The Concept of 'Sustainability' in the Metaverse:

Comparative Insights from International Principles

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Abstract

While interest in the Metaverse's role in achieving the United Nations Sustainable Development Goals (SDGs) is increasing, research on sustainability within the Metaverse remains limited and often narrowly defined. National policies on Metaverse governance exhibit diverse approaches, yet a comprehensive analysis of how sustainability is incorporated into these frameworks remains limited. Accordingly, this paper examines how different nations conceptualize Metaverse sustainability through a comparative analysis of Metaverse-related principles from Japan, South Korea, the European Union (EU), and the United Arab Emirates (UAE). The findings reveal significant differences in how nations interpret Metaverse sustainability, highlighting its status as an evolving policy concept. To address existing gaps, this study advocates for integrating all three dimensions—economic development, social inclusion, and environmental protection—into Metaverse governance frameworks. Additionally, it emphasizes the need for policymakers to consider a Metaverse-specific issue: whether and how sustainability should be applied to both physical and virtual spaces.

1. Introduction

In recent years, the Metaverse has attracted attention as a new space that enables real-time social and economic activities in virtual environments. As many countries and corporations work on developing and adopting the Metaverse, interest in the relationship between the Metaverse and sustainability has increased internationally, not only from academic perspectives but also from policy-oriented viewpoints. In particular, there is growing focus on how the development of the Metaverse can contribute to achieving the United Nations Sustainable Development Goals (SDGs) [1]. Considering sustainability while harmonizing with regional and local values and examining Metaverse governance from a global perspective is expected to become a key policy issue in the international community going forward.

However, it remains unclear how each country conceptualizes the sustainability of the Metaverse in its policymaking process. Although research on the Metaverse has expanded, there are only limited studies that deal directly with the concept of sustainability. Existing literature indicates that the concept of sustainability in the Metaverse tends to be narrowly understood, and the discussion has yet to mature [2]. Moreover, although the approaches to Metaverse governance vary among different countries' policies, no comprehensive research has been identified that analyzes how sustainability is incorporated within those policies and how such incorporation differs internationally. Against this backdrop, this paper aims to elucidate how each country perceives "sustainability" in the Metaverse by conducting a comparative analysis of Metaverse principles formulated in different nations. Specifically, it analyzes four Metaverse-related principles issued by Japan, South Korea, the European Union (EU), and the United Arab Emirates (UAE), and examines how these countries position the sustainability of the Metaverse. By understanding the distinctive approaches of each region, it is hoped that the potential for international policy coordination can be explored.

The results of this study reveal that the concept of "sustainability" in the Metaverse is perceived differently in each country. Furthermore, the concept is shown to be still in the developmental stage, not only from an academic standpoint but also from a policy perspective. In order to deepen the discussion on Metaverse-related sustainability, this paper integrates the three United Nations perspectives of economic development, social inclusion, and environmental protection, and proposes policy recommendations to advance international debates more constructively. From this viewpoint, this paper contributes to SDG 17 (Strengthen the means of implementation and revitalize the Global Partnership for Sustainable Development).

2. Literature Review

Concept of Sustainability in the Metaverse

The ambiguity and multifaceted nature of "sustainability" have long been recognized as frequent challenges for researchers. Multiple and sometimes conflicting definitions can hinder the selection of a

suitable sustainability framework [3]. Only recently have researchers begun paying significant attention to what "sustainability" might mean in the context of the Metaverse, and a clear, shared understanding has yet to be established.

In recent studies, there is a growing movement to conceptualize Metaverse sustainability as an idea spanning both virtual and physical spaces. By incorporating virtual environments into the framework, Tanja Mihalič suggested that it may be possible to develop new concepts that extend beyond conventional sustainability indicators which primarily focus on the physical world such as Figure [4].

On the other hand, discourse on the metaverse has predominantly centered on technological and economic dimensions, leaving broader global and local sustainability concerns, as well as their intersections with the digital divide, relatively underexplored [5].

Figure 1: Sustainability pillars within virtual and physical environments



Note: Metaverse can extend across virtual and physical, fantastical or realistic environments **Source:** Mihalic, T. (2024).

Three Perspectives of Sustainability

Since 2015, research on the Metaverse and sustainability has rapidly increased, with reports indicating that 601 papers were published in 2022 [6]. The SDGs (Sustainable Development Goals) were established by the United Nations to pursue sustainable development by harmonizing the three dimensions of environmental protection, economic development, and social inclusion. Existing research on the Metaverse and

sustainability has likewise discussed these three perspectives: environment, economy, and society.

From an environmental standpoint, there are claims that leveraging the Metaverse could promote integration with agriculture, water resource management, and clean energy, thereby reducing environmental impacts [7]. On the other hand, the Metaverse and its underlying technologies consume a vast amount of energy, and there are concerns about the environmental load, particularly arising from the use of blockchain and AI systems. Some argue that international regulations and the adoption of sustainable policies are necessary to address these concerns [8]. In economic terms, it has been suggested that virtual worlds and related technologies could significantly contribute to economic growth and job creation. However, while the Metaverse has the potential to generate new business models and economic activities, it has also been pointed out that ensuring its Prolonged sustainability requires adopting sustainable business strategies from a long-term viewpoint [9]. From a social perspective, it is argued that the Metaverse can offer a new arena for social interaction and help achieve the SDGs. In the field of education, there is an expectation that providing learning environments unconstrained by time and location can enhance the sustainability of education [10].

3. Method

Existing research on the Metaverse demonstrates interest in the concept of sustainability from the three perspectives of environmental protection, economic development, and social inclusion. However, there has not been sufficient discussion on how the sustainability of the Metaverse is perceived from a policy standpoint, and no studies have been found that adopt a comparative perspective among different countries.

Meanwhile, regarding AI, comparative research on AI principles enacted worldwide has shed light on the diverse approaches and views that different countries have toward AI [11]. Building on the experience of formulating AI principles, a number of countries are now beginning to craft principles related to the Metaverse. Therefore, this study aims to clarify how each country perceives Metaverse sustainability by comparing Metaverse "soft laws." Specifically, it analyzes Metaverse principles from the EU, the UAE, South Korea, and Japan.

EU Citizens' Principles

From February to April 2023, the European Commission held an "EU Citizens' Panel on Virtual Worlds." This panel used a participatory process centered on a representative group of EU citizens to consider and formulate recommendations for harnessing next-generation virtual worlds in a safe, fair, and trustworthy manner, focusing on social, technological, economic, and policy-related issues. Additionally, the Citizens' Panel based its work on the *European Declaration on Digital Rights and Principles* and developed principles covering eight fundamental aspects [12].

Specifically, the principles include: (1) Freedom of Choice, (2) Sustainability, (3) Human-Centered Approach, (4) Health, (5) Education and Literacy, (6) Security and Safety, (7) Transparency, and (8) Inclusion.The concept of sustainability is addressed under principle (2), Sustainability, which states that "building virtual environments entails unprecedented use of interaction devices, servers, clouds, and other computing infrastructures, and is environmentally friendly".

UAE's "Self-Regulatory Principles"

In April 2022, under the chairmanship of the UAE Prime Minister's Office, Agile Nations was launched to tackle the multi-faceted challenges of Metaverse governance, establishing the Metaverse Regulatory Working Group. Led by the UAE Minister of State for Artificial Intelligence, Digital Economy, and Remote Work Applications, the Working Group aims to develop common self-regulatory principles and standards for responsible Metaverse use and operation. In October 2023, the UAE Office of AI, Digital Economy, and Remote Work Applications published a white paper titled "Responsible Metaverse Self-governance Framework," presenting nine self-regulatory principles. Specifically, these are: (1) Interoperability of Access, (2) Privacy by Design and by Default, (3) Sustainability by Design, (4) Reciprocity, (5) Transparency for Trust, (6) Fairness, Equality, and Inclusivity, (7) Commitment to Diversity, (8) Accountability, and (9) Safety by Design and Beneficence.

The principle related to sustainability can be seen in the third principle, "Sustainability by Design," which emphasizes the importance of incorporating sustainability—particularly energy efficiency—at the Metaverse design stage [13].

South Korea's "Ethics Principles"

In November 2022, South Korea's Ministry of Science and ICT (MSIT) published the "Metaverse Ethical Principles," aimed at reconciling free economic activities with the protection of individual rights. These ethical principles serve as a voluntary code of conduct without legal binding force and can be referenced by all stakeholders in the process of Metaverse utilization. Additionally, this set of ethical principles sets out three core values, along with eight specific action principles. The three core values are: Authentic Self, Safe Experience, and Sustainable Prosperity. The eight action principles are: (1) Authenticity, (2) Autonomy, (3) Reciprocity, (4) Privacy Respect, (5) Fairness, (6) Personal Data Protection, (7) Inclusivity, and (8) Responsibility for the Future [14].

The aspect of sustainability is included under "Sustainable Prosperity" among the three core values and under "Responsibility for the Future" among the eight action principles. First, "Sustainable Prosperity" is based on the idea that the Metaverse should evolve as a space that creates opportunities for innovation and prosperity and that its benefits should be passed on to future generations. Additionally, "Responsibility for the Future" emphasizes the importance of Metaverse users holding a sense of social responsibility as good citizens and adhering to ethical standards, in order to maintain a sustainable space for present and future generations. In this way, South Korea's notion of "sustainability" in the Metaverse does not place primary focus on environmental aspects, as do the EU and the UAE, but rather centers on economic and social inclusion.

Japan's "Metaverse Principles 1.0"

Anticipating significant growth in the Metaverse market and user base, Japan's Ministry of Internal Affairs and Communications issued the "Metaverse Principles (Version 1.0)" with the goal of creating a safer, more secure environment for users. These guidelines are organized into two pillars: the first, "Principles for Voluntary and Autonomous Development of the Metaverse," covers openness, innovation, diversity, inclusion, literacy, and community, while the second, "Principles for Enhancing the Trustworthiness of the Metaverse," addresses transparency, accountability, privacy, and security [15].

In contrast to the principles of the EU, South Korea, and the UAE, Japan's guidelines do not explicitly mention "sustainability." Although certain cultural or social elements could be interpreted in a manner consistent with sustainability, there is no explicit reference to environmental sustainability.

4. Discussion: Sustainability in Which Space?

This analysis confirms that three of the four sets of principles examined explicitly refer to sustainability, but there are significant differences in interpretation. As a framework for sustainability, three dimensions can be considered: (1) environmental protection, (2) economic development, and (3) social and cultural inclusion. However, no principles were found that comprehensively incorporate all these dimensions.

Specifically, the EU and UAE principles place importance on environmental protection, while the elements of economic growth and social inclusion appear relatively undervalued. In contrast, South Korea's principles interpret sustainability from the perspective of economic growth and social inclusion, but do not explicitly mention the connection between the Metaverse and environmental protection. Meanwhile, it can also be noted that Japan's principles do not directly refer to sustainability at all.

A factor underlying this difference seems to be which space's "sustainability" is in focus in each country's Metaverse principles. When discussing sustainability, there are two perspectives: whether it refers to sustainability in the real world, or sustainability of the Metaverse virtual space itself. As shown in Table 1, combining the space in question with the three SDG dimensions yields the following arrangement:

	Environmental Protection	Economic. Development	Social & Cultural Inclusion
Real World	0	0	0
Virtual World	×	0	0

Table1 : The target space and the SDGs

The upper row of Table 1 indicates that using the Metaverse can contribute to the sustainability of the "real world." On the other hand, the lower row points to ensuring the sustainability of the Metaverse as a "virtual space." As Table 1 shows, when discussing environmental protection with respect to the Metaverse, the main focus is generally on how using the Metaverse can protect the environment in the "real world." Conversely, when discussing the sustainability of the virtual space itself, environmental protection is not considered a central element.

Taking this into consideration, it seems likely that the EU and UAE, which tend to incorporate the environmental protection viewpoint, may be focusing on sustainability in the "real world." By contrast, South Korea and Japan do not incorporate environmental

protection into their sustainability discussions, suggesting that they are likely focusing on the sustainability of the "virtual space" itself.

Thus, when debating Metaverse sustainability, it is necessary to clarify which of the SDG's three dimensions—environmental protection, economic development, and social inclusion - is being addressed, as well as whether the subject is the real world or the virtual world. As the Metaverse develops and the integration of the real and virtual worlds advances, discussions surrounding "sustainability" are expected to become even more complex.

5. Conclusion

This study reveals that among the four countries with established metaverse-related principles—the EU, the UAE, South Korea, and Japan—three of them explicitly reference "sustainability," with Japan being the exception. However, the interpretation of "sustainability" within the principles of the EU, UAE, and South Korea varies significantly. The EU and UAE define sustainability primarily from an environmental perspective, with limited emphasis on economic development and social inclusion. In contrast, South Korea's principles focus on economic development and social inclusion, while considerations related to environmental protection remain minimal. These findings suggest that the concept of sustainability in the metaverse remains underdeveloped from a policy substantial variations perspective. with in interpretation and implementation across countries. This divergence highlights the need for further international discussions and policy coordination to establish a more comprehensive and harmonized approach to metaverse sustainability.

Based on the analysis in this paper, policymakers responsible for constructing Metaverse governance should advance sustainability discussions while balancing (1) environmental protection, (2) economic development, and (3) social and cultural inclusion. To do so, it will be necessary to fully understand the differences in each country's approach uncovered by this study, and to proceed with global policy coordination while taking into account whether "sustainability" targets the real space or the virtual space.

Additionally, this study focused on soft laws formulated by national authorities, but in the future it will be important to also include soft laws enacted by the private sector in the analysis. Future research could clarify the Metaverse's unique "sustainability" perspective by comparing soft laws on the Metaverse with those in other fields, such as AI.

By continuing these efforts, it will become possible to gain a deeper understanding of region-specific

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approaches to the Metaverse, re-examine existing governance models, and promote international policy coordination concerning the Metaverse.

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