Exploring Ethical Challenges in Metaverse Tourism: Comparative Analysis of UNESCO Sites in Germany and Romania

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Abstract: This paper examines the ethical dimensions of metaverse tourism, addressing challenges related to privacy, inclusivity, cultural representation, and governance. Immersive platforms like the Metaverse, Apple Vision, and HoloLens, transform travel by offering sustainable alternatives to traditional travel. However, they also raise complex moral concerns, including data exploitation, digital divide, privacy violations, and the commercialisation of cultural heritage. A mixed-method approach was applied, including a literature review and case study comparing virtual representations of UNESCO World Heritage sites in Germany and Romania. Meta Quest "UNESCO World Heritage Sites in Germany" (presenting 55 sites) and several Romanian sites from YouTube VR and Sketchfab were accessed using Oculus Quest 2 and analysed. Findings reveal that Germany offers centralised app balancing education with promotional commercialisation, yet exposing privacy risks via Meta's tracking and inclusivity barriers from hardware costs. In contrast, Romania relies on fragmented access, promoting community-led, bottom-up authenticity but highlighting accessibility gaps and under-representation in Metaverse ecosystems. Furthermore, results reveal disparities mirroring real-world inequalities, with recommendations for transnational standards to mitigate biases.

Keywords: metaverse, UNESCO World heritage sites, tourism, ethics

JEL Classification codes: Z32, O33

INTRODUCTION

The metaverse, a virtual and immersive environment, has the potential to revolutionise travel and tourism management and marketing. It offers users an alternative to physical travel through technologies such as virtual reality (VR), augmented reality (AR), and mixed reality (MR) (Buhalis et al., 2023). Virtual platforms like Horizon Worlds, Decentraland, Roblox, etc., are accessible through VR/AR/MR headsets such as Meta Oculus Quest 2 and 3, Apple Vision Pro, and Microsoft HoloLens. Metaverse tourism enables users to interact socially, participate in activities, and visit destinations without being physically present. Moreover, it provides sustainable alternatives to conventional tourism, reducing carbon footprints and alleviating overtourism pressures on fragile sites. For instance, virtual tours allow global access to remote or protected areas and promote inclusivity for individuals with mobility constraints or financial limitations (Dwivedi et al., 2022).

Despite these advantages, the metaverse raises significant ethical concerns, such as data exploitation, the digital divide, social inclusion, privacy violations, and the commercialization of cultural heritage (Wu & Zhang, 2023; Zhuk, 2025). As the metaverse evolves, it increasingly mirrors and sometimes amplifies real-world disparities, making it essential to develop appropriate ethical recommendations to ensure equitable and respectful digital experiences.

Scholarly attention to date has largely focused on general concerns (Huang et al., 2023; Munn & Weijers, 2023; Wu & Zhang, 2023; Zhuk, 2025). Comparative studies examining virtual representations of heritage sites across national contexts remain limited.

This paper focuses on UNESCO World Heritage sites as a lens to examine these issues, comparing virtual representations in Germany and Romania. Meta Quest "UNESCO World Heritage Sites in Germany" (presenting 55 sites) and several Romanian sites from YouTube VR and Sketchfab were assessed via the Oculus Quest 2 headset. Employing a literature review and a comparative case study, the research offers novel insights for policymakers to foster sustainable, ethical virtual tourism that preserves cultural integrity.

1 LITERATURE REVIEW

There has been a significant surge in metaverse literature in the field of tourism since the early 2020s. This growth was driven by advancements in VR and AR technologies and the post-COVID shift toward digitalization. Ethical issues in the metaverse are multi-layered, comprising organizational, social, and individual problems and consequences (Munn & Weijers, 2023). Across the literature, these concerns are not treated as isolated risks, but as interconnected challenges emerging from the design and governance of immersive environments. The technological breakthroughs of the metaverse have introduced profound ethical challenges. The metaverse is designed to foster user addiction through persuasive mechanisms that capture attention and promote digital immersion for the purpose of profit maximization. This approach creates a conflict with established principles of social responsibility, potentially generating adverse impacts on mental health. Additionally, it increases social isolation and may weaken the connection to physical reality creating the darkverse phenomenon (Zhang & Ran, 2024).

Meta's immersive environment promotes a vision distinct from the original term coined by Neal Stephenson in the novel Snow Crash. In Stephenson's work, the metaverse is represented as a space of free escape from a world dominated by corporations. On the contrary, Meta's Metaverse is increasingly controlled by tech giants, becoming a corporatized, centralised, censored, and heavily monitored environment. In addition, its users are treated as exploitable resources rather than independent participants. This contrast highlights a broader shift in the literature from interpretations of Stephenson's metaverse toward more critical perspectives focused on power, control, and user agency. This contradiction between the ideal of freedom and the reality of control underscores the urgent need for proactive ethics in technological design. Such ethics must involve sustainability, protection of users, and genuine freedom of choice, to prevent the metaverse from degenerating into a tool for economic and social manipulation (Buhalis et al., 2023).

The most predominant ethical issue regarding metaverse application in tourism is data privacy and security. Interacting with these environments requires a combination of devices like wearable devices, motion sensors, microphones, and heart and respiratory monitors. The main problem with all these devices is that they enable enhanced surveillance compared with traditional applications. A great volume of personal data is generated by the users, including biometrics like heart rate, gaze tracking, voice inflections, and facial expressions. There is also behavioural data collected by Meta's Metaverse (movements, emotions, habits) (Kang et al., 2024). This indicates that privacy concerns in metaverse tourism are structurally embedded in the technology itself, rather than being limited to individual platform practices.

A significant difficulty with data collection and processing in the metaverse is the authenticity of informed consent (Huang et al., 2023). The risks are especially acute for vulnerable groups, such as children and individuals with low digital literacy. Collecting and using data without clear, informed consent violates core ethical principles and may lead to privacy breaches,

intrusive practices, or commercial exploitation. Without strict regulation, companies may use such data for targeted advertising or share it with third parties, while cyberattacks can expose sensitive information and enable abusive profiling (Wu & Zhang, 2023). Additional ethical concerns in metaverse tourism involve data governance and artificial intelligence (AI) use. Personalization algorithms may contain embedded biases and distort outcomes, while avatar-based anonymity can foster cyberbullying, manipulation, and psychological harm (Gómez-Quintero et al., 2024; Qin et al., 2025). Issues such as duplicate identities, deepfakes, and AI-mediated interactions further blur the line between authentic and simulated experiences, reshaping perceptions of reality (Tukur et al., 2023). Together, these issues suggest that ethical challenges extend beyond privacy toward broader concerns of transparency, accountability, and control within digital ecosystems.

The unethical acquisition of user-generated content via generative AI and the disregard for copyright raise serious concerns. Dependence on private platforms can turn collected data into commercial assets, creating conflicts of interest and undermining research and user autonomy. Tackling these risks requires the introduction of ethical principles from the design stage of applications (Monaco & Sacchi, 2023). Key measures include granular informed consent, end-to-end encryption, independent audits aligned with regulations such as GDPR, and "privacy by design". Collectively, these safeguards protect participants and virtual tourists while strengthening the credibility and long-term sustainability of tourism research and practice in the metaverse (Bibri & Allam, 2022).

Another key issue arises from prolonged immersion in virtual environments. The darkverse refers to a phenomenon where the evolution of the metaverse toward hyper-real, highly immersive environments may encourage severe escapism, leading to emotional desensitization and the replacement of real experiences with the matrix (Singh et al., 2025). Prolonged immersion designed for instant gratification can distort perceptions of reality and foster alienation through realistic digital avatars detached from real consequences (Issa et al., 2022). Such developments raise ethical concerns about the human experience, individual autonomy, and the value of tangible reality. Socially, it poses risks to mental health such as addiction, isolation, and apathy, while raising questions about the responsibility of developers, researchers, and institutions in managing its impact (Singh et al., 2025; Dwivedi et al., 2023).

The digitization and virtual recreation of cultural spaces by third-party developers in the metaverse, raises ethical questions related to cultural appropriation, cultural responsibility, and economic sustainability (Munn & Weijers, 2023). Cultural appropriation happens when elements of cultures are adopted by dominant groups without proper understanding, often turning them into commercial or aesthetic products. This practice morally contradicts sustainable tourism fundamentals that emphasize cultural respect and community involvement. Without genuine collaboration, virtual reconstructions can distort historical and spiritual meanings, reducing them to superficial digital commodities (Cruz et al., 2024). Over time, recurrent exposure to streamlined virtual portrayals can weaken authentic understanding and enable the unethical commodification of heritage (Dwivedi et al., 2022). This highlights the importance of governance structures that ensure local participation in digital heritage representation.

Excessive commercialisation raises concerns about fair benefit distribution, as local communities may lose both profits and control over how their culture is represented. This creates key issues of cultural property rights and the need to involve local actors in shaping their virtual identity. From a sustainable tourism ethics perspective, the metaverse should complement heritage conservation and community well-being, not replace or exploit them (Munn & Weijers, 2023).

The global growth of metaverse tourism could considerably affect economies that rely on physical travel. Reduced tourist mobility may lower demand for accommodation, transport,

guides, and local crafts, weakening local economies (Buhalis et al., 2023). Profits from virtual experiences tend to concentrate in major tech platforms, while less-developed regions remain excluded (Zhang & Ran, 2024). At the same time, standardized simulations may erode authentic experiences and promote uniformity, potentially accelerating the neglect of historical and natural sites (Zhang & Ran, 2024). These dynamics suggest that metaverse tourism may reproduce existing global inequalities rather than reduce them.

Within the metaverse, inclusivity and accessibility pose challenges to dominant ethical norms, as this emerging space frequently recreates and accentuates real-world inequalities (Vasist et al., 2026). The reliance on costly devices, high-end internet, and advanced tech excludes rural, low-income, and underdeveloped communities (Monaco & Sacchi, 2023). Algorithms that dictate visibility can also embed subtle, opaque discrimination. As a result, inclusivity becomes a central ethical dimension in evaluating metaverse tourism environments. Therefore, metaverse is an open global space that requires governance recommendations that prioritize equity and social responsibility (Munn & Weijers, 2023; Zhuk, 2025).

Despite the growing body of literature addressing ethical challenges in the metaverse, several limitations remain. First, existing studies predominantly adopt a conceptual or normative perspective, with limited empirical application to specific sectors such as tourism. Second, there is a lack of comparative analyses examining how ethical dimensions manifest across different national, institutional, and technological contexts. Third, ethical concerns such as privacy, inclusivity, and governance are rarely operationalised into analytical criteria that can be systematically applied to real-world digital platforms. As a result, the connection between theoretical ethical debates and actual metaverse implementations remains insufficiently explored. Addressing these gaps, this study provides a comparative analysis of metaverse tourism applications related to UNESCO World Heritage sites in Germany and Romania, focusing on how key ethical dimensions are reflected in practice.

2 METHODOLOGY

The aim of this paper is to examine the ethical dimensions of metaverse tourism, focusing on privacy, inclusivity, cultural representation, and governance, through a comparative analysis of virtual UNESCO World Heritage sites of Germany and Romania. These dimensions were selected based on their recurrence in the literature as key ethical concerns in metaverse environments and were used as analytical categories to guide the study. The research adopts a qualitative comparative case study approach, a structured observation of selected digital platforms representing UNESCO heritage sites. The observation of UNESCO sites was carried out using the Oculus Quest 2 headset and the Metaverse platform from Meta company. For German UNESCO sites in the Metaverse, the installation and full exploration of the German application was conducted through multiple sessions of approximately 60 minutes each, including browsing the central map, visiting the sites, completing quizzes, and accessing informational content about the touristic objectives. For Romanian UNESCO sites in the Metaverse relevant Romanian content was accessed on YouTube (VR/360° mode), Sketchfab, and other accessible websites. This selection reflects a more decentralised and platform-diverse digital ecosystem compared to the German case. Case selection was based on the availability of virtual representations of UNESCO World Heritage sites and their relevance in illustrating different technological and organizational approaches (centralised vs. fragmented systems). Each case was systematically examined according to the predefined ethical dimensions, allowing for a structured comparison between the two national contexts. For each dimension, specific indicators were considered: (1) privacy – presence of data collection mechanisms and transparency of user data use; (2) inclusivity – accessibility of platforms, language options, and usability; (3) cultural representation – accuracy, depth, and degree of community involvement in content creation; (4) governance – degree of institutional control

versus platform dependency. Observational data were recorded descriptively and then comparatively analysed to identify patterns, differences, and similarities across the two cases. The contrasts and lessons learned were subsequently synthesized to highlight key differences in how ethical dimensions are reflected in each context. Replicability is supported by the detailed description of platforms accessed, hardware used, session structure, and analytical criteria provided above; any researcher with access to an Oculus Quest 2 and the listed public platforms could replicate the core observations. However, as a single-researcher observational study, the design acknowledges potential subjectivity. To mitigate this, the researcher maintained notes and cross-checked observations against official platform documentation. The study relies primarily on direct platform observation triangulated with secondary sources (app privacy policies, developer descriptions, and academic literature). Future research could enhance robustness through additional triangulation, such as user surveys or expert interviews.

3 RESULTS AND DISCUSSION

3.1. UNESCO World Heritage Sites of Romania and Germany

Romania has 11 inscribed UNESCO World Heritage Sites that not only preserve Romania's heritage but also contribute to global understanding of European history, biodiversity, and cultural evolution (Comisia Națională a României pentru UNESCO, 2026). On the other hand, Germany has 55 inscribed properties on the UNESCO World Heritage List, making it one of the countries with the highest number of sites globally (UNESCO World Heritage Centre, 2025). Therefore, Romania and Germany differ markedly in the scale and focus of their UNESCO portfolios, as shown in Table 1. Germany has five times as many sites (55 vs. 11), attributable to its larger size, denser historical layers, and proactive nominations since the 1970s. Both prioritize cultural sites (~82% in Romania, ~95% in Germany), but Romania has a stronger emphasis on natural heritage proportionally (~18% vs. ~5%). Shared themes include Roman frontiers and beech forests, underscoring trans-European connections (Comisia Națională a României pentru UNESCO, 2026; UNESCO World Heritage Centre 1992-2026, 2025).

Thematically, Romanian sites often evoke rural, fortified, and Orthodox traditions, reflecting a history of invasions and isolation. In contrast, German sites highlight urban development, royal patronage, and industrial innovation, mirroring its role in the Holy Roman Empire and modern Europe. Preservation efforts in Germany benefit from robust funding and infrastructure, with sites like Cologne Cathedral drawing millions of visitors annually. Romania's sites, while equally valuable, face greater challenges from economic constraints, though tourism is growing (Comisia Națională a României pentru UNESCO, 2026; UNESCO World Heritage Centre 1992-2026, 2025).

Tab. 1 Overview of Romania's and Germany's UNESCO World Heritage Sites

Aspect	Romania	Germany
Total Sites	11	55
Cultural Sites	9	52
Natural Sites	2	3
Oldest Inscribed Site	Danube Delta (1991)	Aachen Cathedral (1978)
Newest Inscribed Site	Frontiers of the Roman Empire - Dacia (2024) / Sculptural Ensemble of Constantin Brâncuși at Târgu Jiu (2024)	The Palaces of King Ludwig II of Bavaria (2025)

Aspect	Romania	Germany
Geographic Distribution	Primarily in Transylvania and northern regions (e. g., Maramureș, Suceava Counties)	Spread across 16 states, with concentrations in Bavaria and North Rhine-Westphalia
Key Themes	Focus on fortified villages, wooden churches, ancient forests, and Roman/Dacian history	Strong emphasis on medieval architecture, industrial heritage, and Roman frontiers

Source: own computation

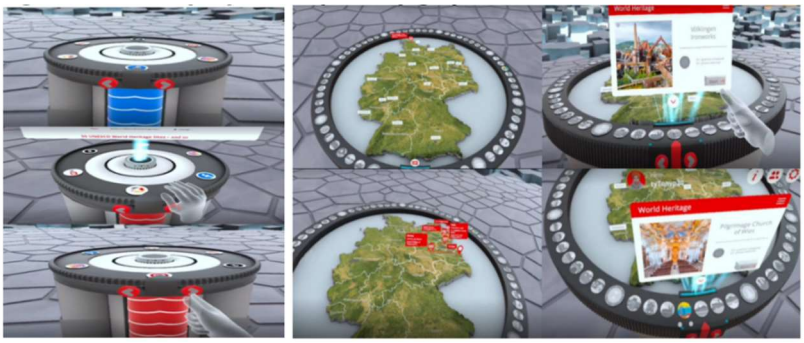
3.2. Germany's UNESCO World Heritage Visualization in Metaverse

The "UNESCO World Heritage Sites in Germany" (Version 1.0.4) application, developed by Mobile-Etage GmbH and published by the German National Tourist Board, is an educational tourism platform available on the Meta Horizon Store. It is compatible with Meta Quest 2, 3, 3S, and Pro devices, supports multiple languages like English, Chinese, French, German, and includes an option to reset user progress (German National Tourist Board, 2025). The app supports both AR and VR modes, with navigation possible individually or in multiplayer mode is achieved through room-scale movement or joystick. The main interface (Figure 1) includes three interactive elements: a map table, a social table, and a portal door, alongside a personal notebook. The map table (Figure 2) is a rotatable interface displaying Germany's map, with a spinnable toothed rim that allows users to browse UNESCO sites. The social table (Figure 2) links directly to external platforms, including YouTube, Instagram, TikTok, Pinterest, Facebook, and the official developer website, highlighting the integration between the metaverse experience and broader digital promotion channels. The portal door enables access to selected locations, where users can explore 360° environments and complete objectives, reflecting a structured and guided exploration model rather than free navigation (German National Tourist Board, 2025). The app includes a privacy section stating that it processes sensor and device data, such as eye tracking, microphone input, hand tracking, and spatial data, to enable interaction, navigation, and system performance. It also collects user-related information (e.g., User ID, profile, avatar, followers, and usage data) to support core services, personalization, and platform functionality (German National Tourist Board, 2025). Data collection and processing is governed by the policies of Mobile-Etage GmbH, alongside the Meta Horizon Developer Data Use Policy and Refund Policy, which regulate data collection, storage, and protection. The application also provides safety guidance, warning that the mixed-reality experience may feel highly realistic and advising users to remain aware of their physical surroundings; younger users are encouraged to consult a trusted adult (German National Tourist Board, 2025).

Fig. 1 Room-scale

Source: Screenshot taken by the author of "UNESCO World Heritage sites in Germany" app open in Metaverse

Fig. 2 Social table (left) and Map table (right)



Source: Screenshot taken by the author of "UNESCO World Heritage sites in Germany" app open in Metaverse

The main strengths and ethical issues of UNESCO World Heritage sites of Germany present in Metaverse app are listed in Table 2.

Tab. 2 Germany's UNESCO World Heritage Sites Presentation in Metaverse

Aspect	Feature	Justification
Strengths	Comprehensive coverage	All 55 UNESCO World Heritage Sites in Germany are integrated within a single application.
	High production quality	Professional 360° environments, smooth navigation, and structured storytelling enhance user engagement.
	Educational–promotional balance	Informational content is embedded alongside subtle destination branding, blending heritage education with tourism marketing.
	Interactive engagement	Gamification features increase immersion and sustained user attention.
Ethical Issues	Data privacy and tracking	Use of Meta's VR infrastructure raises concerns regarding biometric tracking, behavioural data collection, and surveillance-based advertising models
	Inclusivity barriers	Access requires relatively expensive hardware (e.g., Meta Quest devices), creating socio-economic barriers and reinforcing the digital divide.
	Commercialization of heritage	While framed as educational, the application integrates destination marketing elements, blurring boundaries between cultural preservation and tourism promotion.

Source: own computation

In conclusion, the German model reflects a highly institutionalised and resource-intensive approach, prioritising quality and reach but embedding structural ethical risks linked to platform capitalism.

3.3. Romania's UNESCO World Heritage Visualization in Metaverse

In contrast, Romania's UNESCO World Heritage representations are not centralised within a dedicated metaverse platform; instead, content is distributed across platforms such as YouTube VR and Sketchfab. The sites are gaining digital visibility through virtual tours, 3D reconstructions, and immersive projects, establishing an emerging presence in the Metaverse. For example, Danube Delta is represented through documentary-style 360° VR videos

showcasing traditional lifestyles, such as the daily life of local fishermen (Simioniuc, 2020; see Fig. 3). Other examples include multiple 3D models and virtual reconstructions of the Historic Centre of Sighișoara, a preserved medieval fortified town and birthplace of Vlad the Impaler (Vak.Expert, 2024) and the Dacian Fortresses of the Orăștie Mountains, showcasing pre-Roman Dacian settlements and sanctuaries (Romaniadevis, 2016). Also, several cultural UNESCO sites show notable digital representation. The Churches of Moldavia have a stronger digital presence, with monasteries such as Humor available as detailed 3D photogrammetry models on Sketchfab, enabling immersive exploration of their renowned exterior frescoes (Brunchi, 2022). Similarly, the Wooden Churches of Maramureș are represented by individual 3D models, including the church in Bârsana with its distinctive tall spires and shingled roofs (Muzeul Municipal Sebeș, 2025; see Fig. 4). The Villages with Fortified Churches in Transylvania, like Prejmer, Dârjiu, and Saschiz, have likewise been recreated using 3D scans and photogrammetry, providing virtual access to defensive structures, frescoes, and rural landscapes (FAE_Drones, 2017; Institutul Național al Patrimoniului, 2025; Manolescu, 2018). According to the author's knowledge, some Romanian UNESCO sites still lack accessible VR or 3D representations in the Metaverse.

Fig. 3 Danube Delta 360 VR

Source: Screenshot taken by the author in Metaverse of Simioniuc (2020) VR video

Fig. 4 The Wooden Church of Barsana, Maramures

Source: Screenshot taken by the author in Metaverse of 3D model from Muzeul Municipal Sebes (2025)

The main strengths and the ethical issues of UNESCO World Heritage sites of Romanian present in Metaverse app are listed in Table 3.

Tab. 3 Romania's UNESCO World Heritage Sites Presentation in Metaverse

Aspect	Feature	Justification
Strengths	Community-led production	Content is often created by local institutions, independent creators, or small organizations.

Aspect	Feature	Justification
	Bottom-up authenticity	Representations appear less overtly commercialized and more culturally grounded.
	Lower technological threshold	Many experiences can be accessed without dedicated VR hardware, increasing baseline accessibility.
Ethical Issues	Fragmented access	The absence of a unified platform results in scattered user journeys and inconsistent quality standards.
	Under-representation in Metaverse	Romanian heritage sites lack visibility within dominant VR marketplaces, limiting global reach.
	Amplified digital divide	While hardware barriers may be lower, limited institutional investment and technological infrastructure constrain scalability and professional quality

Source: own computation

Thus, Romania's UNESCO sites demonstrate a growing but uneven presence in the metaverse. Cultural properties with existing 3D scans and photogrammetry models show the strongest digital integration, while natural landscapes and recently inscribed sites present substantial potential for future immersive development. Romania's model reflects structural marginalisation within the Metaverse ecosystem, mirroring broader disparities in technological adoption and tourism funding across Europe.

3.4. Comparative Analysis and Findings

The comparative analysis juxtaposes Germany's centralised, platform-driven approach to metaverse tourism against Romania's decentralised, community-oriented model. The side-by-side comparison of the two cases is presented in Table 4. This examination is structured around the key ethical dimensions: privacy, inclusivity, cultural representation, and governance structures; which are drawn from the literature as interconnected challenges in immersive digital environments (Munn & Weijers, 2023; Buhalis et al., 2023; Kang et al., 2024). These dimensions are particularly important because they reveal how technological design and platform architecture not only reflect but also intensify existing socio-economic disparities between Western and Eastern Europe, while shaping the ethical implications of virtual heritage tourism.

Table 4. Ethical Issues in Romania's vs. Germany's UNESCO World Heritage Sites Presentation in Metaverse

Dimension	Romania	Germany	Discussion of Ethical Issues
Platform Structure	Fragmented platforms	Centralised app	Fragmented structures promote grassroots participation but create ethical risks of inconsistency and weak oversight; centralised models offer coherence yet raise concerns over corporate control and reduced user agency
Coverage	Selected sites scattered	55 sites unified	Scattered coverage leads to under-representation of Romanian heritage in global digital spaces, reinforcing inequalities; unified coverage improves visibility but risks homogenizing diverse cultural

Dimension	Romania	Germany	Discussion of Ethical Issues
			narratives through a single corporate lens.
Production Quality	Variable, user-generated	High, professional	User-generated content preserves local authenticity but may compromise accuracy and quality; professional production ensures reliability yet often prioritizes commercial appeal over genuine cultural depth.
Accessibility	More device-flexible	Hardware-dependent	Both models exclude segments of the population, reproducing the digital divide and violating principles of equitable access to cultural heritage.
Commercialisation	Minimal overt commercialisation	Integrated promotional strategy	Low commercialisation protects cultural integrity but limits sustainability; high commercialization transforms heritage into a marketable product, raising ethical questions about authenticity versus economic exploitation.
Privacy Risk	Lower risks but inconsistent protections and platform-dependent	High risks from Meta tracking	Decentralised systems reduce mass surveillance but offer uneven protection; centralised tracking enables pervasive data exploitation and challenges informed consent, conflicting with GDPR and core privacy ethics.
Inclusivity	Limited (Accessibility gaps due to fragmentation and infrastructure)	Limited (hardware barriers exclude low-income users; high digital readiness)	Infrastructure barriers in Romania and economic/hardware barriers in Germany limit inclusive access to shared European cultural heritage.
Cultural Representation	Authentic, community-led; risks of under-representation	Accurate but commercialised; official partnerships	Community-led approaches enhance cultural respect and reduce bias, yet risk marginalisation; official partnerships ensure accuracy but may commodify sites and prioritize tourism revenue over authentic meaning.
Governance	Weak standards; potential for appropriation	Strong content control but platform monopoly concerns	Weak governance increases risks of cultural appropriation and misuse; strong corporate control ensures quality but concentrates power, limiting community voice and raising monopoly-related ethical concerns (Bibri & Allam, 2022; Monaco & Sacchi, 2023)

Source: own computation

Privacy differs markedly between the two cases. Germany's centralised Meta platform entails extensive behavioural and biometric data collection, including gaze tracking, emotional responses, and movement patterns, which significantly raises serious concerns about meaningful informed consent and the commercial exploitation of user data (German National Tourist Board, 2025). This aligns closely with the literature that identifies surveillance as structurally embedded in Metaverse design rather than merely a platform-specific issue (Kang et al., 2024; Huang et al., 2023). In contrast, Romania's decentralised approach substantially reduces centralised tracking and data aggregation, yet it suffers from fragmented and inconsistent data protections coupled with weak intellectual property safeguards. This fragmentation leaves heritage content and local creators vulnerable to potential misuse, unauthorized commercial reuse, or even cultural appropriation through generative AI tools, highlighting the governance gaps often overlooked in open-platform ecosystems.

Inclusivity reveals persistent barriers in both contexts. While Germany's advanced digital readiness is undermined by the requirement for expensive proprietary hardware (such as the Oculus Quest 2 or compatible devices costing over €300), effectively excluding lower-income and digitally marginalised users despite the country's high overall connectivity. Romania's model, on the other hand, is constrained by significantly lower broadband penetration and broader infrastructural limitations across rural and less-developed regions. These contrasting yet equally limiting patterns confirm that metaverse tourism tends to reproduce rather than alleviate real-world digital divides, reinforcing socio-economic inequalities between Western and Eastern Europe and limiting equitable access to shared cultural heritage (Vasist et al., 2026; Monaco & Sacchi, 2023).

Cultural representation and authenticity show a clear trade-off. Romania's community-driven content on open platforms supports greater inclusion of local narratives and voices, thereby reducing the risk of external cultural bias and top-down reinterpretation. However, this approach still carries the risk of under-representation in global Metaverse ecosystems, where visibility algorithms often favour professionally produced, high-fidelity content. Germany's app ensures higher historical accuracy and professional quality through UNESCO partnerships, yet they lean heavily toward commercialisation. This tendency potentially commodifies heritage sites by transforming them into marketable tourism products, prioritizing revenue generation (e.g., integrated booking links and sponsored events) over deeper cultural understanding and authentic engagement (Cruz et al., 2024; Buhalis et al., 2023; Dwivedi et al., 2022).

Governance structures remain a critical weakness in both models. Romania lacks unified standards for content moderation, intellectual property protection, and meaningful community oversight, which increases the risks of cultural appropriation and uncontrolled external exploitation of heritage resources. Conversely, Germany's strong platform control provides more consistent content quality and moderation but raises serious concerns over corporate monopoly power and limited user and community agency in shaping how heritage is represented.

The comparative findings between Germany's centralised and Romania's decentralised models of UNESCO World Heritage representation in the Metaverse provide valuable empirical insights that can inform the development of a more comprehensive and balanced ethical framework for metaverse tourism and digital heritage. By systematically examining the trade-offs across privacy, inclusivity, cultural representation, and governance, this study moves beyond purely conceptual debates and offers concrete, operational recommendations.

First, the analysis demonstrates the limitations of purely centralised or decentralised approaches and highlights the need for hybrid governance models. Such frameworks should integrate the technical efficiency, professional quality, and wide reach of centralised platforms with the authenticity and community participation characteristic of decentralised initiatives. For instance, large technology providers could be required to adopt open standards for user-

generated content while implementing mandatory ethical oversight and quality protocols. This hybrid structure would reduce corporate monopoly risks on one hand and fragmentation-induced under-representation on the other.

Second, the pronounced differences in privacy risks underscore that data governance must be treated as structurally embedded in platform design. An effective ethical framework should therefore enforce "privacy by design" principles specifically adapted to immersive environments. These could include granular and ongoing informed consent mechanisms for biometric and behavioural data, independent third-party audits, and differentiated protection standards that address both centralised surveillance and decentralised vulnerabilities (Kang et al., 2024; Huang et al., 2023).

Third, the persistent inclusivity barriers observed in both cases, hardware costs in Germany and infrastructural limitations in Romania, indicate that equitable access must constitute a core pillar of any ethical framework. Recommendations include the development of low-cost or browser-based alternatives, public subsidies for disadvantaged users, and universal design standards that ensure compatibility with diverse devices and assistive technologies, thereby preventing the reproduction of real-world digital divides (Vasist et al., 2026; Monaco & Sacchi, 2023).

Fourth, the evident trade-offs in cultural representation emphasize the necessity of embedding community participation and authenticity safeguards from the earliest design stages. A robust framework should mandate meaningful involvement of local stakeholders and heritage communities in content creation, transparent provenance mechanisms (e.g., blockchain-supported), and clear guidelines to limit excessive commercialisation while allowing sustainable benefit-sharing models. This would help mitigate risks of cultural appropriation and commodification of heritage (Munn and Weijers, 2023; Cruz et al., 2024).

Finally, this study illustrates the value of comparative empirical research as a foundation for ethical standard-setting. By operationalising key ethical dimensions into valuable criteria and applying them across contrasting national and technological contexts, it provides a replicable analytical model. Such an approach can support the creation of transnational guidelines that promote interoperability, cultural sensitivity, accountability, and the protection of both user rights and heritage values.

Summarizing, the findings advocate for a context-aware, participatory, and hybrid ethical framework that harnesses the strengths of both centralised efficiency and decentralised authenticity while systematically addressing their respective weaknesses. By prioritising equity, user agency, community involvement, and cultural integrity, such a framework would contribute to more responsible and sustainable applications of the Metaverse in cultural heritage tourism. This ultimately ensures that digital innovation serves rather than undermines the preservation and democratic enjoyment of global heritage.

CONCLUSION

Romania and Germany's UNESCO portfolios differ significantly. The main presence of Germany UNESCO sites is represented by the centralised VR application developed by the German National Tourist Board and distributed via the Meta ecosystem for use on devices such as the Meta Quest 2. The application, "UNESCO World Heritage Sites in Germany," presents all 55 heritage sites through immersive 360° panoramas, interactive tasks, and gamified features including badges and multiplayer functions. Therefore, Germany benefits from institutional coordination and funding, resulting in cohesive user experience. Romania's fragmented approach reflects limited integration into dominant metaverse infrastructures. The technological gap mirrors broader economic and digital infrastructure differences between

Western and Eastern Europe. Both approaches present ethical challenges, though of different nature. For Romania, the risks are related to invisibility, under-representation, and structural marginalisation in global metaverse ecosystems. In contrast, for Germany there are higher risks related to surveillance capitalism, commercialisation, and exclusion through cost barriers. The findings indicate that metaverse tourism does not neutralize geopolitical disparities. Instead, immersive tourism appears to reproduce the existing socio-economic asymmetries (funding, technological capability, and global visibility) while introducing new governance and privacy dilemmas.

The study relies on publicly available information about technological implementations without primary user data such as surveys or longitudinal impact assessments on visitors. This restricts insights into actual user experiences, accessibility in practice, or the effectiveness of these digital representations in promoting cultural awareness or tourism.

Future studies could expand this work by conducting comparative user studies across both countries, measuring metrics such as immersion, learning outcomes, emotional engagement, and satisfaction in VR/metaverse experiences of UNESCO sites. Incorporating quantitative data from app analytics, eye-tracking in VR, or pre- / post-exposure knowledge tests would strengthen claims about reproducing or mitigating socio-economic asymmetries.

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