



JRC CONFERENCE AND WORKSHOP REPORT

Shaping the Next Generation of Virtual Worlds

Science for Policy event

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ABSTRACT

Next generation virtual worlds present a strong, multifaceted potential that also need to be analysed in light of the challenges they may pose along societal, technological, and economic and policy dimensions. To dive deeper into the EU's strategic approach to immersive technologies, the Joint Research Center organised the 'Shaping the Next Generation Virtual Worlds – Science for Policy (online) event', gathering experts and policymakers to foster collaboration and knowledge exchange to navigate the socio-economic and technological landscapes of virtual worlds. Key discussions addressed the role of research in policy, the socio-economic implications of virtual worlds, and the EU's actions to support new business models and applications in virtual environments.

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01 INTRODUCTION

On 8 November 2023, the Digital Economy Unit of the European Commission's Joint Research Centre (JRC) organised the 'Shaping the Next Generation Virtual Worlds – Science for Policy event'. Virtual worlds experts and professionals from academia, research centres, the private sector, NGOs, and the European Commission elaborated on technological developments and socio-economic challenges presented in the ['Next Generation Virtual Worlds: Societal, Technological, Economic and Policy Challenges for the EU'](#) report, published in July 2023.

This *Science for Policy* conversation provided an opportunity to **mobilise a network of prominent scholars and professionals** working in the rapidly evolving realm

of virtual worlds, with the goal of fostering collaboration, knowledge exchange, and foresight thinking to shape the next era of immersive experiences and explore new frontiers of virtual worlds.

The event presented the vision and specific actions and initiatives planned by the Commission within the framework of the Strategy '**An EU initiative on virtual worlds: a head start in the next technological transition**', adopted on 11 July 2023. The speakers emphasised the rapid technological advances and the limitless possibilities offered by immersive digital environments, and showcased immersive experiences. An interactive 3D virtual room exhibition was made available to participants to explore relevant resources.

Overall, the discussions represented a preparatory exercise in the context of the creation of a **Centre for Advanced Studies (CAS)** at the JRC dedicated to investigating next generation virtual worlds.

The event, moderated by **Michele Vespe**, *Acting Head* of the Digital Economy Unit at the JRC, kicked off with a plenary session available openly via web streaming, followed by three breakout sessions on different virtual worlds related topics.

02 OPENING AND PLENARY SESSION

Stephen Quest, Director General of the Joint Research Centre, highlighted the **importance of anticipation** in policymaking and the role of the JRC in shaping policy responses to the challenges posed by emerging technologies. He emphasised the need to support the development of new technologies, thanks to which we could improve policy-making and public services. He also expressed the need to identify possible risks early on, and stressed the importance of the three-year exploratory research project on virtual worlds that will fulfil that need, under the umbrella of the JRC Centre for Advanced Studies.

The discussion continued with the joint interview of **Yvo Volman**, Director for Data at DG CNECT, and **Francesca Campolongo**, Director for Digital Transformation and Data at the JRC. They discussed the aims of the communication strategy on virtual

worlds and Web 4.0, the timing of the initiative, and the role of research in shaping the next generation of virtual worlds. Yvo Volman highlighted Europe's strengths in research, innovation, industry, and legislation, emphasizing the need for a common approach at the European level to ensure a **leading role** in the development of virtual worlds. Francesca Campolongo emphasised the role of research in driving the EU's position in the field and highlighted the importance of **independent research** and collaboration with other Commission services in shaping European policies.

The keynote speakers, **Mel Slater**, distinguished researcher of the University of Barcelona, and **Mavi Sánchez Vives**, Head of Systems Neuroscience at IDIBAPS, shared insights into the **positive and negative implications** of virtual worlds, including the opportunities for fostering creativity, reducing the need for travel, and bringing remotely located people together. However, they also highlighted challenges such as technical, economic, educational, legal, and ethical aspects of virtual worlds, including issues of privacy, regulation, and long-term exposure. Dr Sánchez Vives presented the **uses of virtual reality in mental and physical health applications, including training, mental health, rehabilitation, and remote assistance**. Furthermore, she presented the use of virtual reality in social and behavioural applications, such as prevention of gender violence. The speakers emphasized the need for a balanced approach, ensuring that technology enhances experiences without replacing them.

JRC researcher **Isabelle Hupont** introduced the '[Next Generation Virtual Worlds: Societal, Technological, Economic and Policy Challenges for the EU](#)' Science for Policy report, published in July 2023. The publication was the result of a collaborative effort by a multidisciplinary team of over 15 experts, encompassing legal, policy, industry, economy, education, sustainability, technical, and social science fields. The aim was to analyse the societal, technological, economic, and policy challenges of next generation virtual worlds, which encompass a continuum from fully real to fully virtual experiences, including augmented reality, augmented virtuality, and virtual reality, known as Extended Reality (XR). She explained how the report defined next generation virtual worlds as **experiences that incorporate varying degrees of virtual and real information** with different levels of immersiveness and interaction. The presentation emphasised the convergence of key technological enablers, such as enhanced telecommunication and computational infrastructures, coupled with exponential technological advancements such as artificial intelligence, Internet of Things, and blockchain.

Cesare Dunker, policy officer at DG GROW, concluded the plenary session with a presentation on the concrete industrial applications of virtual worlds, including digital twins for predictive maintenance in manufacturing and virtual reality training in healthcare. It emphasised the European Commission's actions to accelerate the uptake of new business models, foster a supportive European business environment, and explore new digital cooperation models to support the deployment of virtual world solutions across industries.

In conclusion, the Science of Policy event on Next Generation Virtual Worlds provided valuable insights into the opportunities and challenges of virtual worlds and

highlighted the role of **research, innovation, and collaboration** in shaping the European Union's position in this rapidly evolving field. The event set the foundation for a network of virtual world scholars and experts and emphasised the need for a **common European approach** to ensure a leading role in the development of virtual worlds.

03 PARALLEL SESSION

OPPORTUNITIES AND IMPLICATIONS OF VIRTUAL WORLDS FOR THE PUBLIC SECTOR

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Moderator: Sven Schade, Senior Policy Officer, European Commission.

Speakers:

- ▶ **Marina Manzoni**, Innovation Officer for Digital Technologies and Applications, at the Directorate-General Joint Research Centre, European Commission.
- ▶ **Stanisław Tosza**, Associate Professor in Compliance and Law Enforcement, University of Luxembourg.
- ▶ **Marisa Ponti**, Associate Professor, Dept. Applied Information Technology, Univ. of Gothenburg, Sweden.
- ▶ **Dietmar Gattwinkel**, Seconded National Expert at the Directorate-General for Communications Networks, Content and Technology, European Commission.
- ▶ **Richard Michael Dreyling III**, Junior Researcher and PhD candidate at Tallinn University of Technology.

SUMMARY OF TALKS

The session *Opportunities and implications of virtual worlds for the public sector* explored issues related to public governance, including the role of the public administration (the administration of public good). In particular, it explored its mandate (based on the rule of law), its objectives (public value creation), its operating context within the European Union (multi-level governance and partnerships), and available instruments (determined by public policy). Three key principles were considered when suggesting any change affecting public administration, namely: clear added value, proportionality, and the legal framework.

A crucial aspect of governing the virtual worlds will consist in **defining the role of relevant private actors** and their **relationship with the public power**. Hence, we first approached this setting from an enforcement perspective - highlighting that most of the responsibility to monitor and moderate what is allowed on their platforms will fall on private companies that will have also to provide law enforcement with the tools to do effectively operate on these platforms. While we cannot know yet exactly in which ways crimes may occur in virtual worlds, we can assume that, as these worlds develop, they will be exposed to criminal activity. As experience shows from current internet activity, such as social media, it is inevitable that virtual worlds will present challenges, such as hate speech, terrorist propaganda, disinformation, etc. The private actors will be by necessity tasked with **combatting illicit content**. This task affects fundamental rights of the users, such as freedom of speech. They will also be inclined to execute this task having their business interest in mind, which might not be aligned with the public interest. Tools of accountability available for the public sector will also be lacking. At the same time, virtual worlds will offer excellent opportunities for law enforcement, given the amounts of data to be amassed. However, access to that data will present a legal challenge, as the interactions in virtual worlds may not happen in a single jurisdiction. Although parties will have the feeling of being next to each other, they could physically be in different places, thus a single offence could affect several jurisdictions and different authorities could own the data. In such circumstances, new regulations might be necessary to assure that investigations can be conducted without violating sovereignty of the countries in question.

The discussion then turned to the application of virtual worlds at the **local level**, like **CitiVerses**. We discussed how CitiVerses might help **support citizen participation** in decision-making, and the importance to take steps to avoid exacerbating the digital divide in Europe. For example, certain segments of society cannot make evenly use of the opportunities provided by CitiVerses because of their socioeconomic status, ethnical background, age, gender, and geography. Also citizen acceptance cannot to be taken for granted. City administrators and other actors developing and managing CitiVerses need to understand the **drivers of people acceptance** to design interventions. About the once-only principle: who is doing the sharing and using which Identity, citizens or administrators? In any case, **trust** is a critical component of implementing the once-only principle. To make the system work, citizens and businesses must trust that their information will be securely and responsibly managed. This trust is typically built through robust data protection measures, secure authen-

tication, and clear data usage policies. **Trust, security, and data privacy** are especially challenging in CitiVerses.

On the one hand, governments and public administrations will have to govern: control, influence, or regulate Virtual Worlds. This means they will have to enforce rules with the providers of virtual worlds or by themselves. Important rules to be enforced will have to concern identity, protecting user representation, so called ‘avatars’, against identity theft (impersonation) but also connecting avatars to real world identities. On the other hand, they will also have to govern in virtual worlds. Possible options include (a) being where users are in a form of outreach with low-threshold services; (b) making use of the added forms of interaction, such as in the retrieval, presentation and manipulation of data; (c) acting as guardians for access of public space; or (d) providing services for the virtual worlds, such as the upskilling of people to use it, provide help to create once presence, etc.

Last but not least, we underlined the importance for **regulation** to deal with the world as it exists, not a presumption of what the virtual worlds will look like. Hence, agility, flexibility, feedback loops, and iteration should be key principles in moving toward CitiVerses and other virtual worlds that accomplish those things stated above.

WHAT IS NEXT?

The session confirmed initial indications from the JRC Science for Policy report, but it also enriched the current debate with additional insights. The issues discussed in the session are also topics for the current work of the European Commission Innovation Friendly Regulations Advisory Group (IFRAG). This group focuses on the use of emerging technologies in support of the public sector to [improve, optimise and innovate its operations and service provision](#). It works on **dedicated use cases of virtual worlds** and its advice may also support actions and programmes related to [public procurement](#), the [digital provision of key public services to citizens and businesses](#), and experimentation with advanced emerging digital technologies by public authorities in controlled environments ([regulatory sandboxes](#)). The group will continue its work until early 2024, and deliver a final report addressing several issues that were discussed in this session.

04 PARALLEL SESSION

IMMERSIVE TECHNOLOGY IN EDUCATION AND TRAINING

Moderator: Romina Cachia, Project Leader at the Directorate-General Joint Research Centre, European Commission.

Speakers:

- ▶ **Rehana Schwinninger-Ladak**, Head of the Interactive technologies, Digital for Culture and Education Unit at the Directorate-General for Communications Networks, Content and Technology, European Commission.
- ▶ **Georgi Dimitrov**, Head of the Digital Education Unit at the Directorate-General for Education, Youth, Sport and Culture, European Commission.
- ▶ **Rikardo Lamadrid Intxaurreaga**, Director of Technology and Advanced Learning at the Basque Country Government, Spain.
- ▶ **Dr Fotis Liarokapis**, Associate Professor of Extended Experiences at CYENS - Centre of Excellence, Nicosia, Cyprus.

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SUMMARY OF TALKS

The aim of this session was to provide an **overview the role that extended reality (XR) and virtual worlds may play in education**, with inputs from four distinguished speakers. Romina Cachia, team leader of the Digital Education and Skills project at the JRC, started highlighting some key insights from two recent science for policy reports.

The '[Next Generation Virtual Worlds: Societal, Technological, Economic and Policy Challenges for the EU](#)' report identifies education as one of the **main sectors in which such technological innovations are expected to bring profound changes**. Most notably, the sense of human presence in multiple interconnected virtual worlds may not only enable new forms of learning through experimentation and play in cyber-physical environments, but also support new forms of social learning. The

second report discussed, '[On the Futures of Technology in Education: Emerging Trends and Policy Implications](#)', argues that **future connectivity infrastructures (6G) will intertwine cognition, space and action in unprecedented ways**. Immersive simulations underpinned by such connectivity infrastructures and Artificial Intelligence (AI) will redefine experiential learning and make possible the delivery of learning experiences that otherwise would not be feasible due to high cost or risks.

Rehanna Shwinninger-Ladak gave an overview of **recent policy developments in relation to virtual worlds**. Most notably, she presented the [EU initiative on virtual worlds](#), the recommendations emerging out of the recent [citizen's panel on virtual worlds](#) and a [study looking at opportunities, success stories and challenges of XR adoption in health and education](#).

Georgi Dimitrov discussed **immersive technologies in relation to the two recent Council recommendations** on 1) the [key enabling factors for successful digital education and training](#) and 2) [improving the provision of digital skills in education and training](#).

Rikardo Lamadrid Intxaurreaga focused on the **implications of immersive technologies in Vocational Education and Training (VET)**. He emphasised the value of smart, interactive and immersive digital spaces as transformation levers, shaped by the values of a human-centred approach.

Fotis Liarokapis discussed some of the **main needs**, such as more pedagogically sound and evidence-based VR design and evaluation, challenges (e.g., cost, glitches, advanced skills) and gaps (e.g., access/equity) that affect the adoption of XR in education. In addition, he presented '[XR4ED: Accelerating innovation in learning and education through EdTech and XR](#)', a project funded by the European Union's Horizon Europe programme tackling those issues.

WHAT IS NEXT?

With the report 'On the Futures of Technology in Education: Emerging Trends and Policy Implications', the Digital Education and Skills team at JRC opens up a new strand of work to analyse in more detail the **role that technological innovations play in education and training**. In this context, the JRC will organise a workshop looking specifically at the potential of XR and virtual worlds in education and training, during the course of 2024.

05 PARALLEL SESSION

ECONOMIC CHALLENGES FROM NEXT GENERATION VIRTUAL WORLDS

Moderator: Nestor Duch Brown, Team Leader at the Directorate-General Joint Research Centre, European Commission.

Speakers:

- ▶ Maciej Sobolewski, Economist, OECD.
- ▶ Paul M. Momatz, Professor of Entrepreneurial Finance, Technical University Munich.
- ▶ Juli Ferré Nadal, Sports Marketing Consultant, Commercial Management and Innovation. Founder of JFN sport.
- ▶ Martin Dawson, Deputy Head of the Audiovisual Industry and Media Support Programmes Unit, at the Directorate-General for Education, Youth, Sport and Culture, European Commission.

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SUMMARY OF TALKS

Virtual worlds or metaverses will change the ways in which goods and services are produced, advertised, transacted, distributed and consumed. Although these changes are expected to be relevant, it is premature to tell what the final shape of the economics in metaverse will be. However, by looking at emerging trends, the speakers of this parallel session discussed about **what the economic activity in virtual worlds might look like.**

Virtual worlds might transform the way people work, shop or entertain on the internet into immersive, engaging and more valuable online experiences. **E-commerce** is the main area where this is already happening, as some fashion and home décor brands are already experimenting with 3D virtual stores as a new marketing and distribution channel. The virtual shopping experience is richer and more comprehensive as shoppers can interact with product creators and trendsetters, play thematic games and ultimately order a product. Following the example of this economic activity, the discussions turned to culture and entertainment. In this respect, European cultural and

media sectors, including audiovisual, are a high stake sector as regards virtual worlds because they can have a great impact on production and distribution of content as well as the behaviour of audiences. In this regard, **video games** can be a gateway to virtual worlds. This is a huge global industry developing cutting edge technology on XR and has developed communities of audiences and Europe has some key players in this market. Similarly, the panel looked at **sports**. There, after an initial bubble, the topic of virtual worlds has drastically slowed down, which is otherwise normal with all new emerging technologies. However, the key driver in sports will be the live content – this is something very particular about sports and other cultural activities such as theatre –, the value and uniqueness of live consumption poses enormous challenges to the technology, and it is very complex in terms of rights.

After signalling the characteristics of different sectors and how the emergent virtual worlds can impact them, the discussion moved to **competition issues**. Market structures with one or a few providers gaining the most users and market value are common in the digital economy. Large concentration is an outcome of competition for the market – a specific model of rivalry that arises due to economies of scale, switching costs and network effects –. By enabling cross-platform exchange and collaboration, **positive network effects could be lifted to the global level of interconnected networks** instead of remaining condemned within a single closed ecosystem. This induces more entry, promotes innovation and enhances economic wealth in the open ecosystem. Drawing from past mistakes, namely a domination of centralised platforms, **regulators need to ensure conditions for co-existence of decentralised and open ecosystems in the virtual worlds**. This will require striking a right competitive balance between both types of ecosystems, without a threat of foreclosure on either side.

According to the speakers, there is no doubt that **with the success of the virtual worlds, the volume of purchases of virtual objects will increase**, such as in-game items and collectibles, wearables, or digital artwork. Most of these items can be classified as either digital assets or durable consumables for future resale. What makes them suitable for investment purposes is scarce quantity and unique, individual attributes. Virtual assets are represented as non-fungible tokens and are traded for cryptocurrencies on blockchain. Unlike other types of digital crypto assets, most notably stable coins, utility and security tokens, issuance and circulation of NFTs will not be regulated in the forthcoming Markets in Crypto-assets Regulation (MiCA), the first-ever EU regulation of the crypto asset sector. Although NFTs are excluded from this comprehensive framework, they are already subject to standard capital gains tax or income tax, which raised the issue of taxation. The Web 2.0 gave rise to many new business models, which disrupted traditional industries. Virtual worlds could potentially further transform the ways in which companies create, deliver and capture value. **It will take at least 10-15 years until the technology reaches market and business readiness**. As new uses of virtual worlds emerge every day, the outcomes of the business model innovation are yet unknown.

WHAT IS NEXT?

Several questions arised during the exchanges. For instance, regarding digital assets one may wonder what needs to be done to increase trust of users in NFTs. **Should NFTs be regulated and scrutinised to eliminate vulnerability to theft and money laundering, increase IP protection of legitimate issuers?** Similarly, payment methods in the virtual worlds create concerns due to the fact that crypto currencies are less trusted than fiat money. Convertibility to fiat money is ensured by stable coins, but private coins can be vulnerable to liquidity problems. **Do we need central bank digital currencies to increase trust and enable transactions on a mass scale?** Finally, regarding the business models and emerging market structures, the speakers launched doubts about **how to strike the balance between centralised and decentralised virtual worlds**; can both co-exist or rather one or the other is likely to dominate? Is there a risk that multi-product walled-garden platforms run by big tech firms will take over emerging independent ecosystems via envelopment? What type of data governance we need: user-centric (portability of avatar and device data across platforms, reuse of proprietary data by third parties) or platform-centric? One important conclusion is that **there is an urgent need for more research to increase our knowledge base about the potential economic impact of next generation virtual worlds.**

06 CONCLUSIONS

Throughout the report, we dived into the highlights and key moments of the ‘Shaping the Next Generation Virtual Worlds – Science for Policy event’. The discussions held in each of the **three parallel sessions shed light on specific aspects that are emerging – or already emerged – to the attention of researchers on one side, and policymakers on the other side.**

Moving from the discussions’ take aways, we can draw the following conclusions, which will serve future endeavours and feed into the conversation on the future science for policy work on virtual worlds:

- ▶ The next generation virtual worlds presents **opportunities and challenges along societal, technological, and economic and policy dimensions.** The need for sound scientific evidence is crucial for anticipating upcoming

areas of intervention by regulators and ensuring that Europe will lead the way in the field.

- ▶ The public administration will need to consider principles such as **clear added value, proportionality, and the legal framework to effectively operating virtual worlds platforms**. Additionally, there is a need to define the **role of private actors and their relationship with public power in virtual worlds**. Governments and public administration will need to regulate virtual worlds, addressing components such as privacy, data protection, law enforcement across multiple jurisdictions, and building trust among citizens. At the same time, they will need to govern virtual worlds, and enhance public services.
- ▶ In the education sector, **extended reality (XR) and virtual worlds have the potential to bring profound changes**. Connectivity infrastructures and Artificial Intelligence (AI) will redefine experiential learning and make possible the delivery of new learning experiences. Thus, the role of technological innovations in education and training is an area that requires further analysis and investigations.
- ▶ There is an **urgent need for more research to increase our knowledge base about the potential economic impact of next generation virtual worlds**. Virtual worlds are expected to change the ways in which goods and services are produced, advertised, and consumed. However, there are concerns about trust, regulation of digital assets, and the impact of emerging market structures with one or a few providers gaining the most users.

Overall, the discussions highlighted the **need for further research, events, and policy developments** to address the opportunities and challenges presented by virtual worlds in various sectors.

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LIST OF ABBREVIATIONS

CAS	Centre for Advanced Studies
DG CNECT	Directorate-General for Communications Networks, Content and Technology
DG GROW	Directorate General for Internal Market, Industry, Entrepreneurship and SMEs
IDIBAPS	Instituto de Investigaciones Biomédicas August Pi i Sunyer
IFRAG	Innovation Friendly Regulations Advisory Group
JRC	Joint Research Centre
MiCA	Markets in Crypto-Assets
NGOs	Non-Governmental Organisations
NFTs	Non-Fungible Tokens
OECD	Organisation for Economic Co-operation and Development

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