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REVIEW

# The metaverse in tension: lines of study and future of the field from the perspective of social sciences

## El metaverso en tensión: líneas de estudio y futuro del campo desde la perspectiva de las ciencias sociales

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## ABSTRACT

This article analyzes the tensions and emerging lines of research surrounding the metaverse from an interdisciplinary perspective of the social sciences. A bibliometric study (2020-2023) in Scopus identified a predominance of research focused on technological infrastructures—extended reality, blockchain, and artificial intelligence—which contrasts with the scant attention paid to ethical, psychosocial, and environmental implications. While educational and economic applications lead global academic production, topics such as privacy, governance, and digital inequalities remain marginal, revealing a gap between innovation and social critique. In contrast to global agendas, the Latin American context—exemplified by Colombia—faces unique challenges: access gaps, rural exclusion, and risks of digital colonialism, which demand public policies adapted to local realities. The study concludes that the metaverse is not a neutral space, but a field of contestation where corporate interests, historical exclusions, and opportunities for social justice converge. The social sciences emerge as key actors in humanizing its development, integrating critical frameworks that prioritize equity, citizen participation, and sustainability.

**Keywords:** Metaverse; Social Sciences; Digital Inequality; Technological Governance; Latin American Context.

## RESUMEN

El artículo analiza las tensiones y líneas de investigación emergentes en torno al metaverso desde una perspectiva interdisciplinar de las ciencias sociales. Mediante un estudio bibliométrico (2020-2023) en Scopus, se identificó un predominio de investigaciones centradas en infraestructuras tecnológicas —realidad extendida, blockchain e inteligencia artificial—, que contrasta con la escasa atención a implicaciones éticas, psicosociales y ambientales. Mientras aplicaciones educativas y económicas lideran la producción académica global, temas como privacidad, gobernanza o desigualdades digitales permanecen marginales, revelando una brecha entre innovación y crítica social. En contraste con agendas globales, el contexto latinoamericano —ejemplificado en Colombia— enfrenta desafíos únicos: brechas de acceso, exclusión rural y riesgos de colonialismo digital, que exigen políticas públicas adaptadas a realidades locales. El estudio concluye que el metaverso no es un espacio neutral, sino un campo de disputa donde convergen intereses corporativos, exclusiones históricas y oportunidades para la justicia social. Las ciencias sociales emergen como actoras clave para humanizar su desarrollo, integrando marcos críticos que prioricen equidad, participación ciudadana y sostenibilidad.

**Palabras clave:** Metaverso; Ciencias Sociales; Desigualdad Digital; Gobernanza Tecnológica; Contexto Latinoamericano.

## INTRODUCTION

The metaverse is emerging as a disruptive phenomenon redefining human-technology interaction and the social, economic, and cultural structures of the 21st century.[1,2] From its conceptualization in science fiction to its current materialization—driven by advances in extended reality, blockchain, and artificial intelligence—this technology has permeated academic debates, public policy, and corporate strategies.[3,4,5,6] However, its rapid evolution contrasts with the lack of critical reflection from the social sciences. This field has historically analyzed how technological innovations transform—and are transformed by—human dynamics.[7]

The background reveals exponential growth in technical studies since 2020, focusing on infrastructure, algorithms, and business models. However, a gap remains in understanding its psychosocial, ethical, and environmental implications. Pioneering research suggests that the metaverse could amplify existing inequalities—from digital divides to data colonialism—while others see it as a tool for democratizing access to education or healthcare.[8,9,10] These contradictions underscore the urgency of addressing the issue from an interdisciplinary perspective, where sociology, critical economics, and social psychology engage in dialogue with engineering.

The current context exacerbates this need: corporations and governments invest billions in metaverse developments without clear regulatory frameworks while citizens navigate enthusiasm and skepticism.[11,12] In addition, events like the pandemic have accelerated the adoption of virtual spaces, normalizing work and educational and recreational practices in immersive environments.[13,14,15] This scenario raises fundamental questions: How are identities reconfigured in a world where the physical and digital are intertwined? What new forms of exclusion or solidarity emerge in these digital ecologies? How can innovation be balanced with sustainability?

This article positions itself at this crossroads of uncertainties. Its relevance lies in systematizing, for the first time, emerging lines of study within the social sciences, identifying theoretical tensions and gaps that demand immediate attention. By mapping how the academic discourse on the metaverse has been constructed—from economics to environmental sociology—we seek to offer a starting point for future research that prioritizes not only the technological "what" but also the social "for whom" and "where to." In a world moving toward permanent hybridization, understanding these dynamics is not optional: it is imperative for designing inclusive futures.

## METHOD

The methodology adopted for this article was structured using a bibliometric approach to identify trends, patterns, and tensions in academic production on the metaverse from the social sciences.[16] The Scopus database was selected for its disciplinary breadth and rigorous indexing. The period analyzed covered the years 2018 to 2023 to capture the rapid growth in publications following the technological and social momentum of the last decade. The search chain prioritized documents whose title, abstract, or keywords included "metaverse," filtering by subject areas related to the social, environmental, economic, business, and art sciences.

For the quantitative analysis, the total volume of annual publications was examined, which made it possible to identify productivity peaks and correlate them with global events, such as the pandemic or advances in artificial intelligence. The distribution of citations was evaluated using percentiles and the h-index, which helped to identify the most influential works and their impact on specific subfields. The primary sources were categorized according to their frequency of appearance and impact factor, highlighting interdisciplinary journals that address technology and society.

On a qualitative level, a keyword co-occurrence analysis was performed using VOSviewer, which revealed emerging thematic clusters, such as sustainability, digital identity, and virtual economy. These clusters were contrasted with a manual review of abstracts and conclusions to identify the dominant lines of research and their interconnections. Transparency was prioritized when selecting documents, excluding duplicates, and verifying the contextual relevance of each study.

The integration of both approaches made it possible to quantify academic output and critically interpret the narratives that define the metaverse today.[17] For example, discussions on ethics and governance coexist with technical proposals, although with less representation in terms of citations. This imbalance reflects a tension between theory and practice, a finding explored in depth in the article. To ensure robustness, the data was triangulated with secondary sources, such as sector reports and recent public policies, enriching the analysis's social perspective.

Finally, specialized software (ATLAS.ti and Excel) was used to visualize collaboration networks between

authors and institutions, identifying geographical and academic hubs that lead research. This process combined automation with human interpretation, ensuring that the results not only described trends but also offered a critical view of the field's future. The methodology seeks to balance technical rigor with contextualized reflection, which is essential for projects that analyze constantly evolving technologies.

## RESULTS

*Review of scientific output*

An analysis of academic output on the metaverse between 2018 and 2023 reveals exponential growth, marked by technological and social milestones that reshaped research interest (figure 1). In 2018 and 2019, the scarce literature (5 and 1 document) reflects a still-nascent concept, mainly associated with speculative or technical-experimental narratives. This period coincides with an exploratory phase, where the term metaverse was linked to niches such as video games or virtual reality without straightforward integration into social science agendas.

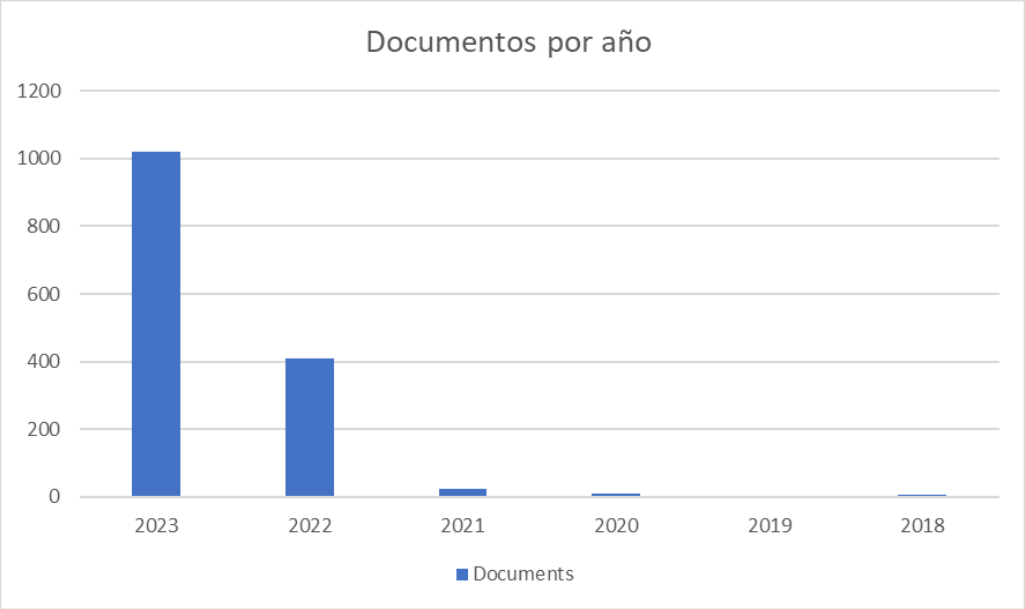


**Figure 1.** Distribution of publications by year

The turning point came in 2020, with a moderate increase to 11 documents. This initial rise could be related to the global impact of the pandemic, which accelerated the adoption of digital environments and reignited debates about virtuality, remote work, and online education. However, it is in 2021 that the trend consolidates (23 documents), coinciding with massive corporate announcements—such as Facebook's renaming to Meta—that brought the metaverse into the public sphere. This year marks the transition from a marginal topic to an interdisciplinary field of study, albeit still fragmented.

The most dramatic quantitative leap is seen in 2022 (408 documents) and 2023 (1021 documents), which show an explosion of academic interest. This growth is not only a response to technical advances, such as improvements in extended reality hardware or blockchain protocols, but also to the urgency to understand critical social implications, from the commodification of data to the redefinition of privacy. The temporal distribution suggests that, after an initial phase of technocentric enthusiasm, the social sciences began to address the phenomenon more systematically, albeit with still scattered approaches.

The upward curve reflects a paradox: while academic output is multiplying, thematic and geographical asymmetries persist. For example, the post-2021 increase could be associated with funding priorities in developed economies or pressure to publish on emerging trends, which could explain a concentration on applied studies (e.g., business models) over theoretical reflections (e.g., digital ethics). Furthermore, the gap between 2022 and 2023 suggests a maturing field where both volume and methodological diversity are growing, incorporating qualitative studies and decolonial critiques.

This landscape underscores the need to articulate analytical frameworks that transcend mere technological description. The acceleration in academic production does not, in itself, guarantee critical depth. On the contrary, it poses risks of fragmentation or repetition of dominant narratives, such as the utopian vision of technology companies. Therefore, data not only quantifies a phenomenon but also challenges academia to prioritize holistic approaches, where the social is not an appendix but the axis of the discussion on the metaverse.

*Distribution of citations and main trends*

The citation analysis reveals a dynamic of academic influence that follows but also intensifies the exponential curve observed in documentary production (figure 2). The data show non-linear growth: while in 2018 and 2019 citations are marginal (n=1 and n=5, respectively), in 2020 and 2021, they increase moderately (n=22 and n=45) before skyrocketing in 2022 (n=1386) and 2023 (n=7742). This pattern reflects two simultaneous phenomena: the late consolidation of the metaverse as a field of study and the cumulative effect of seminal works published in previous years, which become essential references as the topic gains relevance.

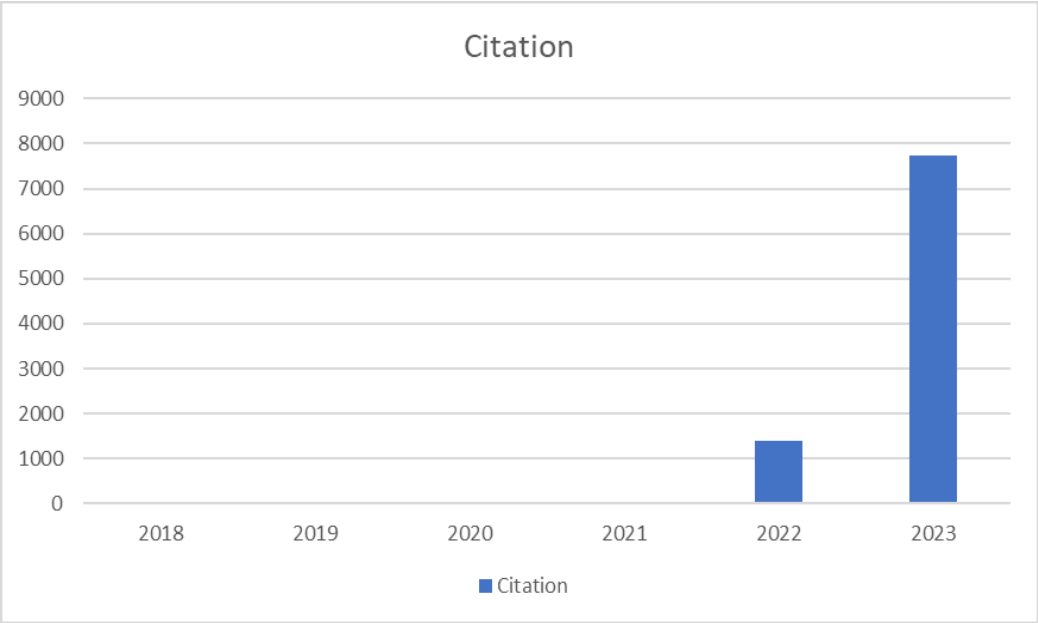


**Figure 2.** Analysis of citation distribution

The stratospheric leap in 2023—with 7,742 citations—indicates an increase in the amount of research and a maturing of intellectual influence networks. The h-index of 79 corroborates this impact: almost 80 documents have been cited at least 79 times, an exceptional value for an emerging field. However, this figure conceals asymmetries. The concentration of citations in the last two years suggests that a minority of studies (possibly technical or linked to commercial applications) are monopolizing attention, while critical or interdisciplinary research—such as that in the social sciences—may be underrepresented.

The temporal distribution also reveals a citation lag typical of booming fields: papers published in 2022–2023 receive citations immediately, fueled by the urgency of a trending topic. In contrast, although foundational, earlier studies (2018–2021) accumulate less retroactive recognition. This raises questions about how academia values originality versus novelty and whether database recommendation algorithms prioritize recent articles over pioneering contributions.

The average of 25,8 citations per document (30 045 citations/1 163 documents) hides a skewed distribution: while some articles exceed 1000 citations—possibly systematic reviews or technological proposals—many others receive little attention. This gap points to a possible thematic homogenization, where specific lines (e.g., business applications of the metaverse) dominate the discourse. At the same time, environmental ethics or digital identity psychology are relegated.

The high citation productivity in 2023 also suggests a risk of academic inflation: the metaverse becomes a catch-all keyword to increase visibility, even in tangential studies. This phenomenon, common in emerging fields, could dilute conceptual rigor. However, the high h-index indicates that, despite the noise, a solid core of research is defining the field.

In summary, citation data measures the academic community's priorities—and biases—. The post-2022 explosion reflects opportunities and challenges: while it facilitates the construction of shared theoretical frameworks, it also threatens to marginalize critical approaches or those less aligned with technocentric narratives. This landscape reinforces the need for studies that, like the present article, question dominant trends and broaden the spectrum of what is researchable.

*Main sources of publication*

An analysis of the leading academic sources reveals a field under construction, marked by tensions between disciplinary interests and the urgency to address the metaverse from multiple angles (table 1). Sustainability Switzerland leads with 45 documents, reflecting a cross-cutting concern for integrating environmental and

social sustainability into the development of immersive environments. This predominance suggests that the metaverse is not analyzed solely as a technological tool but as an ecosystem with material footprints—energy consumption, data mining—that require regulatory and critical frameworks.

**Table 1.** Main sources

| Source | Number of documents |
|---|---|
| sustainability switzerland | 45 |
| journal of metaverse | 33 |
| linguistic and philosophical investigations | 32 |
| review of contemporary philosophy | 26 |
| cyberpsychology behavior and social networking | 17 |
| springer proceedings in business and economics | 16 |
| business of the metaverse how to maintain the human element within this new business reality | 16 |
| handbook of research on consumer behavioral analytics in metaverse and the adoption of a virtual world | 15 |
| Information Technology And Tourism | 14 |
| IEEE Transactions On Learning Technologies | 14 |

Specialized sources such as Journal of Metaverse (33 documents) and Cyberpsychology, Behavior and Social Networking (17) reveal a dual approach: on the one hand, the consolidation of a technical niche focused on protocols and usability; on the other, growing attention to psychosocial phenomena, such as the construction of digital identities or addiction to virtual environments. However, the presence of journals such as Linguistic and Philosophical Investigations (32) and Review of Contemporary Philosophy (26) introduces a humanistic layer often absent from technological debates. These works explore, for example, how the metaverse redefines concepts such as "presence," "authenticity," and "agency," which are key issues for the social sciences.

The strong representation of business sources—Springer Proceedings in Business and Economics (16) and the book Business of the Metaverse... (16)—underscores a pragmatic bias: much of the literature prioritizes monetization, immersive marketing, or talent management models in virtual environments. This emphasis contrasts with the scarcity of critical studies on labor inequalities or data exploitation on these platforms. However, the manual Consumer Behavioral Analytics in Metaverse (15) attempts to balance this trend by linking big data analysis with consumer ethics, albeit from a still instrumental perspective.

Journals with lower output—Information Technology and Tourism (14) and IEEE Transactions on Learning Technologies (14)—point to emerging applications in specific sectors, such as virtual tourism and hybrid education. These numbers, although modest, are significant: they indicate that the metaverse is beginning to permeate areas traditionally anchored in the physical world, requiring a rethinking of notions such as "experience" and "meaningful learning."

The distribution of sources confirms a paradox: the field is expanding in fragmented directions, with little dialogue between disciplines. While Sustainability Switzerland engages with global policies, philosophical sources question epistemologies, and business studies normalize the commodification of virtual space. This lack of cohesion is not a void but a symptom of how the metaverse mirrors the contradictions of the digital age. The scarcity of journals focused on social justice or equity—absent from the top 10—reinforces the need to articulate research agendas that challenge the frameworks imposed by corporate or technical actors.

*Keyword analysis*

Keyword analysis identified a diverse field of study where technological advances, practical applications, and questions from the social sciences converge (figure 3). The data showed that immersive technologies, such as virtual reality (n=335) and augmented reality (n=127), constitute the backbone of the metaverse because of their frequency and their interconnection with other concepts. Together with blockchain (n=90) and artificial intelligence (n=71), these tools define a digital ecosystem dependent on decentralized protocols and complex algorithms necessary to create virtual economies and personalized experiences. However, this technical infrastructure contrasts with the lack of attention to ethical or environmental issues, an imbalance explored further below.

Education emerged as a priority in the applied field, with terms such as e-learning (n=68) and students (n=46) reflecting a commitment to democratizing access to knowledge through immersive environments. On the other hand, sectors such as health—represented by healthcare (n=10) and mental health (n=13)—showed incipient but still marginal progress. It is striking that while marketing (n=26) and NFT (n=28) stand out as

pillars of the digital economy, concepts such as sustainability (32) appear as critical counterpoints, although without the depth necessary to question extractive models.

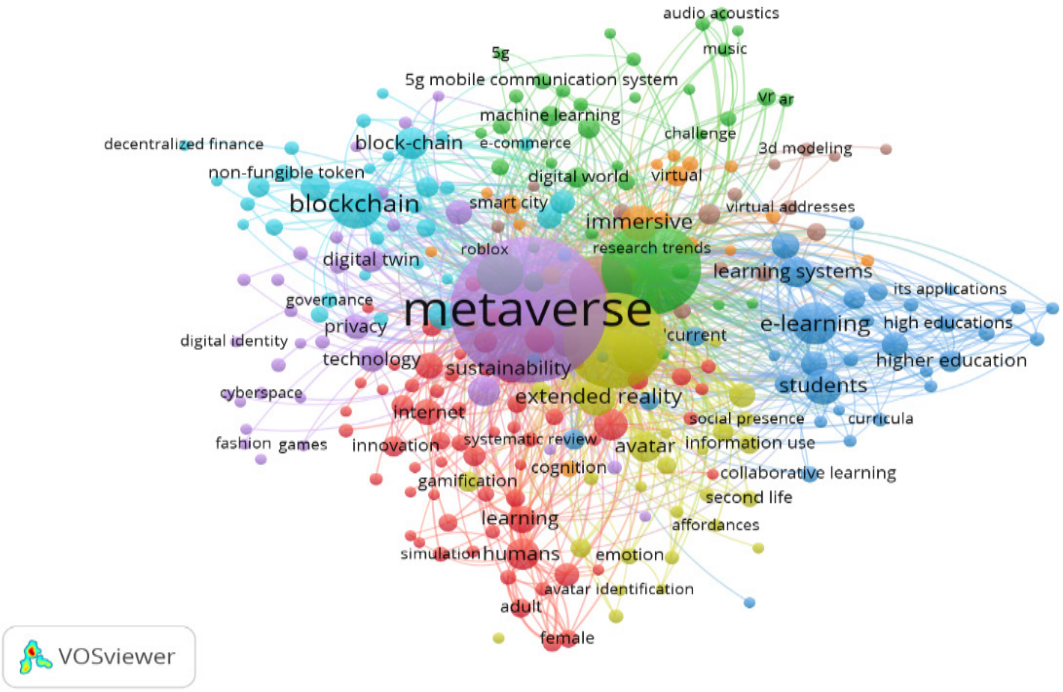


**Figure 3.** Co-occurrence of keywords

One of the most relevant findings was the technical and social gap. Although privacy (n=23) and data privacy (n=8) are mentioned, their low frequency suggests that crucial debates—such as mass surveillance or data ownership—remain in the background. Worse still, terms such as social interactions (n=5) or identity (n=5) are almost non-existent, revealing a gap in the study of psychosocial impacts. This omission is worrying, as the metaverse replicates physical spaces and redefines notions of community, belonging, and individual agency.

Methodologically, quantitative approaches predominated, with tools such as bibliometric analysis (n=15) or VOSviewer (n=6) used to map trends. While this allows patterns to be visualized, the absence of qualitative methods—such as digital ethnographies—limits the understanding of complex phenomena, from algorithmic discrimination to the construction of hybrid identities. In addition, systematic reviews such as literature reviews (n=11) prioritized descriptive syntheses, with little space for critical theoretical frameworks, such as decolonial or gender studies.

Contradictions emerged when contrasting concepts. For example, blockchain (n=90), a technology with high energy costs, coexists with sustainability (n=32), a term that criticizes precisely those impacts. This unresolved tension reflects a dominant narrative: corporate influence, visible in mentions of Facebook (n=10) or Meta (n=7), prioritizing innovation over responsibility. Meanwhile, ethics (n=16) or governance (n=9) lack the centrality necessary to balance the discourse.

In short, the keywords paint a picture where the technical overshadows the human. The data expose trends and challenge academia: there is an urgent need to integrate critical perspectives that explore how the metaverse reproduces inequalities or, conversely, opens paths toward equity. Technology is advancing, but without deep reflection on its social implications, the risk of perpetuating exclusions—or creating new ones—becomes tangible. The challenge is not to master tools but to ensure they serve a more just future.

*Main lines of research and their interconnections ´*

The study of the dominant lines of research on the metaverse reveals three interrelated axes that, although distinct, are organically intertwined. The first focuses on technological infrastructure, where developments such as virtual reality, artificial intelligence, and blockchain protocols stand out.[18,19,20] These do not function in isolation: the integration of digital twins (n=24) with the internet of things (n=24) suggests efforts to replicate physical systems in virtual environments, while machine learning (n=17) and computer vision (n=6) point to algorithms that optimize human-machine interaction.[21,22] This line, although technical, supports practical applications in sectors such as engineering and logistics, where precision and automation are priorities.

A second axis revolves around transforming traditional sectors, particularly education and the economy.[23,24,25] In education, terms such as immersive learning (n=15) and collaborative learning (n=10) reveal a commitment to active pedagogies, where immersion simulates environments and redefines participation

dynamics.[26,27,28] At the same time, the digital economy relies on NFTs(28) and smart contracts (n=5) to create virtual markets, albeit with an approach that prioritizes innovation over-regulation.[29,30,31] Here, the interconnections are apparent: tools such as blockchain (n=90) facilitate secure transactions in the metaverse but also raise unresolved dilemmas, such as the environmental footprint or the concentration of power in centralized platforms.[32]

The third axis, less developed but emerging, addresses psychosocial and environmental impacts.[33,34] Concepts such as sustainability (n=32) and ethics (n=16) appear as critical counterweights to the technocentric narrative, although their integration with other lines is incipient.[23,35] For example, while augmented reality (n=127) is linked to business applications, few studies explore how its mass adoption affects the perception of public space or mental health.[36,37] This disconnect reflects a structural tension: the social sciences analyze consequences but do not always engage in dialogue with those who design the technology.

The interconnections between these axes are both collaborative and conflictual. Technological infrastructure enables educational and economic applications but also generates externalities—such as access gaps or surveillance risks—that demand more robust ethical frameworks.[38,39,40] In turn, the commodification of virtual spaces (e-commerce, marketing) depends on advances in AI (n=71) and big data (n=10) but rarely questions who controls this data or how its benefits are distributed.[41] Even in education, where the metaverse promises inclusion, terms such as digital divide (absent) reveal a worrying omission: without equitable access, the democratization of knowledge remains an empty promise.[42]

Finally, a fourth cross-cutting theme emerges: the governance of the metaverse.[43] Although terms such as governance (n=9) and data privacy (n=8) are in the minority, their presence signals an emerging recognition that technology requires regulation.[44] However, the limited interaction between this theme and the previous ones—for example, few studies link blockchain with citizen participation mechanisms—limits its impact. In a field dominated by technical and commercial considerations, the question of who defines the rules of the metaverse and for what purposes remains unanswered.

Together, these lines define the current state of research and the project's possible future. The most urgent interconnection is not in algorithms but in building bridges between disciplines: engineers collaborating with sociologists or economists dialoguing with environmentalists. Only then will the metaverse cease to be a set of tools and become a collective project.

## DISCUSSION

The discussion about research trends in the metaverse reveals a global paradox: while its technical development is advancing exponentially, social and critical understanding remains fragmented, especially in regions such as Latin America.[45,46] At the international level, the hegemony of studies focused on technological infrastructure—extended reality, blockchain, AI—reflects a narrative driven by corporations and global innovation centers.[4] This approach, while valuable, tends to naturalize the metaverse as a neutral space, ignoring how its technical designs reproduce power dynamics, from data concentration to the exclusion of unconnected communities.[47] In contrast, countries such as Colombia face structural challenges—the digital divide, educational inequality, and limited broadband access—that condition their participation in this revolution.[48,49,50] While the world debates NFTs or digital twins, basic questions persist in the local context: How can we prevent the metaverse from deepening the marginalization of rural areas? What public policies could ensure a just transition to hybrid environments?

The global emphasis on educational and economic applications of the metaverse finds a distorted mirror in Colombia. Although the country has made progress in initiatives such as e-learning and digital government platforms, there remains a disconnect between technological promises and social realities.[51,52,53] For example, Colombian universities' pilot projects explore immersive virtual classrooms, but these efforts are hampered by limitations such as a lack of accessible devices and insufficient teacher training. Furthermore, while international literature analyzes the monetization of digital assets (NFTs, smart contracts), debates are emerging in Colombia about how these tools could be applied to strategic sectors—such as agriculture or tourism—without replicating extractive models that have historically affected vulnerable communities.[54]

In the psychosocial sphere, the contrast is even more striking. While global studies mention terms such as ethics and sustainability in passing, there is a growing need to investigate specific cultural impacts in Colombia. How can local identities—indigenous, Afro-descendant—be integrated into a metaverse designed according to globalized parameters? How do dynamics of structural violence, such as forced displacement, translate into digital environments? Absent from the dominant literature, these questions are central to a region where technology cannot be separated from historical memory or social justice.

The governance of the metaverse illustrates another gap. Underrepresenting terms such as governance (9) and data privacy (8) suggest that regulation remains reactive rather than preventive globally. Although regulatory frameworks exist in Colombia, their application to the metaverse is in its infancy. Unique dilemmas arise: how can the intellectual property of artisans who digitize their works on platforms controlled by foreign companies be protected? What mechanisms for citizen participation could ensure that the metaverse is not

a space for digital colonization? These questions require adapting regulations and rethinking the relationship between technology and sovereignty.

Finally, the metaverse presents a crossroads for the social sciences in Colombia. On the one hand, there is a risk of uncritically adopting global research agendas focused on technology. On the other hand, there is an opportunity to lead contextualized approaches, where technology is understood as a means—not an end—to address historical problems such as inequality, peace, and environmental sustainability. The challenge is no small: to build a metaverse that engages with the roots and aspirations of a diverse society in reconstruction instead of importing models.

## CONCLUSIONS

The technical infrastructure of the metaverse is advancing faster than critical reflection on it. The data shows a hegemony of studies focused on technological developments (extended reality, blockchain, AI), while issues such as ethics, governance, and psychosocial impacts occupy a marginal place. This asymmetry reflects global priorities driven by corporate actors and warns of the risks of replicating inequalities in digital environments. There is an urgent need to integrate interdisciplinary frameworks where the social sciences engage with engineering, not as observers, but as co-designers of inclusive futures.

The metaverse is not a neutral phenomenon: its adoption requires geopolitical and cultural contextualization. While the global discourse prioritizes commercial or educational applications, regions such as Colombia face unique challenges: digital divides, rural exclusion, and legacies of inequality. This demands public policies that transcend the mere importation of technologies and adapt them to local realities. For example, pilot projects in education or tourism must be linked to historical repair agendas, ensuring that marginalized communities are not left out of the digital revolution.

The social sciences have a pivotal role in humanizing the metaverse. Beyond describing trends, they must problematize dominant narratives and question who controls—and benefits from—these spaces. In Colombia, this means investigating how the metaverse can amplify or mitigate structural conflicts, from land concentration to cultural appropriation. The goal is not to compete with technical innovations but to ensure that they serve collective justice, memory, and sustainability projects. Only then will the metaverse cease to be an abstract promise and become a territory of equitable opportunities.

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## CONFLICT OF INTEREST

None.

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