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EXPLORING THE SOCIAL AND ECONOMIC CONSEQUENCES OF THE METAVERSE: A MULTI-CRITERIA APPROACH TO THE SDGs

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Abstract. This study explores the social implications of the Metaverse, a transformative digital ecosystem, through the lens of the United Nations Sustainable Development Goals (SDGs). The research identifies fourteen key concerns associated with the adoption of Metaverse technologies and assesses their societal impact. A two-stage methodology was employed: an expert panel utilized Grey Step-wise Weight Assessment Ratio Analysis (SWARA) and Grey Combined Compromise Solution (CoCoSo) to assign relative weights and to rank these concerns, reflecting their significance in societal contexts. Following this, an international survey was conducted to quantitatively gauge public perspectives across diverse demographics. Key findings highlight substantial psychological impacts linked to immersive experiences, such as addiction and mental health challenges, which pose a threat to SDG 3 (Good Health and Well-being). The environmental sustainability of Metaverse technologies is also critically examined, stressing the urgent need for green practices to mitigate carbon emissions and reduce energy consumption. Furthermore, ethical issues, particularly surrounding data privacy and user consent, are discussed, emphasizing the importance of robust regulatory frameworks to ensure safe and equitable user experiences. The study reveals the Metaverse's potential to both foster global connectivity and exacerbate existing social inequalities, advocating for balanced, inclusive approaches to ensure equitable access. By integrating expert insights with broad public opinions, this research provides a comprehensive analysis of the complex relationship between digital technology and societal well-being, offering a foundation for future exploration of the responsible evolution of the Metaverse.

Keywords: Metaverse social impact, SDGs, virtual environment governance, technological equity, MCDM, grey SWARA, grey CoCoSo, social concerns.

JEL Classification: C44, O33, Q01, D81, Z13.

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1. Introduction

The Metaverse is going to be a game-changer for Augmented Reality (AR), Virtual Reality (VR), and digital, as it is going to be a final combination of all that, bringing a shared 3D virtual space for all users to be able to interact, create, and participate in shared digital reality. The term, popularized by writer (Stephenson,1992) in his science fiction novel "Snow Crash", has come a long way, and the development of technologies like high-speed internet and more powerful computing helped it become widely adopted. Much money is now invested

This article was originally published with error. This version has been amended. Please see Corrigendum https://doi.org/10.3846/tede.2025.25284 by some of the largest corporations in the world in Metaverse development due to a belief that this vision of future development could redefine the contours of daily life, such as work, education, and entertainment (Allam et al., 2022). Metaverse has been criticized by many to be an "unfulfilled promise", meaning the hype is higher than the current state of technology and users (Allam et al., 2022).

The Metaverse is full of social consequences of all sorts be they opportunities or threats. On the flip side of the coin, the Metaverse bridges the world together, strengthens remote teamwork, and provides immersive learning spaces (Zaky & Gameil, 2024). It enables new economic activity, from virtual real estate and immersive advertising to digital services, revolutionizing established business models and industries (Allam et al., 2022). However, the potential downsides cannot be easily dismissed. Various issues of concern, such as addiction, mental health disorders resulting from increased screen time, increasing inequalities as new technology becomes a requirement of engagement, and ethical discussions around data collection and representation in these virtual spaces, have been raised by (Wani, 2023). In the longer term, the real economy is profoundly impacted over time as the Metaverse grows as a platform and its applications seep into sectors like education, entertainment, city planning, etc., leading to a trickle-down effect.

At this point, especially with the accelerating Metaverse adoption, it is vital to comprehend social issues around it. Discussions regarding the Metaverse tend to be dominated by the technological capabilities, as well as market value (of the nearest decade), simply ignoring the essential need for an exhaustive overview of potential social impact (Addai et al., 2024). This study attempts to fill such a gap by systematic identification and prioritization of the social issues that will arise as the Metaverse continues to infiltrate societies worldwide. this study is guided by the following central research question: What are the main social implications of the emerging Metaverse, and how do they relate to United Nations Sustainable Development Goals (SDGs)? Given this context, the study serves as an important contribution to the understanding of the implications of sustainable digital transformation, shedding light on how the ins and outs of this evolving digital challenge can be leveraged to benefit the interests of policymakers, technologists, and educators (Scaini et al., 2021).

Thus, this study specifically aims at three goals: First, To detect and rank the related social concerns regarding Metaverse adoption; Second, To investigate those concerns through the lens of the SDGs to decipher their consequences in line with SDG; and Third, it is important to offer actionable insights for stakeholders in order to manage these issues.

This research chooses specific sustainable development goals (SDGs) for this analysis, highlighting the most relevant areas: 1. SDG 3 (Good Health and Well-being), 2. SDG 10 (Reduced Inequalities), 3. SDG 12 (Responsible Consumption and Production), and 4. SDG 16 (Peace, Justice, and Strong Institutions).

Considering that it is expected that digital engagement is only to experience growth in times to come (Mokhtar et al., 2020), this study attempts to answer the question: How can the socio-economic effects of the Metaverse be critically and closely observed and improved upon based on the expected scale of existing inequities from an approach to the digital environment? It is not an exhaustive investigation about every relevant SDG to the Metaverse, but a closer examination of the four that most clearly reflect the major social challenges of the Metaverse.

Firstly the paper introduces the metaverse and the United Nations Sustainable Development Goals. Section 2 provides a comprehensive literature review, examining the intersection of Metaverse technology with sustainable development goals. Section 3 outlines the methodology, detailing the two-stage approach using expert panel assessment and international survey, and explains the selection of four specific SDGs as decision criteria. Section 4 data analysis, identifying and ranking 14 key social concerns related to Metaverse implementation. Section 5 presents the results, discusses the findings, and analyzes the implications for each selected SDG. Section 6 offers management insights and practical recommendations. Finally, Section 7 concludes the study, summarizing key points and suggesting directions for future research.

2. Literature review

The Metaverse is defined as a collective virtual shared space, created by the convergence of virtually enhanced physical reality and persistent virtual reality Allam et al. (2022). It encompasses notable technologies such as Virtual Reality (VR), Augmented Reality (AR), and various digital economies, facilitating immersive spaces where users can interact, engage, and create. As conceptualized, the Metaverse is more than just a technological advancement; it is envisioned as a virtual environment where physical rules can be transcended, allowing enhanced social interactions and economic opportunities (Zaky & Gameil, 2024).

In both academic and industrial circles, the Metaverse is regarded with enthusiasm and skepticism. While proponents advocate for its potential to revolutionize sectors such as gaming, real estate, and education, critics point to the current lack of practical applications that demonstrably enhance business relevance (Wani, 2023). Numerous studies highlight that, despite the considerable investment in Metaverse technology, significant business cases remain few and often limited in scope. For instance, Cratsley and Mackey (2018) observed that while applications in tourism and cultural heritage differ, they often echo traditional means of engagement rather than exploit the Metaverse's full capabilities. Additionally, Go and Kang suggested that enhancing digital tourism could provide revenue while reducing environmental degradation, indicating some promising applications (Go & Kang, 2022). However, it is crucial to recognize that many of the existing applications lack scalability and comprehensive integration with core business processes.

Emerging research increasingly correlates the implications of the Metaverse with the United Nations Sustainable Development Goals (SDGs). Literature reviews have revealed that while the Metaverse holds transformative potential in promoting sustainability, enhancing education, and fostering global connections these benefits need to be matched with rigorous frameworks that evaluate their societal impact (Vlăduţescu & Stănescu, 2023). Previous studies have examined various intersections of technology and sustainability, highlighting the potential of digital spaces to create opportunities for social inclusion, economic growth, and environmental sustainability (Vlăduţescu & Stănescu, 2023). However, current research predominantly focuses on social and economic impacts while often abstracting environmental concerns. Wani (2023) emphasizes that mental health, impacted by usage patterns within digital environments, can directly impede progress toward SDG 3 (Good Health and Well-being) (Cratsley & Mackey, 2018). Moreover, studies indicate that the social inequities exacerbated by unequal access to Metaverse technologies may detract from achieving SDG 10 (Reduced

Inequalities) (Cratsley & Mackey, 2018). This demonstrates the necessity for a balanced view of both the opportunities and challenges presented by the Metaverse.

The social implications of the Metaverse are profound and multifaceted, encompassing various psychological, societal, and ethical challenges.

1. Psychological impacts: Concerns around addiction and the potential exacerbation of mental health issues due to immersive experiences are significant. Research indicates that excessive engagement in virtual environments can lead to negative psychological outcomes such as anxiety and depression (Addai et al., 2024); And contribute to the phenomenon of digital dependency, mirroring addiction models seen in other contexts (Cratsley & Mackey, 2018).
2. Social behavioral changes: As users increasingly opt for virtual interactions over real-world ones, this can lead to social isolation, affecting community cohesion and diminishing face-to-face relationships (Go & Kang, 2022). On the flip side, the Metaverse could enhance social support mechanisms, providing platforms for marginalized communities to connect.
3. Ethical concerns: Privacy issues, data exploitation, and the potential for harassment within virtual environments present considerable ethical quandaries. The immersive nature of the Metaverse complicates consent and data ownership principles, raising critical questions about user rights and accountability (Vlăduţescu & Stănescu, 2023).
4. Environmental impact: The energy demands associated with the infrastructure of the Metaverse also pose sustainability challenges, particularly as the technology scales. Studies have outlined concerns surrounding the carbon footprint generated by extensive computing resources necessary for VR operations, calling for strategies to mitigate these impacts (Vlăduţescu & Stănescu, 2023).

Prior research methodologies employed to assess the societal impacts of virtual environments have varied widely, reflecting the complex nature of digital interactions. Common approaches include qualitative assessments focused on case studies revealing individual experiences within the Metaverse and quantitative methods analyzing data across larger populations (Mokhtar et al., 2020; Wani, 2023). These methodologies, while illuminating, can often be limited by context and scale.

In considering alternatives for our own research, we employed the Grey SWARA and Grey CoCoSo methods due to their robustness in handling uncertainty and facilitating Multi-Criteria Decision-making (MCDM) (Wani, 2023). These methods allow for the incorporation of subjective expert judgments alongside quantitative data, providing a nuanced perspective on the social concerns linked to the Metaverse and aligning them with relevant SDGs. Other MCDM techniques, such as the Analytic Hierarchy Process (AHP) or the Technique for Order of Preference by Similarity to Ideal Solution (TOPSIS), could also be considered; however, they may not adequately address the complexities associated with emerging technologies like the Metaverse (Vlăduţescu & Stănescu, 2023).

In conclusion, the literature presents a compelling case for the need to rigorously analyze the implications of the Metaverse while emphasizing its intersection with the SDGs. Addressing social concerns that arise from its implementation is critical for ensuring that the technology fulfills its potential to serve society sustainably and equitably. A complete list of societal aspects of metaverse emersion is analyzed in Table 1.

Table 1. Metaverse societal concern and its dimensions (source: authors' own elaboration)

No.	Societal aspects	Dimensions	References
1	Psychological and behavioral effects	▪ Corporation control and subliminal manipulation: potential for metaverse environments to influence user behavior and cause cognitive dissonance. ▪ Metaverse addiction: immersive nature may lead to a preference for the virtual over the real world, increasing susceptibility to manipulative messaging. ▪ Mental health effects: risks of exacerbating mental health issues through phenomena like self-enhancement and proteus effects.	Bojic (2022), Henz (2022), Usmani et al. (2022), Walther (2024)
2	Social interaction and withdrawal	▪ Escapism and substitution of real life: potential for the metaverse to become a substitute for real-life experiences, leading to social withdrawal. ▪ Hikikomori effect: extreme social withdrawal due to addiction to the metaverse. ▪ Embedded social presence effects: virtual experiences impacting real-world actions and emotional states. ▪ Social psychopathology due to autism spectrum disorder: ensuring virtual interventions for ASD are effective and maintain patient engagement.	Bojic (2022), Combe et al. (2024), Lee et al. (2022), Usmani et al. (2022), Zhang et al. (2022)
3	Social support and self-efficacy	▪ Enhanced supportive interactions and social self-efficacy: Need to protect users from toxic environments and promote empathy and support in the metaverse.	Oh et al. (2023), Thakral et al. (2023)
4	Influence on attitudes and behaviors	▪ Impact on real-world attitudes and behaviors: strong identification with avatars influencing real-world attitudes and behaviors.	Lu and Mintz (2023)
5	Access and equity	▪ Accessibility and socioeconomic disparities: Ensuring equitable access to metaverse technologies to prevent exacerbation of disparities.	Benosman (2023), Radanliev et al. (2024)
6	Ownership and privacy	▪ Private ownership and management: privacy concerns are due to the commodification of virtual space and user data.	Canny (2022)
7	Abuse and harassment	▪ Sexual and racial abuse: inadequate recourse and oversight leading to harassment and abuse in the metaverse.	Bokinni (2022), Lanigan (2024)
8	Power Concentration and regulation	▪ Concentration of power: risk of monopolization by few companies, reducing diversity and choice. ▪ Policy and regulation: need for policy principles to guide metaverse development and serve the public interest.	Mosco (2004, 2023), Owen (2022), Yong (2022)
9	Environmental impact	▪ Climate change: increased energy consumption and carbon emissions from metaverse operations.	Ezra (2021)
10	Legal complexities	▪ Law and jurisdiction: Challenges of enforcing laws and ensuring consumer protections in the metaverse.	Bardawil (2021), Lanigan (2024)
11	Ethical and societal concerns	▪ Inequality and bias: risk that biases and inequalities could persist in the metaverse. ▪ Identity and authenticity: challenges in maintaining authenticity and the essence of one's identity with the transition to virtual identities.	Cheng et al. (2022), Macionis and Plummer (2005), Seigneur and Choukou (2022)

End of Table 1

No.	Societal aspects	Dimensions	References
12	Digital literacy and participation	▪ Digital divide: risk of exacerbating disparities due to unequal access to technology and skills.	Hollensen et al. (2023)
13	Data security	▪ Privacy and security: concerns regarding data breaches, identity theft, and surveillance.	Wang et al. (2022)
14	Ethics and representation	▪ Ethical concerns: consent, ownership, and manipulation related to digital representations and avatars.	Bibri (2022), Dincelli and Yayla (2022), Mou et al. (2024)

3. Methodology

3.1. Decision criteria

Beyond the analysis of the social challenges of the metaverse, taking into account the environmental, economic, and social performance, as well as the governance and business strategies most likely to be affected, the sustainability of the metaverse cannot be analyzed without ranking this challenge. It should be completed according to the SDGs, according to its impact. The SDGs actually summarize 17 goals to achieve a sustainable future and world for all as shown in Table . These goals were set by the United Nations General Assembly (UNGA) in September 2015 after an extensive process of consultation and negotiation (De Giovanni, 2023). Given that the SDGs have a 2030 deadline, progress towards their achievement by the United Nations through various indicators and reporting mechanisms, including sustainability from micro-scale analysis (e.g., energy consumption) to Macro scale analysis (e.g., world hunger), is monitored. SDGs are more likely to be directed at countries because some global challenges, such as gender equality, climate change, justice, and peace, can be addressed and managed at a very high level in society. However, companies, institutions, individuals, and stakeholders, in general, can use the SDGs to demonstrate their contribution globally.

Table 2. The 17 sustainable development goals of the "2030 Agenda" (source: United Nations, 2015)

SDG 1: No Poverty	SDG 10: Reduced Inequalities
SDG 2: Zero Hunger	SDG 11: Sustainable Cities and Communities
SDG 3: Good Health and Well-Being	SDG 12: Responsible Consumption and Production
SDG 4: Quality Education	SDG 13: Climate Action
SDG 5: Gender Equality	SDG 14: Life Below Water
SDG 6: Clean Water and Sanitation	SDG 15: Life on Land
SDG 7: Affordable and Clean Energy	SDG 16: Peace, Justice and Strong Institutions
SDG 8: Decent Work and Economic Growth	SDG 17: Partnerships for the Goals
SDG 9: Industry, Innovation and Infrastructure	–

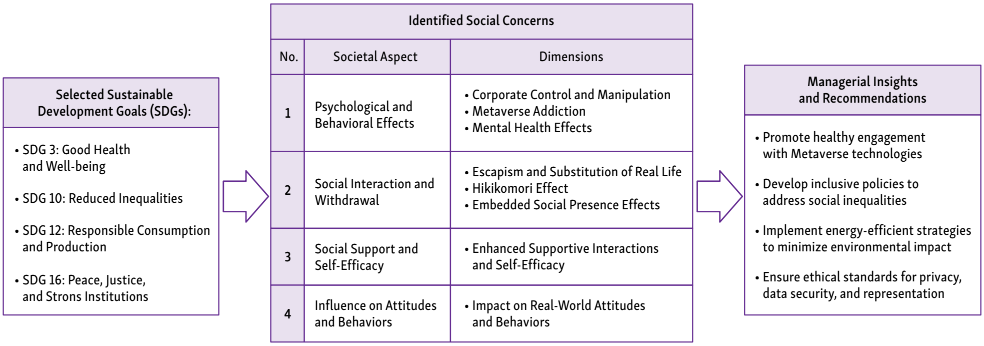

Figure 1. The logic of selected criteria (source: authors' own elaboration)

This selection criterion is consistent with the principle of significance in sustainability research and focuses on aspects likely to have significant economic, environmental, and social impacts in the context of the Metaverse. It also allows for a more detailed exploration of the interrelationships between these goals and the identified social concerns of Metaverse adoption, it's summarized and visualized in Figure 1.

3.2. Grey SWARA

Grey SWARA is an adaptation of grey theory (Garg, 2021) to the Step-wise Weight Assessment Ratio Analysis (SWARA) method (Keršulienė et al., 2010). The process of Grey SWARA follows the steps outlined by (Cao et al., 2019).

Initially, experts rank the criteria from most important to least important.

$$j: \text{ criterion}, j = 1,2,3,\ldots n,$$
$$d: \text{decision maker}, d = 1,2,3,\ldots D,$$
$$\begin{cases} j = 1 \Rightarrow \text{ the most important criterion} \\ j = n \Rightarrow \text{ the least important criterion} \end{cases}.$$

Next, the experts determine the grey comparative importance values.

$\overline{s}_{jd}$: upper limit of grey evaluation according to decision maker d criterion j,

$\underline{s}_{jd}$: lower limit of grey evaluation according to decision maker d criterion j.

After gathering the evaluations from the experts, the Grey SWARA method proceeds with mathematical computations. The first step is to derive the grey comparative coefficients using Eqs. (1)–(2).

$\overline{k}_{Jd}$: upper limit of grey comparative coefficient,

$\underline{k}_{jd}$: lower limit of grey comparative coefficient,

$$\begin{cases} j = 1 \Rightarrow \underline{k}_{jd} = 1 \\ j > 1 \Rightarrow \underline{k}_{jd} = 1 + \underline{s}_{jd} \end{cases}; \tag{1}$$

$$\begin{cases} j = 1 \Rightarrow \overline{k}_{jd} = 1 \\ j > 1 \Rightarrow \overline{k}_{jd} = 1 + \overline{s}_{jd} \end{cases}. \tag{2}$$

The following step involves determining the grey unscaled weights of the criteria using Eqs. (3)–(4).

$\overline{q_{jd}}$: upper limit of grey unscaled weight,

$\underline{q_{jd}}$: lower limit of grey unscaled weight,

$$\begin{cases} j=1 \Rightarrow \underline{q_{jd}}=1 \\ j>1 \Rightarrow \underline{q_{jd}}=\dfrac{\underline{q_{(j-1)d}}}{\overline{k_{jd}}}; \end{cases} \tag{3}$$

$$\begin{cases} j=1 \Rightarrow \overline{q_{jd}}=1 \\ j>1 \Rightarrow \overline{q_{jd}}=\dfrac{\overline{q_{(j-1)d}}}{\underline{k_{jd}}}. \end{cases} \tag{4}$$

Grey scaled weights are then computed using Eqs. (5)–(6).

$\overline{w_{jd}}$: upper limit of grey scaled weight,

$\underline{w_{jd}}$: lower limit of grey scaled weight,

$$\underline{w_{jd}}=\frac{\underline{q_{jd}}}{\sum_{j=1}^{n}\overline{q_{jd}}}; \tag{5}$$

$$\overline{w_{jd}}=\frac{\overline{q_{jd}}}{\sum_{j=1}^{n}\underline{q_{jd}}}. \tag{6}$$

The scaled weights are determined using Eq. (7).

w_{jd}: scaled weight of criterion j according to expert d,

$$w_{jd}=\frac{\underline{w_{jd}}\,\overline{w_{jd}}}{\sum_{j=1}^{n}\left[\underline{w_{jd}}+\overline{w_{jd}}\right]}. \tag{7}$$

Finally, the decision makers' opinions are integrated using Eq. (8).

w_j: integrated scaled weight of criterion j,

$$w_j=\frac{\sum_{d=1}^{D}w_{jd}}{D}. \tag{8}$$

3.3. Grey CoCoSo

The Grey Combined Compromise Solution (Grey CoCoSo) method represents an advanced multi-criteria decision-making (MCDM) technique that integrates the Grey Systems Theory with the CoCoSo model. This methodological framework is particularly useful in addressing decision-making scenarios characterized by incomplete or uncertain information. Originally introduced by Deng in the early 1980s, Grey Systems Theory facilitates the extraction of meaningful insights from limited data, thereby enabling effective decision-making under conditions of ambiguity (Badi & Pamucar, 2020).

The CoCoSo model, developed by Yazdani et al. (2019a), merges two widely recognized decision-making approaches: the Simple Additive Weighting (SAW) method and the Exponentially Weighted Product Model (EWPM). The integration of these techniques within the grey framework enhances decision reliability by accommodating uncertainty and incorporating comprehensive comparative evaluations (Yazdani et al., 2019b).

The Grey CoCoSo model follows a structured sequence of steps designed to facilitate systematic decision-making. Elmansouri et al. (2022) presented the methodological approach as follows:

Step 1. Selecting a set of key attributes that describe the alternatives.

Step 2. Determining the attribute weights: The weight of attribute W_j can be calculated as follows:

$$\otimes W_j = \frac{1}{K}\left[\otimes W_j^1 + \otimes W_j^2 + \cdots + \otimes W_j^K\right],$$

$$\otimes W_j^K = \left[\underline{W_j^K}, \overline{W_j^K}\right]. \tag{9}$$

Step 3. The alternatives are evaluated by the decision makers: decision makers use linguistic or verbal variables when assessing alternatives based on various criteria. $\otimes G_{ij}^K\left(i = 1,2,\ldots,m,\ j = 1,2,\ldots,n\right)$ represents the attribute value assigned by the kth decision maker to any attribute value of the alternative. In the grey system, this value is represented as $\otimes G_{ij}^K = \left[\underline{G}_{ij}^K, \overline{G}_{ij}^K\right]$ and is computed as follows:

$$\otimes G_j = \frac{1}{K}\left[\otimes G_j^1 + \otimes G_j^2 + \cdots + \otimes G_j^K\right]. \tag{10}$$

Step 4. The construction of Grey Decision Matrix:

$$G = \begin{bmatrix} \otimes G_{11} & \otimes G_{12} & \cdots & \cdots & \otimes G_{1n} \\ \otimes G_{21} & \otimes G_{22} & \cdots & \cdots & \otimes G_{2n} \\ \cdots & \cdots & \cdots & \cdots & \cdots \\ \cdots & \cdots & \cdots & \cdots & \\ \otimes G_{m1} & \otimes G_{m2} & \cdots & \cdots & \otimes G_{mn} \end{bmatrix}. \tag{11}$$

Step 5. The normalization of Decision Matrix:

$$D^* = \begin{bmatrix} \otimes G_{11}^* & \otimes G_{12}^* & \cdots & \cdots & \otimes G_{1n}^* \\ \otimes G_{21}^* & \otimes G_{22}^* & \cdots & \cdots & \otimes G_{2n}^* \\ \cdots & \cdots & \cdots & \cdots & \cdots \\ \cdots & \cdots & \cdots & \cdots & \\ \otimes G_{m1}^* & \otimes G_{m2}^* & \cdots & \cdots & \otimes G_{mn}^* \end{bmatrix}. \tag{12}$$

For a benefit attribute $\otimes G_{ij}^*$ is expressed as:

$$\otimes G_{ij}^* = \left[\frac{\underline{G}_{ij}}{G_j^{\max}}, \frac{\overline{G}_{ij}}{G_j^{\max}}\right]. \tag{13}$$

where, $G_j^{max} = \max_{1<i<m}\left\{\bar{G}_{ij}\right\}$ and for a cost attribute $\otimes G_{ij}^*$ is expressed as

$$\otimes G_{ij}^* = \left[\frac{G_j^{min}}{\bar{G}_{ij}}, \frac{G_j^{min}}{\underline{G}_{ij}}\right], \tag{14}$$

where $G_j^{min} = \min_{1<i<m}\left\{\underline{G}_{ij}\right\}$.

Step 6. Weighted Normalized Grey Decision Matrix normalized D^* matrix is weighted by the:

$$\otimes V_{ij} = \otimes G_{ij}^* X \otimes W_j. \tag{15}$$

Process which establishes the weighted normalised grey decision matrix $\otimes D_W^*$:

$$D^* = \begin{bmatrix} \otimes G_{11}^* & \otimes G_{12}^* & \cdots & \cdots & \otimes G_{1n}^* \\ \otimes G_{21}^* & \otimes G_{22}^* & \cdots & \cdots & \otimes G_{2n}^* \\ \cdots & \cdots & \cdots & \cdots & \cdots \\ \cdots & \cdots & \cdots & \cdots & \\ \otimes G_{m1}^* & \otimes G_{m2}^* & \cdots & \cdots & \otimes G_{mn}^* \end{bmatrix}. \tag{16}$$

Step 7. The total weighted comparability sequence (S_i) and the sum of the weighted comparability sequences (P_i) for each alternative are calculated as follows:

$$S_i = \sum_{j=1}^{n}\left(w_j r_{ij}\right). \tag{17}$$

This S_i value is achieved based on grey relational generation approach:

$$P_i = \sum_{j=1}^{n}\left(r_{ij}\right)^{w_j}. \tag{18}$$

Step 8. The relative weights of the alternatives are computed using the following aggregation strategies. In this step, three appraisal score strategies are employed to generate the relative weights of the other options, which are derived using the following Equations:

$$K_{ia} = \frac{P_i + S_i}{\sum_{i=1}^{m}\left(P_i + S_i\right)}; \tag{19}$$

$$k_{ib} = \frac{S_i}{\min_i S_i} - \frac{P_i}{\min_i P_i}; \tag{20}$$

$$k_{ic} = \frac{\lambda\left(S_i\right) + \left(1-\lambda\right)\left(P_i\right)}{\left(\lambda \max_i S_i + \left(1-\lambda\right)\max_i P_i\right)}, \ 0 \le \lambda \le 1. \tag{21}$$

Step 9. The final ranking of the alternatives is determined as follows:

$$k_i = \left(k_{ia}k_{ib}k_{ic}\right)^{\frac{1}{3}} + \frac{1}{3}\left(k_{ia} + k_{ib} + k_{ic}\right). \tag{22}$$

3.4. Research design

This research employs a two-stage approach, comprising expert panel assessments followed by international surveys, to systematically analyze the social concerns associated with the Metaverse. In the first stage, a panel of experts was convened to identify and weigh the key social issues relevant to the Metaverse's impact on society. This foundational qualitative layer was necessary to establish informed criteria that encapsulate the most pressing concerns. The second stage involved a broader international survey that quantitatively assessed the weight of these concerns across diverse populations, ensuring that the research uniformly addresses the multifaceted implications of the Metaverse (Cruz & Oliveira, 2024).

The methodological framework directly addresses the research goals of identifying, prioritizing, and exploring the implications of social issues in the Metaverse by ensuring that both expert insights and the broader public perspective are accounted for. This blend of methodologies ensures robustness in the findings, aligning with the primary research question concerning the critical social concerns that arise from the adoption of this transformative technology (Ioannidis & Kontis, 2023).

3.5. Data collection

The expert panel consisted of 18 researchers and social science practitioners selected for their relevant academic backgrounds and professional experiences in emerging technologies and sustainability studies. Their expertise was crucial in guiding the discussion on social concerns and providing a well-rounded comprehension of the implications surrounding the Metaverse (Marković-Blagojević et al., 2024). This selection process was methodically structured to ensure a diverse representation encompassing various fields such as psychology, digital communication, technology, and ethics.

To capture a global perspective, an online survey was distributed to university faculty members across developing countries, including Iran, India, Saudi Arabia, and Qatar. These countries were strategically selected due to their rapid adoption of digital technologies and unique socio-economic challenges. The demographic scope of the survey encompassed a wide array of academic disciplines to represent varied viewpoints, ensuring comprehensive feedback from individuals who are knowledgeable about the implications of the Metaverse on society (Prados-Castillo et al., 2024). A total of 63 responses were collected, providing a robust dataset for further statistical analyses.

The Grey Step-wise Weight Assessment Ratio Analysis (SWARA) method was chosen for its efficacy in dealing with imprecise or uncertain information, a common characteristic of studies involving social technology impacts (Feng et al., 2022). The method involves establishing a matrix of criteria that experts assess, yielding weights that reflect the relative importance of each issue identified. This approach is particularly advantageous as it incorporates subjective expert judgments while quantifying them, allowing for a nuanced understanding of the interplay between identified concerns (Othman et al., 2024).

Following the completion of the expert ranking, the Grey Combined Compromise Solution (CoCoSo) method was employed to prioritize the identified social concerns derived from the expert panel. CoCoSo is an innovative MCDM technique that integrates principles from traditional ranking models (Weighted Sum Model and Weighted Product Model), enhancing the assessment of social issues by balancing various criteria's input (Carvalho & Alves, 2022). Utilizing Grey CoCoSo allows for a clearer prioritization of concerns, as it considers multiple performance indicators from the gathered survey responses, creating a comprehensive overview of societal impacts (Hussain et al., 2023).

The sampling method involved a non-probabilistic approach, primarily targeting expert participants based on their qualifications and international respondents based on academic roles within their respective countries (Marković-Blagojević et al., 2024). This strategic selection allowed for a more informed understanding of the social concerns within the Metaverse while addressing potential biases inherent to self-selection.

Statistical analyses were conducted using descriptive statistics to summarize the survey data, in addition to inferential statistics to test the significance of relationships between different identified concerns and their perceived impacts on society. The analysis involved both qualitative insights from the expert panel and quantitative findings from the broader survey, allowing for a comprehensive evaluation of the data collected, thereby ensuring the results remain both actionable and applicable to policy-makers and industry stakeholders involved in the careful management of the Metaverse's societal impact (Prados-Castillo et al., 2024).

4. Data analysis

We employed the Grey Step-wise Weight Assessment Ratio Analysis (SWARA) method to calculate the weights of the decision criteria. This method is particularly useful when dealing with uncertain or imprecise information, often in emerging fields like Metaverse studies.

Table 3 shows the calculations for the first respondent, demonstrating the step-by-step process of the Grey SWARA method. This includes each criterion's lower and upper bounds (s_1, k_1, q_1, w_1) and the final weights (w) using Eqs. (1)–(8).

Explanation of Symbols:

$C_1, C_2, ..., C_n$: Criteria considered for the decision-making process. Each C represents a specific criterion used in the Grey SWARA method

$s_1(low)$, $s_1(up)$: Lower and upper bounds of the criterion adjustment step.

$k_1(low)$, $k_1(up)$: Lower and upper bounds of the grey coefficient (k_1).

$q_1(low)$, $q_{11}(up)$: Lower and upper bounds of the normalized value (q_1).

$w_1(low)$, $w_1(up)$: Lower and upper bounds of the calculated weights (w_1).

w: Final weight obtained after normalization.

Aggregation of weights. Table 4 presents the calculated average weights for all 18 respondents from the initial expert panel. This aggregation allows us to see the overall importance assigned to each criterion (c_1, c_2, c_3, c_4) across the expert group.

The final average calculated weights of criteria are visualized in Figure 2. Meanwhile, Figure 3 shows the weights given to each criterion by each of the respondents.

Table 3. The calculations for the first respondent by grey SWARA (source: authors' own elaboration)

Criteria	$s_1(low)$	$s_1(up)$	$k_1(low)$	$k_1(up)$	$q_1(low)$	$q_1(up)$	$w_1(low)$	$w_1(up)$	w
C_1	0	0	1	1	1	1	0.334112	0.439473	0.372704
C_2	0.3	0.6	1.3	1.6	0.625	0.769231	0.20882	0.338056	0.263478
C_3	0.2	0.7	1.2	1.7	0.367647	0.641026	0.122835	0.281713	0.194907
C_4	0.1	0.3	1.1	1.3	0.282805	0.582751	0.094489	0.256103	0.168911

Table 4. The calculated average for all respondents (source: authors' own elaboration)

Respondent	C_1	C_2	C_3	C_4
1	0.372704	0.168911	0.194907	0.263478
2	0.418978	0.167627	0.281795	0.131599
3	0.374069	0.251876	0.234006	0.140049
4	0.139835	0.298631	0.177851	0.383682
5	0.186603	0.276193	0.410591	0.126613
6	0.329139	0.304307	0.238809	0.127745
7	0.232075	0.438225	0.215	0.114701
8	0.44186	0.26174	0.176656	0.119744
9	0.397309	0.129162	0.16441	0.30912
10	0.094921	0.264584	0.140355	0.50014
11	0.497471	0.263171	0.15623	0.083127
12	0.381767	0.200974	0.297124	0.120136
13	0.183095	0.249997	0.195713	0.371195
14	0.190991	0.244786	0.46245	0.101774
15	0.176656	0.26174	0.44186	0.119744
16	0.17302	0.103231	0.290964	0.432785
17	0.30912	0.129162	0.16441	0.397309
18	0.397261	0.148571	0.218602	0.235566
Average	0.294271	0.231272	0.247874	0.226584

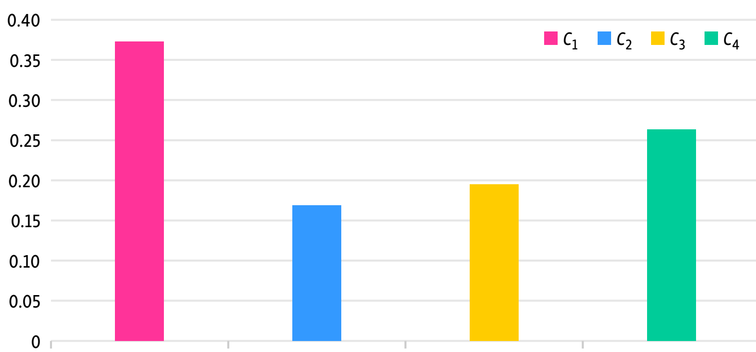

Figure 2. The calculated weight of criteria (source: authors' own elaboration)

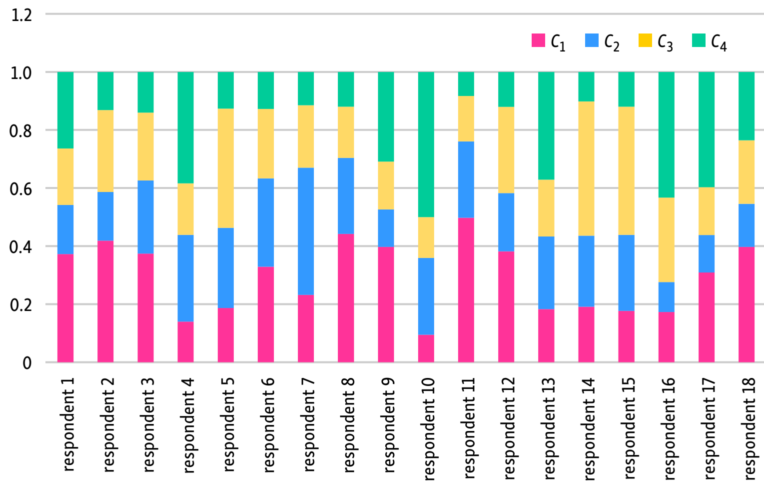

Figure 3. Weights assigned to each criterion by respondents (source: authors' own elaboration)

Table 5 shows the results from the broader international survey. This table includes columns for various factors (s, p, k_a, k_b, k_c, k) using Eqs. (17)–(22) and a final rank, indicating that a multi-criteria decision-making method (Grey CoCoSo) was applied to prioritize the identified social concerns related to Metaverse implementation.

Table 5. The ranking of recognized social concerns using Grey CoCoSo (source: authors' own elaboration)

Concern	$s(low)$	$s(up)$	$p(low)$	$p(up)$	k_a	k_b	k_c	k	Final rank
1	0.404	0.404	2.561	2.561	0.065	3.299	0.660	1.863	10
2	0.592	0.592	2.778	2.778	0.074	4.239	0.750	2.305	5
3	0.426	0.426	3.214	3.214	0.080	3.791	0.810	2.187	8
4	0.442	0.442	3.238	3.238	0.081	3.874	0.819	2.227	6
5	0.232	0.232	1.646	1.646	0.041	2.000	0.418	1.145	14
6	0.772	0.772	3.666	3.666	0.098	5.557	0.988	3.026	2
7	0.480	0.480	1.931	1.931	0.053	3.244	0.537	1.730	12
8	0.531	0.531	2.665	2.665	0.070	3.911	0.712	2.144	9
9	0.648	0.648	2.936	2.936	0.079	4.577	0.798	2.478	3
10	0.362	0.362	2.456	2.456	0.062	3.055	0.627	1.739	11
11	0.587	0.587	2.868	2.868	0.076	4.274	0.769	2.336	4
12	0.408	0.408	1.855	1.855	0.050	2.884	0.504	1.562	13
13	0.529	0.529	2.804	2.804	0.073	3.986	0.742	2.201	7
14	0.766	0.766	3.720	3.720	0.099	5.562	0.999	3.038	1

5. Results and discussion

The identification of 14 social concerns associated with the Metaverse is grounded in insights derived from both expert panels and broader survey feedback. These concerns encapsulate critical aspects of digital interaction and technology integration, reflecting both immediate impacts and longer-term societal implications. Each concern is distinct yet interconnected, illustrating a complex web of influences that technology can exert on psychological, social, ethical, environmental, and economic facets of human life.

For instance, the concern regarding "psychological effects" not only addresses addiction and mental health but also touches upon cognitive development and emotional well-being. This is particularly essential given the immersive nature that characterizes virtual experiences, potentially leading to altered perceptions of reality and user dependency on digital interfaces Wynn and Jones (2023). This concern aligns with the increasing evidence correlating excessive screen time and mental health challenges (Pellegrino et al., 2023).

Similarly, "social interaction and withdrawal" highlight the paradox of greater connectivity through digital means juxtaposed against the risk of isolation, particularly in younger demographics who may prefer virtual interactions over physical ones (Vlăduţescu & Stănescu, 2023). This concern emphasizes the need for platforms that encourage healthy social engagements while combatting loneliness and disconnection in real life.

The emphasis placed on "data privacy and security" arises from the digitization of personal identities and interactions in the Metaverse, wherein users may inadvertently expose sensitive information. The ethical ramifications of this concern necessitate stringent data protection measures and the development of transparent user agreements that enhance trust and accountability (Kouroupi & Metaxas, 2023).

Environmental impact concerns were fueled by the extensive energy demands associated with infrastructure supporting virtual environments. With increasing energy consumption, there lies a parallel obligation to implement sustainable practices that could mitigate the carbon footprint, thus addressing multiple SDGs simultaneously (Hurst et al., 2023).

Finally, issues related to "mployment displacement" signal the changing nature of work, necessitating societal adaptation to new job paradigms and digital economies. This encompasses both the opportunities presented by new job creation in tech sectors and the risks posed to traditional employment in scenarios increasingly encompassed by automation and digital transformation (Pellegrino et al., 2023; Rajguru & Brüggemann, 2024).

The ranking of social concerns based on the Grey SWARA and Grey CoCoSo methods highlights the weighted importance of each issue as perceived by experts and survey participants. This dual-method approach not only validates the critical concerns identified but also provides a structured manner for prioritization.

Through visual tools such as Table 1, the ranking illustrates a clear hierarchy, with psychological effects occupying the top position, indicating widespread agreement on the significance of mental health in this technological landscape. Social interaction and withdrawal, while ranked second, emphasize the importance of human connection signaling to stakeholders that digital platforms should enhance rather than replace in-person interactions (Zhao & You, 2023).

Moreover, the categorization of these concerns in relation to the SDGs allows stakeholders to position each social issue within broader sustainable development objectives. For example, as data privacy and security occupy a highly ranked position, stakeholders involved in the development of the Metaverse must align their practices with SDG 16, thereby ensuring that justice, equity, and strong institutions form the backbone of their operational frameworks (Hussain et al., 2023). Implications for Sustainable Development:

1. Psychological effects: Addressing the psychological impacts of the Metaverse ties closely to SDG 3. Effective strategies could include the design of virtual environments that promote healthy social interactions, provide psychological support mechanisms, and incorporate mental health awareness campaigns that resonate with users (Jamshidi et al., 2023). Emphasizing education on the risks of excessive virtualization is vital in fostering a balanced approach to technology use.
2. Social inequality: Social inequality as it pertains to access and equity poses significant challenges related to SDG 10. Uneven access to Metaverse technologies risks creating a new digital divide. Strategies to mitigate this could include community outreach programs, improving infrastructure in underserved areas, and actively developing platforms that prioritize inclusivity (Vlăduţescu & Stănescu, 2023). Collaboration between governments, NGOs, and tech companies could be vital for promoting equal access.
3. Environmental impact: The pressing environmental implications of energy consumption in the Metaverse underscore the relevance of SDGs 12 and 13. As industry stakeholders recognize the necessity for sustainable practices, adopting green technologies and renewable energy sources for powering the Metaverse will be crucial. Partnerships with environmental organizations can further guide sustainable initiatives (Hurst et al., 2023; Kouroupi & Metaxas, 2023).
4. Ethical issues: Ethical concerns align with SDG 16 by emphasizing the importance of justice and strong institutions. Organizations must establish comprehensive ethical guidelines, promote transparency in terms of data usage, and implement mechanisms to protect users from harassment and abuse within virtual spaces. Creating a framework that encourages user empowerment and community engagement will help in fostering equitable digital environments (Rajguru & Brüggemann, 2024).

Interpreting the findings within the context of societal challenges reveals that the Metaverse presents both transformational opportunities and potential dangers. On one hand, the potential for creating inclusive, diverse, and innovative societies rests on the successful implementation of strategies addressing the identified concerns. On the other hand, neglecting the social implications could exacerbate existing disparities and lead to significant setbacks in achieving sustainable development.

When compared to the existing literature, this study affirms findings from previous research indicating that immersive technologies can disrupt social dynamics but also offer avenues for positive engagement (Jamshidi et al., 2023; Pellegrino et al., 2023; Wynn & Jones, 2023). The alignment with theoretical frameworks, such as the sustainability intersections within virtual environments, enhances the understanding of how the Metaverse might evolve within a broader societal context (Rajguru & Brüggemann, 2024). Continuous discourse in academia is required to align technological advancement with social well-being and environmental protection.

In conclusion, this comprehensive exploration into social concerns linked with the Metaverse presents not only a necessary call for awareness but also advocates for responsible innovation. It challenges stakeholders to reimagine the narrative surrounding technology as an instrument for societal advancement rather than merely a source of disruption. By fostering collaboration across sectors and incorporating the insights gained from this research, we can insure that the evolution of the Metaverse contributes to a sustainable, equitable future for all.

6. Managerial insights

Detailed discussion offering managerial insights and recommendations for responsible Metaverse integration, providing in-depth policy implications, corporate responsibility strategies, as well as educational and social program initiatives. This comprehensive analysis draws from a wealth of academic literature and practical case studies, and it is structured in accordance with the following three components: policy implications, corporate responsibility, and educational/social programs. The discussion interprets the findings derived from the earlier methodology and results, and synthesizes considerable evidence that supports responsible governance of Metaverse technologies while aligning with sustainable development objectives.

Policy implications for the metaverse are critical in shaping a safe and socially sustainable digital ecosystem. Policymakers are urged to develop adaptive regulatory frameworks that address ethical dilemmas and privacy issues arising from the widespread collection and monetization of personal data. Sánchez-Adame et al. (2023) emphasize that as users interact and create content in immersive digital environments, a vast amount of behavioral and biometric data is generated data that holds significant commercial value. However, this same data generation leads to heightened concerns over digital privacy and security. Thus, governments must craft legislation that safeguards user data and ensures that microtransactions and other commercial practices within the metaverse are ethically designed. These policies might include strict data protection measures, transparency requirements for algorithmic decision-making, and consumer rights to opt out of data collection programs.

Policymakers should furthermore focus on establishing oversight agencies to continually monitor the application and impact of metaverse technologies. Such agencies would be tasked with the responsibility of performing regular audits and risk assessments, ensuring the rapid adaptation of regulations to keep pace with technological innovation. The creation of international standards through multilateral cooperation can promote harmonized regulatory approaches across borders, which is essential given the inherently global nature of the metaverse. By doing so, stakeholders across nations can collectively work to safeguard public welfare while encouraging robust technological development.

Corporate responsibility plays an equally pivotal role in ensuring the metaverse evolves as a force for good rather than as an enabler of social inequity and psychological distress. Lee and Chaney (2023) outline concerns related to usability, digital fatigue, and adverse psychological effects that drive resistance to metaverse applications. Corporations developing metaverse platforms must, therefore, integrate checks and balances into their business models. Companies ought to embed "privacy-by-design" principles into their system architectures, so that data security becomes a foundational aspect of product development. In addition, ethical stewardship should be a cornerstone of Corporate Social Responsibility (CSR) initiatives, where firms proactively address issues such as digital disenfranchisement, misinformation, and manipulative interface designs.

Corporate governance structures should also be reformed to include dedicated ethics committees that oversee digital product launches and regularly assess the social impacts of new features. These committees, staffed with experts from diverse fields such as IT, digital ethics, psychology, and law, can help identify potential negative externalities before they exacerbate social issues. Moreover, companies should publish detailed CSR reports that describe their efforts to promote inclusivity, equity, and mental well-being among users. By ensuring transparent communication about these efforts, businesses build trust with consumers and set benchmarks for the industry. In an era where socially responsible investing is gaining momentum, demonstrating a commitment to ethical practices in the metaverse may translate to long-term competitive advantages.

Furthermore, the notion of corporate responsibility must extend to support initiatives promoting environmental sustainability. Studies such as those by Vlăduţescu and Stănescu (2023) indicate that the metaverse currently demands substantial energy resources for computation and data storage. For companies operating within this sphere, adopting green IT policies, investing in renewable energy sources, and optimizing server infrastructures to reduce their carbon footprints is essential. Organizations can leverage emerging technologies such as artificial intelligence for energy optimization and consider collaboration with renewable energy providers. This approach addresses environmental challenges and aligns corporate practices with global Sustainable Development Goals (SDGs) such as SDG 12 (Responsible Consumption and Production) and SDG 13 (Climate Action).

Education and social programs form the third pillar of a holistic strategy for responsible metaverse integration. Modern digital literacy extends beyond basic computer skills and must encompass an understanding of digital ethics, data privacy, and the psychological implications of immersive technologies. Carstensen and Emmenegger (2023) discuss the role of education as a fundamental social policy tool in mature knowledge economies. In this context, educational institutions should actively incorporate modules on digital citizenship and metaverse ethics into the curricula at various levels. These courses are designed not only to teach technical skills but also to provide critical thinking frameworks for understanding the societal ramifications of constant digital connectivity.

To ensure widespread access, government initiatives and corporate partnerships are vital for launching large-scale digital literacy campaigns. Othman et al. (2024) argue that accessibility and inclusion in the metaverse are crucial, particularly for disadvantaged populations who might otherwise be excluded from these new digital environments. Digital literacy programs should specifically target vulnerable groups, offering immersive training that helps individuals understand and navigate potentially exploitative digital practices. Such programs can employ Virtual Reality (VR) toolkits that simulate common digital scenarios, allowing learners to experience both the benefits and risks of an increasingly digital society. Ensuring that these educational resources are accessible and culturally sensitive is essential for bridging the digital divide and promoting equity.

Beyond formal education, public awareness campaigns are needed to inform the general populace of potential psychological and social risks. Research conducted by Lee and Chaney (2023) has shown that psychological resistance to metaverse adoption can stem from concerns such as digital addiction, social isolation, and even cognitive overload. Public health authorities should work with educational institutions and private sector stakeholders to disseminate best practices for balanced digital behavior. These might include programs for "digital detox," peer support networks, and the development of mobile applications designed to monitor and mitigate symptoms of digital fatigue. Such initiatives help individuals maintain healthier lifestyles and contribute to building an informed citizenry capable of engaging with digital technologies sustainably.

Moreover, policymakers could incentivize research into the long-term social effects of metaverse usage by funding interdisciplinary studies that merge insights from psychology, sociology, and computer science. For example, funding research initiatives based on models proposed by Dwivedi et al. (2023) can help identify the negative societal impacts early on, enabling timely policy interventions. These studies are crucial, as they may reveal trends regarding metaverse-induced mental health issues, social alienation, or even addictive behaviors. When policies are informed by robust empirical evidence, regulations become more effective in promoting societal welfare while fostering technological innovation.

At a higher strategic level, both public and private sectors should consider establishing multi-stakeholder advisory boards that include representatives from academia, civil society, industry, and government. Such advisory boards would serve as conduits for knowledge sharing, ensuring that policy designs are continually updated in line with emerging research and social trends. Incorporating diverse viewpoints into decision-making processes ensures that policies are not only forward-looking but also sensitive to social and cultural differences. This collaborative approach can help mitigate potential negative externalities associated with metaverse adoption while harnessing its potential as a tool for socioeconomic advancement.

In summary, the managerial insights and recommendations for responsible metaverse integration present a multifaceted strategy that involves the formulation of proactive public policies, the adoption of robust corporate social responsibility practices, and the promotion of comprehensive educational programs. Policymakers must create adaptive, transparent regulatory frameworks and establish international standards that guide ethical and sustainable metaverse practices. Corporate decision-makers, on the other hand, need to embrace CSR by integrating privacy-by-design principles, establishing internal ethics committees, investing in green technologies, and ensuring inclusivity through comprehensive stakeholder engagement and transparent reporting.

Educational institutions and social programs have a critical role in preparing citizens for an increasingly immersive digital future. By incorporating digital citizenship and ethical usage modules into formal curricula and funding widespread digital literacy initiatives, governments and corporates alike can bridge the digital divide and empower users to navigate the metaverse safely. In parallel, public awareness campaigns and interdisciplinary research are indispensable for preempting potential negative societal impacts, thereby allowing for timely interventions that mitigate risks such as psychological strain and social isolation.

It is clear from the literature that a combination of these strategies can help transform the metaverse into a tool for positive social change. Sánchez-Adame et al. (2023) provide a blueprint for ethically designed microtransactions that safeguard privacy, while Lee and Chaney (2023) illustrate how addressing psychological resistance can foster healthier digital engagement. Dwivedi et al. (2023) remind us of the "darkverse" potential of unregulated digital spaces, reinforcing the necessity for urgent policy intervention. Complementary insights from Vlăduţescu and Stănescu (2023) highlight the environmental implications of metaverse technologies, strengthening the call for sustainable practices. Othman et al. (2024) emphasize accessibility and inclusion, ensuring the metaverse does not widen existing social divides. Finally, Carstensen and Emmenegger (2023) and Rajguru and Brüggemann (2024) offer frameworks for integrating educational policies and sustainable dimensions into metaverse governance all of which form a cohesive strategic approach. These findings offer a useful approach for policy makers to map national policy domains for digital to SDGs, with specific focus on facilitating the access and ethical governance of immersive technologies of nations to SDGs.

Collectively, these recommendations serve as a roadmap for decision-makers who seek to harness the transformative benefits of the metaverse while minimizing its risks. By addressing ethical, social, environmental, and educational dimensions in a holistic manner, stakeholders can ensure that the metaverse evolves in a way that drives economic innovation and contributes to a more just, inclusive, and sustainable society. In this way, a forward-looking and interdisciplinary approach supported by robust research and proactive governance will be essential in transforming the promise of the metaverse into a reality that upholds the highest standards of social welfare and sustainability.

7. Conclusions

This study has systematically identified and prioritized fourteen key social concerns associated with the emergence of the Metaverse, highlighting a complex interplay of psychological, social, ethical, and environmental factors. Among these, the most significant concerns include psychological effects (such as addiction and mental health issues), social interaction and withdrawal, data privacy and security, and environmental impacts related to energy consumption. Other critical issues comprise access and equity, ethical representation and inclusivity, and the implications of abuse and harassment within virtual spaces.

By employing expert insights and quantitative data gathered from an international survey, we captured a robust understanding of how these issues impact individuals and communities. This dual-method approach not only corroborated the significance of these concerns but also facilitated a nuanced ranking that aligns each issue with relevant Sustainable Development Goals (SDGs). The results underscore the potential risks associated with the Metaverse while affirming its capability to serve as a platform for positive societal change when appropriately managed.

This research contributes significantly to the existing body of knowledge across multiple academic disciplines, including consumer behavior, psychology, marketing, and social sciences. By integrating insights from these fields, it provides a comprehensive understanding of how immersive technologies reshape user experiences and engage with societal values. The study addresses the critical gap in literature concerning the social implications of the Metaverse, particularly as it relates to emerging concerns about psychological and behavioral effects. This contribution is timely and pivotal, given the rapid growth of immersive technologies and their societal integration.

Furthermore, the findings align with and extend current discussions around the SDGs, emphasizing the importance of ethical practices in technology development. By demonstrating how identified social concerns correlate with specific SDGs, this research advances the scholarly discourse on the intersection of technology, society, and sustainable development. It affirms that addressing social issues in the Metaverse is not only a matter of corporate responsibility; it is also crucial for fostering inclusive economies and resilient communities. The novelty of this research lies in its holistic approach to assessing social impacts in the Metaverse, presenting both theoretical insights and practical applications that can inform policy and corporate strategies.

While this study lays a foundational understanding of the social concerns linked to the Metaverse, several areas warrant further exploration. Firstly, research on Metaverse governance must be prioritized, particularly in establishing frameworks that provide oversight, accountability, and ethical guidelines for immersive technologies. Future studies should investigate how international regulatory bodies can collaborate to develop harmonized standards that ensure user protection and data privacy across digital landscapes.

Secondly, consumer behavior in virtual environments presents a fertile domain for future research. As users increasingly migrate towards immersive experiences in the Metaverse, exploring factors such as user motivations, brand interactions, and decision-making processes within virtual contexts will be crucial. Research focusing on the dynamics of consumer engagement, including brand loyalty and trust in digital spaces, can yield valuable insights for marketers and brand strategists.

Lastly, it is essential to conduct longitudinal studies that monitor the evolving social impacts of the Metaverse. Understanding long-term trends can illuminate how behaviors, attitudes, and societal norms shift as the Metaverse becomes more integrated into daily life. Such research can inform intervention strategies and accountability mechanisms that align with sustainable development principles, ensuring that the Metaverse benefits society while minimizing detrimental effects.

This framework can facilitate future research addressing specific social concerns such as psychological, legal, and ethical issues in depth, and in a comparative perspective between different socioeconomic or regional contexts. Moreover, generalizing the multi-criteria model in the direction of dynamic simulations and longitudinal forecasts can provide useful anticipations about the future societal implications of the Metaverse.

In conclusion, this research provides valuable insights into the multifaceted social concerns associated with the Metaverse, underscoring the importance of responsible governance and robust stakeholder engagement. By acknowledging the ethical, environmental, and societal implications, we can harness the transformative potential of the Metaverse to create equitable and sustainable digital futures.

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