement in the digital sector.

  Regulators should consider appropriate remedies and enforcement actions to address anticompetitive conduct and restore competitive dynamics in digital markets.

- Remedies may include structural remedies (e.g. divestitures, spin-offs), behavioral remedies (e.g. conduct commitments, pricing controls) or regulatory interventions (e.g. interoperability mandates, data access requirements) tailored to the specific circumstances of each case.

2. **Vertical Agreements (VBER):** The Vertical Block Exemption Regulation (VBER) provides a safe harbor for vertical agreements governing online distribution and licensing of digital content (which may capture virtual worlds markets), between

content creators, platform operators and distributors. This safe harbour exempts agreements from antitrust scrutiny if they meet predefined criteria (e.g. market share thresholds and absence of hardcore restrictions).
The VBER's provisions on territorial and customer restrictions may influence how virtual worlds are 'distributed' and accessed within the EU market. Given that a virtual world by definition is cross-border innately as a virtual world market exists on the internet and may be internet native, it is yet unclear whether these platforms will benefit from the VBER's safe harbour. There is also a need for balance between competition and innovation in line with the principles of vertical agreement legality under the VBER. While the VBER aims to prevent anti competitive restraints, it also recognizes the importance of allowing companies to protect their intellectual property rights, preserve brand image and ensure quality standards in digital content distribution.

**Recommendations:** The VBER may influence platform-to-business relationships within virtual worlds ecosystems, where platform operators interact with content creators, developers and service providers. Agreements between platforms and business users, such as revenue-sharing arrangements, access to platform services, and content moderation policies, may be subject to the VBER's provisions on vertical restraints and competition law.

- Updating the VBER and vertical guidelines to account for the specific characteristics of digital markets, such as platform-to-business relationships, data dependencies, and platform access conditions.

  Regulators face challenges in applying the VBER to platform-to-business relationships, particularly in cases where platform operators wield significant market power or engage in unfair trading practices.

- Strengthening enforcement mechanisms to address anti-competitive conduct by dominant platforms, such as abusive tying or bundling practices, unfair trading conditions, and discriminatory treatment of third-party business users.

  Issues such as platform gatekeeping, self-preferencing, and data access may raise concerns about the abuse of dominance and anticompetitive conduct, requiring careful scrutiny under EU competition law.

- Clarifying the application of competition rules to virtual worlds markets, including the treatment of platform self-preferencing, discriminatory access practices and interoperability requirements.

Virtual worlds business models may use dynamic pricing algorithms, personalized recommendations and user-generated content to enhance user experiences and drive engagement.

- Regulators should assess whether agreements related to pricing algorithms data access, and content curation comply with the VBER's provisions on vertical restraints and competition law.

3. **Horizontal Agreements (HBER):** The HBER provides a safe harbor for certain horizontal agreements between companies operating at the same level of the supply chain such as agreements between competitors or agreements within a consortium. While the VBER primarily addresses vertical agreements, the HBER focuses on horizontal cooperation among competitors. In virtual worlds environments, companies may engage in horizontal agreements to collaborate on joint ventures, standard-setting activities or industry consortia aimed at developing common standards, interoperability protocols or content-sharing platforms. The HBER's provisions on horizontal agreements may influence how such collaborations are structured and assessed under EU competition law.

   For example, virtual worlds-related companies may form joint ventures or consortia to pool resources, share risks and collaborate on the development or promotion of virtual worlds platforms, technologies or content. The HBER's safe harbor provisions may exempt such agreements from antitrust scrutiny if they meet certain criteria (e.g. not exceeding specified market share thresholds and not eliminating effective competition). Companies in virtual worlds environments may participate in standard-setting organizations (SSOs) to develop technical standards, interoperability protocols, or content formats that facilitate compatibility and interoperability among different virtual worlds platforms. The HBER's provisions on collaborative standard-setting activities aim to promote innovation, interoperability and consumer welfare while preventing collusion, exclusionary conduct or market foreclosure.

   The HBER sets out criteria that horizontal agreements must meet to benefit from the safe harbor, including not exceeding certain market share thresholds, not containing hardcore restrictions, and contributing to improvements in production or distribution. Companies engaged in horizontal cooperation in virtual worlds environments must ensure that their agreements comply with these criteria to avoid antitrust scrutiny and enforcement actions. Regulators may face challenges in enforcing the HBER in virtual worlds environments – particularly in cases involving complex technologies, dynamic market dynamics and global competition. This may extend to issues such as collective dominance, information exchange and coordinated effects which may require careful analysis and investigation to ensure effective enforcement of EU competition law.

4. **Algorithmic Pricing and Collusion Risks:** Antitrust authorities should develop expertise in detecting and deterring anti-competitive pricing algorithms and algorithm-driven collusion in digital markets. This includes:

- Establishing guidelines or standards for assessing the competitive effects of algorithmic pricing algorithms, including price discrimination, price signaling and coordinated pricing behavior.

- Enhancing transparency and accountability in algorithmic decision-making processes, including algorithmic auditing, algorithmic fairness assessments and algorithmic impact assessments.

- Strengthening enforcement mechanisms to address algorithm-driven collusion, including collusion facilitated by machine-to-machine communication, tacit collusion and algorithmic price-fixing agreements.

**10) Do you expect the emergence of new business models and technologies to trigger the need to adapt EU antitrust investigation tools and practices?**

Please refer to question 12 in part 1.

**Additional considerations regarding decentralized technologies like blockchain and their influence to the development and governance of virtual worlds**

Blockchain technology could enable secure and transparent ownership and exchange of virtual assets, such as land, items, and avatars, through non-fungible tokens (NFTs). This capability could serve as a backbone of the digital economy within virtual worlds where users possess actual ownership and play active roles in governance. Decentralized autonomous organizations (DAOs) could also emerge as a new governance model for virtual communities, allowing users to vote on decisions and changes within the virtual world. Such a participatory governance model could cultivate a sense of community and shared proprietorship, potentially fostering more democratic and equitable virtual environments. Regarding privacy and identity management, blockchain technology can offer mechanisms for secure and decentralized verification of identities, enabling users to maintain control over their personal data and its dissemination across virtual worlds.

While blockchain holds the potential to make virtual worlds more secure, democratic, and user-centric, realizing this potential requires careful consideration of technological, legal, and ethical challenges, alongside continued innovation in blockchain technologies and their applications.