



EC VIRTUAL WORLDS INITIATIVE – THE INDUSTRIAL METAVERSE

Tuesday 23 January 2024

18h00 Cocktail – 18h30 Roundtable – 19h30 Dinner & Debate
Members' Salon, European Parliament

Organised in partnership with Siemens



INTRODUCTION BY PARLIAMENTARY HOST

Maria GRAPINI MEP, (Romania S&D) Vice Chair, Internal Market & Consumer Protection Committee

I would like, as Vice-Chair of the Internal Market Committee, to welcome you most warmly to the Parliament and to this important debate on the Commission's Virtual Worlds Initiative.

I would also like to welcome the European manufacturers as well as representatives this evening from the RWTH Aachen University, Fraunhofer Institute.

As you know the European Commission is developing a vision for emerging virtual worlds. This is based on respect for digital rights and EU laws and values. The aim is open, interoperable and innovative virtual worlds that can be used safely and with confidence by both the public and businesses. We voted two Own Initiative Reports (INI) on this topic in the plenary in Strasbourg last week.

Virtual worlds are rapidly becoming a transformative force in the global digital landscape. The current global market for virtual worlds is valued at €27 billion. It is projected to reach €800 billion by 2030. As a result, the sector in Europe is expected to generate approximately 860,000 new jobs by 2025.

Virtual worlds will generate high-resolution images, graphics, and video to enable immersive user experiences, further requiring high-performing infrastructure. It is important to invest in reskilling initiatives to educate the existing workforce in the EU, paying specific attention to under-represented groups in this sector.

I would like to highlight the importance of investing in and promoting the development of appropriate skills to ensure the supply of talented and skilled workers fit for these jobs in the EU, as well as of creating appealing conditions to retain EU talent, attract foreign talent, and promote entrepreneurship and innovation in the territory of the EU.

As someone who has devoted many years as an entrepreneur and then Minister for SMEs in Romania to promoting business development and jobs, I especially welcome this European Commission initiative. I hope we will have a constructive debate with interesting inputs that will help us in the future legislation process.

And last but not least, I would like to stress the importance of raising European citizens' awareness about responsible usage in these digital domains. I support the industry, research, collaboration with educational institutions to increase the workers' skills, as the EU has a workforce crisis.



ROUNDTABLE DINNER DEBATE

Gaspard Demur, EUROPEAN COMMISSION, DG CNECT Deputy Head of Unit 'Digital Transformation of Industrial Ecosystems'

- I am honoured to be here today to discuss the concept of virtual worlds and the myriad of opportunities and challenges they bring, in particular for the manufacturing sector.
- As we embrace this transformative technology, we must navigate these uncharted territories with a comprehensive strategy that safeguards our values and principles.
- At the heart of our strategy lies the unwavering commitment to ensuring that Web 4.0 and virtual worlds embody the core values of the European Union: openness, security, trustworthiness, fairness, and inclusivity.
- It is imperative that the rights we enjoy in the offline world, as workers, consumers, and data subjects, citizens, are fully applicable within these virtual realms.
- Furthermore, we are committed to cultivating an enabling environment for businesses to thrive and flourish within the Digital Single Market. It is our firm belief that fostering innovation and encouraging SMEs to scale up will yield a diverse and competitive ecosystem that drives progress and benefits all stakeholders.
- To harness the transformative potential of Web 4.0 and virtual worlds, the European Commission put into effect a comprehensive Communication titled 'Web 4.0 and Virtual Worlds: A Head Start in the Next Technological Transition.'
- Unveiled on July 11, 2023, this document outlines our overarching vision, strategic priorities, and concrete actions aimed at achieving our ambitious Digital Decade objectives.
- Web 4.0, the anticipated fourth generation of the World Wide Web, promises a seamless integration of the digital and physical worlds, enabling truly intuitive and immersive experiences.
- This paradigm shift will be driven by cutting-edge technologies such as artificial intelligence, the Internet of Things, blockchain transactions, extended reality and virtual worlds.
- Virtual worlds, the cornerstone of this technological evolution, are persistent, immersive environments that leverage extended reality (XR) and 3D technologies to blend the physical and digital worlds in real-time. These virtual landscapes offer boundless possibilities for designing, simulating, collaborating, learning, socializing, conducting transactions, and seeking entertainment.



- The global market for virtual worlds holds immense potential, with projections estimating its growth from €27 billion in 2022 to over €800 billion by 2030.
- Extended reality technologies, such as virtual reality and augmented reality, are pivotal to this growth, and their development is expected to generate up to 860,000 new jobs in Europe alone by 2025.
- Ladies and gentlemen, virtual worlds are not merely futuristic concepts; they are becoming a tangible part of our lives. The European Union is home to numerous pioneers in this field, both SMEs and large companies, demonstrating the region's technological prowess,
- The benefits of virtual worlds are multifaceted and far-reaching. From enhancing healthcare services to revolutionizing education and training, these immersive environments offer a wealth of opportunities that will positively impact our society.
- In the healthcare sector, virtual environments can provide invaluable assistance to medical professionals.
- Virtual worlds also hold immense promise for education and training. By creating immersive simulations of various scenarios, from the effects of global warming to intricate scientific experiments, students can gain a deeper understanding of abstract concepts.
- The creative sector is another domain where virtual worlds are already making a significant impact.
- Public services can also harness the power of virtual worlds to provide personalized administrative services, offer remote assistance in remote and rural areas, and enhance territorial planning and community life.
- Virtual worlds also open a world of possibilities for various industrial sectors. Manufacturing and logistics companies can utilize virtual environments for procedural training, ensuring safer and more effective upskilling in fields such as aviation and maritime industries.
- By enabling businesses to model, prototype, and test design iterations in real time and immersive environments, virtual worlds have the potential to minimize waste and optimize production processes.
- Ladies and gentlemen, the European Commission's Communication on 'Web 4.0 and Virtual Worlds' lays out a comprehensive strategy to lay the foundation for the long-term transition towards these transformative technologies.
- This strategy is anchored on four fundamental pillars: skills, businesses, government, and governance at both the EU and global levels.
- To ensure the successful implementation of this strategy, a series of ten concrete actions were crafted. These actions encompass a wide range of initiatives, including developing a Virtual Worlds Toolbox for citizens. Each action is designed to address specific challenges and seize the opportunities presented by virtual worlds.
- In formulating this strategy, the European Commission has engaged in extensive consultations with stakeholders across Europe.

- We have convened meetings and workshops with industry leaders, academia, and the Virtual reality/ Augmented Reality Coalition to gain a thorough understanding of the challenges and opportunities faced by European businesses in this emerging domain.
- Moreover, we have actively sought the input of citizens. A citizens' panel on virtual worlds, comprising 150 randomly selected individuals, convened over three weekends between February and April 2023. Their thoughtful recommendations have greatly enriched our understanding of the public's perspectives and concerns regarding virtual worlds.
- It is important to note that the European Commission has opted for the more inclusive term "virtual worlds" instead of "metaverse." This broader designation encompasses not only the concept of metaverses but also any type of virtual environment that may emerge in the Web 4.0 landscape.
- European Commission will monitor various aspects of virtual worlds to ensure their alignment with our values and objectives. We will closely examine how these new interactions may impact democracy, fundamental rights, and user safety.
- Additionally, we will monitor the development of virtual worlds to prevent market concentration issues and safeguard consumer trust. A healthy and diverse ecosystem of providers is essential for fostering innovation and competition in this emerging sector.
- Our focus will also extend to the standardization and interoperability of virtual worlds. We will actively promote open-source solutions and foster an ecosystem of decentralized projects to ensure a level playing field for all market participants.
- Recognizing the importance of Extended Reality technologies as the cornerstone of virtual worlds, the European Commission has allocated substantial funding to support research and innovation in this field.
- These investments have supported the uptake of Extended Reality (XR) and Augmented Reality (AR) technologies for industrial applications and use cases in key sectors such as construction, manufacturing, health, media, and education.
- European projects have fostered a vibrant XR and AR community, bringing together user industries, researchers, solution providers, content creators, and national and regional hubs.
- As we embark on this transformative journey into the virtual worlds, it is imperative that we acknowledge the challenges and considerations that lie ahead, particularly in the context of manufacturing.
- Data security and privacy, integration with existing systems, and the training of workers on virtual worlds technologies are paramount concerns that demand our immediate attention.
- The European Union, recognizing the profound impact of the virtual worlds, has already taken proactive steps to promote the respect for fundamental rights in the development and functioning of virtual worlds.
- The Digital Markets Act and the Digital Services Act provide a robust legislative framework that fosters contestability, innovation, growth, and trustworthiness within the virtual worlds.

- These legislative measures emphasize the importance of safeguarding consumers' rights, ensuring that personal data is processed in compliance with EU data protection law, and holding platforms accountable for their actions and systemic risks.
- In the virtual worlds, a realm of boundless digital possibilities, we must prioritise data security and privacy. Robust measures, like encryption and data governance policies, are vital to safeguard sensitive information.
- Integration with existing manufacturing systems is paramount for successful industrial virtual worlds. Seamless data flow between the physical and virtual worlds will enhance processes and drive innovation.
- To unlock the virtual worlds' full potential, we must invest in worker training. Programmes should focus on immersive technologies, user interfaces, and data analytics tools. Empowered workers will drive productivity and efficiency gains.
- While the EU's legislative framework provides a solid foundation for the respect of fundamental rights in virtual worlds, it is essential to acknowledge and overcome the challenges associated with the adoption of the virtual worlds in manufacturing.
- By addressing these considerations, we can pave the way for a successful implementation of the industrial virtual worlds, ensuring that fundamental rights and interests are protected within this transformative technological landscape.
- Scaling up small players and encouraging Small and medium-sized enterprises (SMEs) is of paramount importance for fostering a vibrant and competitive ecosystem in the realm of virtual worlds. SMEs play a crucial role in driving innovation, creating jobs, and contributing to economic growth.
- The European Commission is committed to creating an enabling environment for SMEs to thrive and scale up in the virtual worlds market. This includes providing access to funding, mentorship, and training programs tailored to the specific needs of these enterprises.
- To empower businesses, particularly SMEs, and public sector organizations, the European Union has launched a network of Digital Innovation Hubs (EDIHs) under the Digital Europe Programme. These hubs, spread across the EU, are committed to providing tailored support to help businesses navigate the complexities of digital transformation and harness its transformative power.
- The EDIH network comprises 226 hubs (EDIH + Seals of excellence), each acting as a regional multi-partner consortium bringing together public and private entities, including research organizations, universities, industry associations, regional development agencies, and private sector companies.
- This unique partnership ensures that EDIHs can deliver holistic and comprehensive support that addresses the specific needs of businesses and organizations within their regions.
- A significant strength of the EDIH network lies in its extensive reach. EDIH services are available in nearly 90% of European regions, representing a substantial portion of the EU working population.

- This widespread presence ensures that businesses and organizations across Europe have access to the expertise and guidance they need to embark on their digital journeys.
- The EDIHs are deeply rooted in the research and innovation ecosystem. Universities and research organizations play a prominent role within the network, contributing their cutting-edge knowledge and expertise.
- Private sector companies, particularly those operating in the Information and Communication Technologies (ICT) and professional, scientific and technical activities sectors, also play a vital role in ensuring that EDIHs provide practical and industry-relevant support.
- The EDIH network demonstrates a strong pan-European presence, with competencies in the key technologies supported by the Digital Europe Programme readily available across the continent.
- Manufacturing, Healthcare, and the Public Sector are among the most common sectors supported by EDIHs. These hubs are playing a pivotal role in helping businesses in these sectors adopt digital technologies and adapt to the evolving demands of the digital economy.
- It is important to note that EDIHs services in the Manufacturing sector are available in most of the covered regions. Overall, the EDIH network can play a crucial role in facilitating the further adoption of the virtual worlds in the manufacturing sector.
- By providing guidance and support to SMEs, EDIHs can help them navigate the complexities of the virtual worlds and unlock its potential for innovation and growth.
- The EDIH network, as a key enabler of digital transformation, stands ready to collaborate with industry partners and policymakers to accelerate the adoption of the industrial virtual worlds. Our network of 226 hubs across Europe is uniquely positioned to provide SMEs with the necessary guidance, expertise, and access to technology to embrace the opportunities presented by the virtual worlds.
- Together, we can empower European manufacturers to lead the digital transformation of the manufacturing industry, ensuring Europe's competitiveness and prosperity in the years to come.
- The industrial virtual worlds are not just a vision of the future; it is a reality that is within our grasp. Let us seize this opportunity and shape together the future of manufacturing in Europe.



Szabolcs Szekacs, EUROPEAN COMMISSION, DG GROW, Team Leader – Digital Industry Team

Embracing the Future: Europe's Journey in Virtual World Technologies

I recall being amazed some decades ago by the virtual worlds in William Gibson's "Neuromancer," which once seemed like distant science fiction. Today, these visions are not just realities but are shaping our daily lives and industries. It is with this spirit of innovation and foresight that I address you today, focusing on how Europe can harness the potential of virtual world technologies for the advancement of our industry and the empowerment of our solution providers.

Our journey begins with an essential differentiation: virtual worlds for private and social use, like games and metaverses, versus those for industrial applications. In the Directorate-General for Internal Market, Industry, Entrepreneurship and SMEs (DG GROW), our focus is firmly on the latter. Why? Because we believe these technologies are pivotal in driving the digitalisation and environmental sustainability of the European Union's industry, enhancing its resilience in the global market.

Current State and Impact

The landscape of our industry is transforming at an unprecedented rate. Digital technology now powers a quarter of the €5 trillion annual output in the manufacturing sector. The ripple effects are vast, spanning education, healthcare, and manufacturing sectors. In the EU, over 3,700 entities from various sectors are leveraging virtual worlds, showcasing a robust market dominated by dynamic small firms.

The use cases are numerous. In the manufacturing sector, manufacturers can create virtual replicas of physical machinery. This enables real-time monitoring and predictive maintenance, reducing downtime and extending the lifespan of equipment. We are aware of real life cases where virtual world technologies can also accelerate the permitting process by creating a virtual replica of the installation.

In education, in fields like medicine or engineering, Virtual Reality can provide hands-on training through simulations. Or take tourism, with the help of VR, tourists can explore remote or inaccessible destinations virtually. Or the technology can be used to enhance the visitor experience at historical Sites: Augmented Reality (AR) can bring historical sites to life by overlaying digital information or reconstructions onto the physical world, enhancing the visitor experience.

The industry is taking notice of these benefits. Take the automotive sector for example, where virtual world applications are projected to surge from €1.9 billion in 2022 to 1€6.5 billion by 2030. Overall, the industrial metaverse market is estimated to reach a remarkable \$765.8 billion by 2030. Europe's rich manufacturing heritage positions us uniquely to lead in adopting and innovating these digital technologies.

The technologies can create enormous value not only for industry, but also for our society. According to a recent industrial paper, digital twin technologies, mentioned earlier, at their current technology state could save 7.5 billion tonnes of CO₂ worldwide over about ten years.

Challenges and Opportunities

The real challenge, however, lies in ensuring European firms not only adapt but lead this digital transition. We cannot afford to be overly reliant on non-European technologies. Building on the insights shared by my colleague Gaspard, I will delve into three specific actions spearheaded by DG GROW and aligned with the Commission's Communication on Virtual Worlds.

Facilitating Innovative Cooperation

Virtual worlds redefine interaction, collaboration, and even our concept of work. As we explore new digital enterprise models, like Decentralised Autonomous Organisations, driven by Web 3.0, Smart Contracts, and Distributed Ledger Technology, we must also reassess our legal frameworks. These models promise transparent, efficient, and decentralized decision-making, evident in sectors from healthcare to automotive. For example, a leading car manufacturer's virtual world has revolutionized consumer and supplier engagement, accelerating innovation.

Challenges of Decentralised Autonomous Organisations (DAOs)

Yet, innovation brings complexities. DAOs prompt questions about governance, legal status, liability and economic models. Addressing these challenges is crucial to fully leveraging DAOs' potential.

The Commission's Study

To this end, the European Commission is initiating a comprehensive study to understand the legal implications of DAOs and evaluate necessary legislative adjustments. This endeavor is not just about understanding DAOs but about cultivating a legal landscape that nurtures innovation while safeguarding stakeholder interests.

Toolbox against Counterfeiting

Another key action is combating counterfeiting in virtual worlds. We are developing a toolbox to enforce rights and protect the integrity of virtual platforms. This initiative, nearing completion, is essential for safeguarding both consumers and intellectual property owners.

Supporting Wider Industrial Uptake

Finally, some thoughts about how the EU can support the wider industrial uptake.

My colleague, Gaspard has already mentioned one of the established structures, the European Digital Innovation Hubs, that will help SMEs to adopt these new technologies and technology providers to reach out to customers.

Additional structures will also be leveraged, such as the European Clusters, or the Enterprise Europe Network, the world's biggest business supporting network. This network supports around 30000 SMEs every year. The network will assist SMEs in adopting virtual world technologies, enhancing their efficiency and competitiveness by providing dedicated business support and matchmaking activities.

Conclusion

In the words of William Gibson in "Neuromancer," "The street finds its own uses for things." In the case of virtual worlds, the industry is finding new ways to harness the full potential of this technology. As we reflect on our transition towards a virtually empowered Europe, this quote also reminds us of the unpredictable yet transformative power of technology.

As policymakers, our responsibility is dual-fold: to harness the benefits these innovations offer for our industry and society, and to diligently navigate and mitigate any unforeseen challenges they may present.



Matthieu Worm, SIEMENS, Senior Principal Key Expert

Virtual Worlds

From a Siemens' point of view, it is crucial to fundamentally differentiate virtual world markets in industry from other application fields, like virtual worlds in enterprise communication systems or consumer focused offerings, like in gaming and social media. The virtual world for industrial applications, or 'The Industrial Metaverse', is a space to experience and interact with a Digital Twin, being immersive, interactive, and collaborative.

Three characteristics differentiate virtual worlds in industrial applications from other domains:

1. Industrial virtual worlds are based on data from physical assets that are represented by a Digital Twin.
2. Virtual worlds in industry have a direct link between the virtual and physical world, that offers a concrete economic or sustainability related benefit, ideally being a closed loop real-time interaction.
3. Industrial virtual worlds are an evolution that builds on a decade long development process of automation and digitalization. It is not a revolution but an evolution, meaning a next step in a continuous technology convergence that, together with other developments like the rapid growth of computing capacities and communication infrastructure, leads to a new quality of (photo-realistic, real-time) immersive, interactive collaboration in product engineering, manufacturing, and operation.

Alignment of Existing Regulation

The 3rd bullet point hints towards the key challenge going forward when positioning Europe as the leader in the Industrial Metaverse. It is important to prepare existing regulation like the Machinery Regulation for a digital era and to drive alignment of recent regulation for the digital era, like the AI Act and the Data Act, that have been developed as largely domain independent disciplines, which will now come together in industrial Virtual Worlds. And to invest in the enabling technologies of the Industrial Metaverse.

For the domain of industrial virtual worlds there is already a high regulation and policy density, focusing on Industrial Metaverse building blocks like Data, Cyber Security, AI, platforms. That is why – as the Commission pointed out in their communication (COM(2023) 442) last year – there is no need for any additional regulation regarding industrial virtual worlds. This might be different for consumer applications.

A horizontal “Metaverse Act” to protect the European consumer in virtual worlds, could put the innovation potential in industrial virtual worlds at risk. Already today there is significant related digital regulation in place or in the pipeline. The European competitiveness should not be limited any further.

A Use Case Example

When Giga factories for battery manufacturing are being planned, a wide range of stakeholders is involved, while the required technology for battery manufacturing is complex and evolving every day. In the Industrial Metaverse, experts from governmental, societal, business and technology domains can collaboratively design and establish the factory, experiencing the Digital Twin in its future operating environment, while interacting with it to optimize a mix of different interests. After realisation of the plant, the same model is used for optimization of the operation and collaboration with stakeholders like suppliers and customers.

A use case like this, not only requires rethinking machine safety and cyber security risk for the manufacturing equipment and infrastructure. Seamless data aggregation is a prerequisite, requiring data format exchange standards as well as IP protection. On top of that, as we will log in as real persons in a digital environment, trustworthy digital identities come into play, requiring high levels of security.

The opportunity of the Industrial Metaverse

We must position industrial virtual worlds as a huge opportunity to support the recent societal challenges, especially contributing to a more sustainable industry, a circular economy and to strengthening Europe’s global competitiveness. This opportunity-oriented approach and communication, well reflected in the Commissions initiative of 2023, seems crucial to build societal trust in virtual worlds. We need this trust and an open and balanced dialogue on the various applications to take the people with us. This is of utmost importance regarding e.g., stakeholders like the labour unions and workers councils in all member states, that should be included.

The Position of The European Industry

Market analytics show a \$100 billion market projection for Industrial Metaverse in 2030, compared to a \$40billion projection for the Consumer Metaverse market and \$20 billion for the Enterprise Market. When we combine these numbers with the strong market position of the European manufacturing industry, there is an argument to ensure Europe takes the lead in the Industrial Virtual World domain, rather than trying to win an uphill battle with large established players from China and the USA in the gaming and social media landscape.

European enterprises of all sizes lead global manufacturing digitalization and innovation. Therefore, we suggest targeted funding of research and technology development strengthening the position of Europe in the domains of the Industrial Metaverse.

Standardisation As Key Enabler.

There is a need to drive adoption, deepening and extending of existing industrial standards. It is important to build on existing standards, relevant for industrial brownfield and to further strengthen the position of European industrial players in the international standardisation organisations and in consortia and ecosystems.



Regarding the Common European Data Spaces, interoperability must be ensured to enable cross domain virtual worlds in industry, e.g., combining data from the energy data space with data from manufacturing and mobility.

Key Technology Topics Requiring Accelerated Development

Bringing the Industrial Metaverse to life requires a leapfrog in innovation. The EU can turn our current pole position into a championship win if we lead technology development and convergence with research in the domains of:

- Data aggregation (data harmonization, interoperability)
- Immersion (which includes AR/VR, energy efficient rendering and physics aware architectures)
- Interaction (generative AI, (near) real-time simulation, 5g/6g connectivity, edge and cloud computing)
- Collaboration (digital asset exchange, blockchain, data privacy, IP protection).

In Conclusion

Manufacturing matters to the EU: it employs over 34 million people; it accounts for three quarters of EU exports and it provides over 80% of EU private sector R&D expenditure.

Industrial Virtual Worlds, or The Industrial Metaverse, represents the next chapter in digitalization of this industry.

Europe leads this evolution today and has an excellent opportunity to capture a dominant global position in a sharply growing market.

To do so, we promote the application of existing regulation and focus on adoption of existing standards instead of thinking of any additional regulations.

Targeted funding of research and technology development is needed, particularly in the domain of the Digital Twin, with increased focus on immersion, interaction, and collaboration, and underpinned with AI.

Axel VOSS MEP, (PPE, Germany) Legal Affairs Committee,
Rapporteur: 'Policy Implications of the Development of
Virtual Worlds Civil, Company, Commercial & Intellectual
Property Law Issues'
(Notes taken of the presentation)



Thank you, Antony, for the invitation and thanks Maria also
for hosting this event.
So, now of course we are coming to all the problems.

- When we filed this Report, we have of course more questions than answers and we find this very challenging. Therefore, it is very interesting for the upcoming mandate, probably in coming forward with solutions but probably also with ideas how we might move forward.
- So, with the emergence of the world wide web and the rise of social media, the development of the metaverse, in our point of view, is likely to be the next step in the evolution of our digital world, and it seems that it is an important part of the transition of Web 4.0
- Of course, now we are talking today about AI and other developments.
- But all of sudden if we are creating this virtual world, everything that we have regulated before, probably in the single instrument, all of sudden we have this in one development together. And it is not only about rules and AI and block chains, it is also probably the question of the digital euro – which we are also working on – the currency – what we might need. And I am probably more a kind of person who is relying more on the kind of a currency that I somehow know instead of using the crypto currencies.
- That is why I am hoping that the digital euro will might come forward and will be developed in a proper way.
- This development is creating for us diverse opportunities, eg. in the areas of health and research, manufacturing and education to name just a few.
- There are also numerous legal uncertainties that we have to deal with, especially in the Legal Affairs (Juri) Committee.
- But please bear in mind that there is always a kind of a friendly fight between the Committees, about the competences. So Juri can just focus on what is within its competence – so meaning more or less the civil law.
- So, why was the Regulation not drafted until after tech companies have fully developed social media, for instance, or platforms? It is imperative for my point of view that we now prevent such late actions in the case of the metaverse. And that we are ensuring, from the very beginning, that this development is made in line with European values and so that our citizens' fundamental rights are effectively protected.
- As you know, we have all the time had, and this is probably the fifth time, to think about what was copyright, terrorist content online and child abusing materials, etc. We have all the time the same question: how we can get rid of illegal material from platforms?

- It is always the same situation and we are discussing and discussing and politically this is always fragmented and this is why I think now is a good time to think already about the metaverse.
- Of course, this what we have in mind – this global virtual world. Probably for our citizens it might somehow work differently. But we have to ask ourselves today what we should create or it might be the question of tomorrow, and we do not want the same situation like with the social media.
- Of course, once again we have more questions than answers right now. But this might be the starting point in discussing, in thinking about developing some solutions.
- This is not the question of this mandate but this will be the question for the next mandate.
- We are not quite sure - and this is always the same principle – whether what is valid offline should also be valid online? This is also a kind of a principle where we would like to start, but also knowing that everything will not really work in what we have offline.
- So that is why we need to have some adaptations here.
- We have also to raise and already address all the existing legal acts: the Copyright Directives; and in the near future also the Data Act and the AI Act .
- We have to bear this in mind and also consider that the development of this Metaverse is still at an embryonic stage for us – although probably not for you.
- I do not know if some gamers are in the room, because with the games “All Blocks” and “Fornite” they have already these closed Metaverse developments. For me the gaming industry is more a kind of a NASA in the digital world. It gives you a kind of idea already.
- I think the key word in this debate right now for us is monitoring.
- We should engage with the stakeholders and make sure that we follow all the important developments and market trends so we are able, at the end, to identify the new challenges and already to introduce also the legal adjustment and when necessary to respond to those challenges and ensure protections and enforcements of the right of individuals of companies that might be impacted by the Virtual Worlds.
- Of course, there is a kind of a precondition that you mentioned already. We need Cybersecurity – this is a precondition of everything of what we are doing in this Digital world.
- Then for me, one of the important questions is: How can we avoid crime? We have seen the internet enter the dark internet. Can we think about already in this development to avoid a Dark Metaverse? I am not sure that this is possible. But this is one of these questions.
- You mention already Standards, this is a very important point for us.
- Also accessing from one Metaverse to another one. I do not know how fragmented this might be. Do we need a kind of European Metaverse or is this is not possible?
- At the end, infrastructure is needed. Of course, you mention Energy and also inter-operability is also one of the main points.

So, we are coming more to the detailed questions.

- I can already think about some strange civil rights questions in this regard. As an example, I am walking through a kind of virtual world and I see here something and there something and I would like to buy something - how can I find out who is my contract partner? Someone mentions there is already an identification system or management.
- Of course, I can already imagine the political discussions about this. Because of the anonymity, we should know who we are dealing with.
- I think also in the real world we have real cards and we go to where wherever we would like to go, and we have some security on the card. Probably we need something like this here. I do not know how we should manage this. It might let in an intrusive element but in the end, someone should know who this person might be.
- Also, there is this question: if I am doing a contract in the virtual world – where is the competence and what are the costs at the end, if I have problems? What is the law which might be applied?
- Of course, I think that all this global virtual world should somehow be regulated by a global institution. Because of different interests, this might not happen. Therefore, we have to deal with our own ideas and laws etc.
- Of course, if I am doing business in the Metaverse then probably an avatar needs a kind of legal personality. Here also we are coming to this question: How can we deal with it? How can we fix this? Also, there is a question already mentioned: Probably the machines need a kind of legal personality. This is something where we have to think about right now.
- It might not be questions only for the JURI Committee but these are questions we should have in mind.
- How we can protect minors at the end?
- If you are on the internet, I know you can buy already devices where you can note if someone is acting fraudulently against you. This is possible and here also once again how can we protect people in the Metaverse?
- You might also come to this question: is Data Protection still possible in the Metaverse?
- Is copyright something that we still have possible?
- And patents? I am not sure if this is noticeable somehow that there is patent use that might not be licenced, etc.
- And then we are thinking on the civil law dimension: I mention the question: Can you be replaced by another Avatar? Can you have more Avatars? Then this strange idea - what is happening if an Avatars marries someone else?
- What also it means in the kind of digital heritage?

These are all the questions we should think about. I do not know if this is necessary. I am not sure if we might find solutions but we should think about all of these.

- For these identification management, I do not know if we should have a kind of a registry? Data portability should be possible.

- Taxation is also something what might not be very easy. It is not very easy in the Single Market already in the real world. How we will enforce right there? Especially if you would like to preserve proof? And if you have a kind of a cold case? How can you prove at the end that you have a contract properly done?
- So, these are all these questions where I always would prefer a kind of “global legislator” where we have all the same rules and we do not need to have all the answers probably to all the questions we have.
- We might also think about how we can prove a kind of a consent or agreement, contract etc? Trademarks will take place in the Metaverse, new designs etc.
- So even if the European Court of Justice is then deciding something. How do you enforce the ruling?

So these are all the questions. Unfortunately, I do not have all the answers.

We have a lot more in Civil Law. What we should think? How this can work?

I am finishing there. Just giving you some ideas what we might think and there might be other legal fields still have a question.

This is why we think probably in this next Mandate we will talk about autonomous contracts and smart contracts. I know there are some evaluations already ongoing. This might be part of all what we are then seeing combined in one virtual law.

I hope this gives you also some ideas.

If you have a wonderful dream tonight and you are thinking of a solution, please let us know. It would be wonderful to get some feedback.

Even if I cannot feel there are solutions for it, we have to think about it and prepare for it. I hope that there are solutions that might practical and also in the Virtual Worlds.

Francesco Guerzoni, ORGALIM Europe’s Technology Industries, Senior Adviser Digital & Legal

About Orgalim

- Orgalim represents Europe’s technology manufacturers, spanning the mechanical engineering, electrical engineering, electronics, ICT and metal technology branches. All together they are 770,000 innovative companies (mostly SMEs and microbusinesses), generating an annual turnover of €2819 billion, manufacturing one-third of all European exports and providing 11.9 million direct jobs.
- Our industries are world leaders in advanced manufacturing, providing their business customers with smart machinery, sensors, Industrial Internet-Of-Things devices, connectivity equipment.



- The installation of these smart devices and digital solutions is the key factor that enables the generation of industrial data and its usage to analyse and optimise processes and products. It is thanks to these smart devices and features that digital twins (virtual replicas) of physical machinery and processes can be created. When the digital twins of several systems are interoperable and can come together and interact seamlessly in an “industrial metaverse”, performance and efficiency gains can be tremendous.

Use Cases in Manufacturing Industries

- Let me give you some examples of use cases of the industrial metaverse that we are seeing among manufacturers:
 - Research & Innovation

Making a digital twin of a product by gathering real-world data throughout its whole lifetime can be a game changer during the design, development and production phase of the next generation of products. In addition, if researchers also have access to the data describing precisely the environment the new product is intended for, the industrial metaverse would enable them to test the new product in virtual simulations, without wasting time, resources and money for real-world simulations.
 - Optimisation Of Plant Operations

After installing smart equipment in all its factories, a company is now getting real-time data from all its production lines, stock supplies, vehicle fleet, etc. This enables recreation of a real-time digital replica of what is going on in its factories across different countries in a centralised manner. This enables better decision making and targeted intervention in all processes, making production more efficient, saving energy, reducing waste and emissions thanks to more data-driven choices.

 - It is estimated that, at their current level of technological sophistication, digital twins could save 7.5 billion tonnes of CO₂ worldwide over about 10 years. This is an example of the role the industrial metaverse can play to deliver the Net-Zero transformation. (<https://www.3ds.com/assets/invest/2021-01/dassault-systemes-and-accenture-virtual-twin-and-sustainability.pdf>).
 - Testing And Training Of Industrial AI

Certain Artificial Intelligence systems may need to be tested before being deployed in industrial settings, for example to automatise certain processes like material handling or energy management. The industrial metaverse offers the opportunity to test the AI system and make virtual simulations in safe conditions before deployment in the real world. Moreover, the industrial metaverse, based on real-time data from the physical world, can be used to train the algorithm of the AI system for different scenarios.
- These solutions are complex and require a stack of technologies to be used. Many are already available and more are under development, but there is still a long way to go in terms of uptake and awareness.

The Way Forward: Points To Consider

- In order to thrive, these technologies need: a strong industrial data economy (data spaces for manufacturing will be key); standards for interoperability (to remove technical obstacles to data flows); investments (in smart devices and innovative IIoT solutions); connectivity infrastructure, skills and trust (protection of IP, trade secrets, cybersecurity).

- We welcome the attention the European Parliament and the Commission have recently given to virtual worlds.
- We believe it is important to consider different approaches for different types of virtual worlds. The Industrial metaverse is essentially happening only in the B2B space for industrial purposes and is characterised by the convergence of physical machines and factories and their digital representations. Contrarily to some types of B2C virtual worlds that have exclusively a online/digital dimension. The industrial metaverse can be a driver of competitiveness for European manufacturers and we welcome further discussions on how to best support it.
- From a regulatory perspective, a lot of new legislation has been delivered in recent years which will impact the industrial metaverse. For example:
 - Starting from 2025, the Data Act will change the conditions to access and re-use industrial data and will boost data interoperability. Meanwhile, data spaces initiatives such as Catena-X, Manufacturing-X and others are expected to bring interoperability to a completely new level.
 - Starting from 2026, the liability for defective products will be extended to software and digital manufacturing files under the new Product Liability Directive.
 - Starting from 2027, the new Machinery Regulation and the Cyber Resilience Act will apply new safety and cybersecurity requirements to products that are part of the industrial metaverse.
 - And all this is completed by the Digital Services Act, the Digital Markets Act and GDPR, all of which are already applicable to the industrial metaverse.

Conclusion

This is why, to conclude, we support the discussion on the industrial metaverse, in collaboration with the stakeholders, but recommend not to rush into additional legislation. If need be, the first step should be a gap analysis and ex-ante impact assessment. Perhaps it is an idea to test legislation through regulatory sandboxes, to ensure it is fit for purpose, and future-proof.

Giles Dickson, WINDEUROPE, CEO

We support the industrial metaverse and the Web 4.0 initiative to improve the competitiveness of the European wind supply chain.

The industrial metaverse would enable:

- Design of reliable and lasting components
- Improve construction and installation methods
- Further digitalisation of Operations & Maintenance (O&M)
- Facilitate the training of wind workers
- Engage communities through visualisation and insights, thus improving a happy co-existence.



- Design For Reliable and Lasting Components

Strengthening reliability in wind turbine design will allow material consumption to be optimised, cuts down on investment costs and saves valuable resources. The use of digital twins and augmented reality devices would allow to better visualize, test and interact with designs before manufacturing them.

The large size of components in wind turbines complicates the use of common reliability and validation tests used in other industries, such as sampling or statistical validation. Thus, innovative methods for faster, more accurate modeling are needed.

- Improve Construction and Installation Methods

The upscaling and acceleration of on- and offshore wind calls for new logistical and installation solutions to boost efficiency while ensuring safety and reducing environmental impact.

- Further Digitalisation of Operations & Maintenance

Virtual or augmented reality could assist maintenance workers on the field or in the training centres. And AI-powered technologies could read and recommend maintenance protocols.

Likewise, the use of digital twins that help to visualize and monitor the condition of components during operation would enable to minimize interventions and establish better predictive maintenance and lifetime extensions.

Operators would need to connect and gather real time data from wind turbines and all their subsystems, working closely with wind turbine manufacturers. This will mean developing platforms, cybersecurity solutions, and standardising data, protocols and interoperability. All this will lead to optimal wind park O&M with maximum autonomy.

Example:

AWS has put forward possible use of AI and virtual reality for the O&M of wind farms. (https://pages.awscloud.com/Energy-eBook-Series-reinventing-energy.html?trk=4cd73cb2-1698-486d-b076-1bd773c8ae58&sc_channel=sm&Campaign_Source=everyonesocial&es_id=1fcc4f17b5).

Before a maintenance or failure intervention, images from cameras surveying wind farms could be sent to AI applications which could identify safety risks, such as road blocks, icing conditions, high seas, etc. With the use of virtual reality O&M workers can plan their intervention ahead of visiting the site, while AI could generate recommendations for PPE, tools and equipment to repair faults.

Generative AI could be used to create images to build visualisations of impacts of certain failures/defects in equipment, such as rust, cracks. These images could train models that use scanned images of real defects to detect future failures and deliver advance warnings for predictive maintenance practices.

- Facilitate the training of wind workers

Europe should maintain a highly skilled and educated workforce with comprehensive knowledge of specific wind areas, but also focusing on interdisciplinary and interconnected

expertise, including the domain of IT. It should continue to be a hub of talent for wind energy. And to put in place reskilling programmes for the existing workforce and lifelong learning for future workers.

The metaverse would support Europe to maintain its world-class education for wind energy by developing more immersive and intuitive learning tools.

The re-skilling and upskilling of wind workers is key area where the Web 4.0 and the metaverse can have a big impact. For example, by re-skilling oil and gas workers or coal miners to work in wind energy.

Example:

Twelve offshore wind workers have become the first in the world to receive certification through virtual reality training. The union workers from Massachusetts were trained through a partnership between VinciVR and Siemens Gamesa Renewable Energy. The VR courses feature the Global Wind Organization's (GWO) curriculum. Vinci developed VR simulations of ports and wind turbines to replace hands-on training elements for critical GWO courses, specifically Basic Technical Training and Slinger Signaller. The software enables users to commission a wind turbine and direct crane lifts of heavy loads like turbine blades. (<https://www.vinci-vr.com/vr-employee-training>
<https://www.renewableenergyworld.com/wind-power/worlds-first-offshore-wind-workers-certified-with-virtual-reality/>)

WindEurope is in the advisory board members of DigiWind—a project led by the Danish Technical University. DigiWind focuses on providing specialized education programmes to advance digital skills in the wind.

DigiWind delivers excellence through cooperation and partnership, dramatically boosting the geographic range, gender, and diversity for learners and educators in Master of Science (M.Sc.), Masters, and Lifelong Learning. (<https://www.digiwind.org>)

- Engage Communities Through Visualisation and Insights, Thus Improving A Happy Co-Existence.

With large-scale deployment of wind energy across Europe, questions of energy justice and citizen's participation will become more and more important. Local communities should benefit from the energy transition taking place in their direct proximity and more inclusive and innovative tools for public engagement both offline as well as in digital formats.

Example:

Cinematic Virtual Reality (CVR) experience is used to correct prior erroneous beliefs concerning expected visual and acoustic impacts of wind turbines. Following exposure to CVR, participants' expectations about auditory, visual, and general impacts of wind energy projects shifted positively, especially among participants with limited knowledge of or prior experience with wind energy. (Cramer, et al. 2020. Worth a thousand words: Presenting wind turbines in virtual reality reveals new opportunities for social acceptance and visualization research. Energy Research and Social Science Journal. Volume 67, September 2020, 101507. <https://www.sciencedirect.com/science/article/abs/pii/S2214629620300840>)

Dr. Jakob Greiner, DEUTSCHE TELEKOM AG, Vice President European Affairs

- My organization is not part of heavy industry, but part of this ecosystem, as connectivity is the enabler for the industrial metaverse.
- Imagine a virtual factory environment, in which users can create, manipulate, and test 3D models of products, components, and machinery in a virtual environment. This virtual world allows for collaborative work, remote training, and data analysis, all without the need for physical prototypes or costly equipment. Most importantly, in “real-time” and fully virtual.
- The use of Industrial Metaverse technology is expected to enhance productivity, reduce costs, reduce the ecological footprint and accelerate innovation in various industries.
- Importantly for EU competitiveness, strengthening the industrial sector of EU is crucial, also vis-à-vis other world regions.
- Perspective from Telecoms:
 - In the Staff Working Document accompanying its strategy on virtual worlds, the European Commission identifies connectivity and digital infrastructure as “key enablers for Europe to take a leading role in the development of virtual worlds.”
 - According to some estimates, even a modest use of virtual worlds could drive a 20-fold increase in current data usage (source: Credit Suisse)
 - Looking at the requirements, we know that the emergence of virtual worlds and metaverse-type applications will need new network capabilities and features, capable of managing the increasing data traffic as well as evolving requirements e.g., on latency and bandwidth
 - This is confirmed by a report published by Analysys Mason last year, in which the authors emphasise that “the right infrastructure will be a key determinant of how fast the metaverse can progress”
 - Hence, for us it is very important to think about virtual worlds holistically in a sense that we need to also take into account the infrastructure that is required for Europe to take advantage of metaverse-type applications.
 - This also means that we need to talk about investment needs and what can be done so that the telco sector can meet these. It is no secret that the sector as a whole is struggling to meet investment requirements regarding connectivity (sector has lost a staggering 80% of market capitalization over the past 10 years) – investments into network modernization and capacity will need to come on top.
 - Hence, we need to enhance the overall investment capacity of the telecoms sector, if we don’t want to delay the adoption of virtual worlds in Europe!
 - In this sense we welcome that the IMCO report on virtual worlds rightfully highlights the significant investment needs and the need for the EU to find a way to ensure powerful networks are there to enable the virtual worlds of tomorrow.
 - And that’s why we also welcome that the EU Commission is committed to propose a reform of EU telecoms regulation with its upcoming “Digital Networks Act” (<https://www.linkedin.com/pulse/digital-networks-act-redefine-dna-our-telecoms-thierry-breton/>)



- To conclude:
 - A holistic view that takes into account the role of connectivity and of the investment needs. If we want to be leading in virtual worlds, we need to be leading in digital infrastructure – but for this, we need a strong telecoms sector in Europe and the right regulatory and policy conditions!
 - We need to avoid the emergence of new oligopolies or walled gardens in this emerging space. This is why we welcome the European Commission’s emphasis on openness and interoperability of virtual worlds. No user or business should be locked-in to one ecosystem – let us not repeat the same mistakes as with cloud!
 - Sustainability needs to be part of the discussion. Virtual worlds will bring a massive increase of data traffic which will in turn drive energy consumption. Hence, we need to find ways to incentivize a more efficient use of that data, especially by the largest generators of such data.



Dr. Christina Dienhart, RWTH - Aachen University, Assistant Professor

How will the advent of the metaverse impact the dynamics of value creation within industries? What implications does the metaverse hold for business models, technologies, standards, and the broader ecosystem? What role does the metaverse play in shaping and influencing ongoing sustainability efforts? Is it more a hype or a hope?

These are exemplary questions we ask ourselves at the Institute for Technology and Innovation Management (TIM) at RWTH Aachen University, in research, teaching, and industry projects. As a leading European research institution specializing in strategic, behavioral, and computer-aided technology and innovation management, our

mission is to cultivate knowledge in areas that hold equal significance for academia, industry, policy, and society.

One focus revolves around transforming established organizations confronted with disruptive technological innovations, encompassing Industry 4.0, Artificial Intelligence, Smart Products and Services, Additive Manufacturing, and the Metaverse. Specifically, we are dedicated to unraveling ways in which metaverse technologies impact organisations. Our emphasis extends to understanding the dynamics of interaction and interdependencies among various stakeholders within the metaverse ecosystem. This is also why I am pleased to be here today, as our discussions and talks are at the core of the European metaverse ecosystem.

So, what is new about the metaverse? Why do some people discuss the metaverse as the next big evolutionary step that will change everything, while others say the hype is over?

We define the metaverse as the progressive evolution of digitalizing industries. Rooted in networked industrial assets (Industry 4.0), it manifests itself into immersive, virtual realms showcasing the interconnected facets of a digitalized factory and its digital twins. Complex technology becomes concrete experience. In the industrial metaverse, a paradigm shift occurs, allowing users to oversee and control real production facilities remotely through e.g., personalized avatars. Broadly considered the "next generation of the internet," the metaverse is

expected to revolutionize many aspects of economic activity and social life. It can be a huge creativity booster. It may stimulate new ways of thinking and generates a new form of collaboration.

In the metaverse innovation cycle, we are currently in an experimentation phase without clarity regarding future-proof technologies, use cases, KPIs, and how to accumulate and develop virtual experiences over time. As a research institution, we ask critical questions about the metaverse and develop analyses and solutions together with our industry partners. In various studies, we have found that the most significant technical challenges for developing the metaverse are e.g., computing power, information processing, 5G and 6G connectivity, equipment availability, and lack of interoperability.

Furthermore, economic, and social challenges include factors such as acceptance, business models innovation, interdependencies, added value quantification, skill development, and market structure development. With this in mind, we conduct research studies, work together with experts, and develop R&D projects to find answers for promoting the idea of an inclusive, open, and interconnected metaverse through our role as R & D institution in the metaverse ecosystem.

Our initiatives within the Metaverse realm are categorized into three primary domains:

1. Research and development/industry collaboration
 - a. Cluster of Excellence “Internet of Production (IoP)) - Enabling cross-domain collaboration through real-time and secure information availability;
 - b. Siemens – Aachen Research and Innovation Ecosystem (RIE) - One of the largest technology-oriented research communities in Europe between RWTH Aachen University, KU Leuven and Siemens;
2. Education & training/skill development
 - a. 5-day metaverse lecture – Familiarization of students with the metaverse technologies, current trends and developments, as well as identification of challenges and opportunities in an industrial context; development of business model innovations using real-life examples;
 - b. Industry workshops – Metaverse training for industry representatives in order to develop business models and roadmaps for implementation;
3. User acceptance/empowering civil society
 - a. Delphi Study – Forecasting trends in the metaverse with international metaverse experts in order to formulate recommendations for action and to develop trend radars;
 - b. Whitepaper & Policy Brief (Metaverse and the Smart City) – Formulating a White Paper/Policy Brief that provides insightful recommendations and frameworks for optimal implementation of the metaverse in the smart city context in order to increase civil society engagement.

Key Learnings:

- For gaining social trust, an appropriate public discourse about the metaverse, the associated technologies and associated opportunities and risks are necessary;
- For exploiting optimization potential across the entire supply chain, cross-company collaboration (small and large) in developing use cases is needed;
- The industrial metaverse is a way to visualize and interact with data more intuitively and immersively, offering new ways for users to understand and control industrial processes – new training programmes have to be developed to gain user acceptance;

- In order to counteract rejection and prejudice (not invented here syndrome (NIH)), the focus must remain on the employees. This can effectively be achieved through clear user experience and approachability of technologies;
- For the added value of the metaverse to unfold, management must enable experimentation across the entire breadth of the organization, not just in technology-related departments;
- Business models in the metaverse are unique and versatile - Embedded in a strong innovation ecosystem, they can best create added value through strong knowledge transfer between academia and industry;
- A strong innovation ecosystem (with industry, academic and political partners) is key to promote the further development of a collaborative and inclusive metaverse.

Call for Action:

“The future is already here, it’s just not evenly distributed” William Gibson (1984)

In the dynamic landscape of the industrial metaverse ecosystem, key players must unite forces collaboratively. By harnessing our synergies, we can collectively maximize our impact and shape the future of this transformative realm.

As we examine the current use cases of the metaverse, it becomes evident that the foundational elements are already woven into our reality. While the vision progresses toward actualization, we do not know how the future might look like. Here lies an opportunity for us to actively contribute and shape the trajectory of the metaverse.

It is on us to shape the metaverse ecosystem economically, ecologically, and socially.

Our responsibility is to foster a metaverse that does not perpetuate inequality but instead becomes a catalyst for positive change, where economic dependencies are diversified, and social justice is at the forefront of our collective vision.

Antony Fell, EUROPEAN FORUM FOR MANUFACTURING,
Secretary General

My closing remarks are going to focus on the thanks for all those who have contributed to this evening’s excellent debate on the European Commission’s Virtual Worlds Initiative – The Industrial Metaverse.

First, I would like to thank Maria Grapini MEP, Vice-Chair of the Internal Market Committee. With her extensive experience as a professional engineer, as a government minister and with her knighthood for services to business and industry, we have appreciated her role as our Parliamentary host this evening.



I also wish to express our appreciation to the two European Commission experts this evening: Gaspard Demur, Deputy Head at DG CNECT on ‘Digital Transformation of Industrial Ecosystems’ and Szabolcs Szekacs, from DG GROW who leads their Digital Industry Team. Both of them have not only briefed us, but also taken note of the manufacturers’ views expressed.

A special thanks to Siemens since this meeting came from a proposal of Benedikt Kuettenkeuler and Eddy Roelants. It was therefore a good opportunity for us to have the views of Matthieu Worm, their Senior Principal Key Expert.

It was very useful to have the input from a wide range of manufacturers: Orgalim. Europe’s technology industries; WindEurope; and Deutscher Telecom as well as from the academic world, the RWTH University of Aachen’s professor Christina Dienhart.

We especially appreciated the participation of Parliamentary Rapporteur, Axel Voss MEP from the Legal Affairs Committee, whose role in the policy development of this dossier has been particularly valuable.

Finally, I would like to thank EFM team, Caroline Richmond, and Janice MacCormack for all their support and now formally close this European Forum for Manufacturing event on the EC Virtual Worlds Initiative – the Industrial Metaverse.

