



Article

Governments, Users, and Virtual Worlds: Institutional Strategies in the Age of Big Data and IA

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Abstract

In recent years, several countries have introduced strategic plans aimed at promoting metaverse ecosystems. While these initiatives highlight the metaverse as both a technological frontier and a policy priority, the underlying rationales and metaverse approaches remain insufficiently understood. This gap raises the need to critically examine why governments are investing in the metaverse ecosystem and how metaverse is being approached as an innovative platform for digital public services and businesses. An inductive and deductive content analysis was conducted on various regional, national and supranational metaverse strategic plans (n = 7). Virtual worlds can be understood as persistent, immersive, and interactive digital environments that integrate 3D visualisation, simulation, and real-time data to support activities across social and economic domains. The findings indicate that the metaverse is a virtual space shaped by the dual imperative of addressing societal needs—such as public service delivery and stakeholder engagement—and fostering business opportunities within the evolving digital ecosystem. The analysis revealed four main reasons to promote the social and industrial metaverse ecosystem: sustainability; digital sovereignty; competitive advantage and stakeholder building relationship. The results indicate that the metaverse operates mainly through both transactional and connected approaches, where digital twins, artificial intelligence, and extended reality converge to enable user experiences in ways that transcend physical limitations.

Keywords: metaverse; innovation; market; industrial metaverse; social metaverse; user experience; government; business; stakeholders; IA; digital twins; virtual worlds

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1. Introduction

The concept of the metaverse—a network of interconnected, immersive, and persistent virtual environments—has gained increasing global attention due to its transformative potential in various sectors, including education, social interaction, commerce, and governance (Park and Kim 2022; Wang et al. 2023; Xu et al. 2023). Defined by the European Commission as a digital space that blends physical and virtual realities in real time through 3D and extended reality (XR) technologies, the metaverse is emerging as a critical platform for a wide range of activities such as “designing, making simulations, collaborating, learning, socialising, carrying out transactions or providing entertainment” (European Commission 2023a).

The metaverse is emerging as a transformative digital paradigm with the potential to significantly improve interactions between institutions and citizens (Park and Kim 2022; Wang et al. 2023; Xu et al. 2023), especially among younger demographics (Kshetri et al. 2024). Governments across the globe are beginning to recognize the metaverse not only as a technological innovation, but also as a strategic domain for economic development, citizen engagement, and global competitiveness. The economic potential is substantial: the global market for virtual worlds is expected to grow from approximately €27 billion in 2022 to over €800 billion by 2030, with an estimated market value between €8 and €13 trillion by that same year (Business Finland 2023; European Commission 2023a, 2023c). Countries that fail to position themselves within this evolving ecosystem risk marginalisation in a landscape increasingly dominated by multinational technology firms, potentially exacerbating vulnerabilities related to economic, technological, and geopolitical sovereignty (Business Finland 2023).

Consequently, public authorities and intergovernmental bodies are beginning to craft national metaverse strategies, aiming to establish regulatory frameworks, institutional infrastructures, and public investments that guide its development. These strategic plans are becoming foundational tools for articulating digital priorities and ensuring that immersive technologies align with broader social, economic, and political objectives. Governments are already exploring metaverse applications in areas such as digital diplomacy (e.g., virtual embassies), virtual tourism, urban planning through digital twins, healthcare, and citizen engagement through virtual municipal spaces (Kshetri et al. 2024; Xu et al. 2023; Lnenicka et al. 2024). Furthermore, the metaverse offers unique capacities for simulating complex social and ethical scenarios in controlled environments, thus serving as a tool for policy design and testing (Lnenicka et al. 2024).

Despite this momentum, scholarly attention has predominantly focused on corporate-led metaverse initiatives—particularly within the gaming, entertainment, tourism and retail industries (Kniazeva et al. 2023; Crespo-Pereira et al. 2023; Park and Kim 2022), leaving a research gap concerning the strategic role of governments in shaping virtual futures.

The COVID-19 pandemic served as a catalyst for this shift, positioning the digital realm as a space for reimagining societal organisation and service delivery, while simultaneously reinforcing algorithmic and technocratic forms of governance (Bibri and Allam 2022). Existing studies on public-sector applications focus on metaverse public initiatives to constituents (Kshetri et al. 2024; Lnenicka et al. 2024; Wang et al. 2023) (Table 1). Several governments have expressed intentions to expand their digital governance and smart city initiatives through metaverse-based services, exemplified by initiatives such as Korean Metaverse, Metaverse Seoul or the Metaverse Embassy of Barbados and Israel (Kshetri et al. 2024, Wang et al. 2023; Xu et al. 2023) (Table 1). However, research lacks a systematic examination of national strategic approaches.

Table 1. Description of government metaverse initiatives worldwide.

Country	E-Government Development Index	Initiative Type	Key Sectors Involved	Description of Initiative	Year
Finland	9	Public service	Urban services, mobility, health, safety, events	Tampere is developing a Metaverse strategy to become a 'Metaverse city'. Helsinki has launched 'Virtual Helsinki'.	2023
South Korea	4	Public-private partnership.	Education, universities, private sector.	Government launched the 'Digital New Deal' with \$200M grants for Metaverse R&D; content creation project funded.	2022–2023

Australia	8	Public service	Education, Healthcare, Transportation	New South Wales exploring VR in education and training; XR investments in transport.	2023
United States	19	Public service	Public transport, Smart cities	Philadelphia using AR for transit accessibility; digital twins developed in several cities (Orlando, Las Vegas, Boston).	2021
United Kingdom	7	Public service	Healthcare	NHS invested £1M in XR and AI for medical training via the Metaverse.	2022
Japan	13	Public service	Education	Government promoting Metaverse (Web3) and NFTs; using Metaverse for remote education of non-attending children.	2022
Israel	23	Public service	Foreign affairs, diplomacy.	Opened first Metaverse embassy in South Korea, with meeting rooms and exhibitions.	2022
Norway	15	Public services	Taxation, Public registers	Tax authority, public registers in virtual offices in Decentraland.	2022
China	35	Public service	Urban development, government services	Cities using Metaverse for public services and urban planning, e.g., Shanghai's Fengxian district 3D performing centre replica.	By 2025
Egypt	95	Public service	Training local workers, Health tourism	Metaverse used for staff training and by healthcare authorities for medical tourism.	2022

Source: adapted from Kshetri et al. (2024), actualized to 2024 data.

Table 1 presents the position of each country in the E-Government Development Index—EGDI—(United Nations Department of Economic and Social Affairs 2025), a composite indicator that evaluates three key dimensions of e-government development: the provision of online services—the degree of accessibility and quality of digital public services; telecommunication infrastructure—connectivity and access to the Internet; and human capital—education levels, digital literacy, and technological skills.

The second column shows each country's ranking position. The data reveal that some states, despite not being among the highest-ranked digital governments, have already begun implementing metaverse-related initiatives, even earlier than countries with greater digital maturity. This suggests that these governments may be seeking to improve their digital standing through the early adoption of immersive technologies, designing virtual environments that support the optimisation of their digital infrastructures and strengthen institutional capabilities.

Justification and Research Questions

Government and scientific sectors are increasingly focused on metaverse to provide accessibility and integration into the public sphere driven by advancements in network infrastructure, hardware capabilities, computational efficiency, and content development (Dionisio et al. 2013; Park and Kim 2022; Xu et al. 2023; Lnenicka et al. 2024). Also, government policy measures can leverage the metaverse's capacity to simulate complex social, ethical, and political scenarios in unbiased environments, offering valuable tools for decision-making and governance. Additionally, public interventions may be necessary to assist traditional industries in adapting to technological transformations, ensuring their long-term competitiveness in the digital economy (Lnenicka et al. 2024; Dwivedi et al. 2022).

Studying national metaverse strategies is essential to understanding how institutional priorities are being encoded into the foundational architecture of immersive digital environments. Such analysis can illuminate the motivations, narratives, and policy

orientations that underpin the public sector’s engagement with the metaverse. This paper seeks to address this gap by examining why national governments promote the development of metaverse ecosystems within their territories. Accordingly, this study poses two fundamental research questions:

RQ1: To what extent are national governments actively promoting the development of metaverse ecosystems, and what strategic motivations underpin their inclusion in national digital transformation agendas?

RQ2: What approaches are national governments adopting in integrating the metaverse into their digital transformation agendas?

As the metaverse evolves into a transformative digital paradigm, governments are beginning to engage with its development not only as a technological frontier but also as a strategic domain for public governance, economic growth, and civic innovation. Initial government-led metaverse initiatives have focused on different stages that deploy the provision of virtual services and transactional functions to a connected metaverse.

Table 2 outlines different stages of maturity in the development of public services within the metaverse. In the Emergent stage, governments explore basic uses such as citizen assistance and initial access to information or simple services through virtual avatars and automated agents. The Enhanced stage involves greater realism and interaction, including immersive experiences with spatial audio or virtual visits for public services, tourism, or healthcare. In the Transactional stage, citizens can complete official procedures directly in the metaverse, such as requesting certificates or processing administrative documents, often supported by virtual service representatives. Finally, the Connected stage is defined by integration with advanced urban systems, such as digital twins for infrastructure planning, investment attraction, or diplomatic and international cooperation initiatives. At this point, the metaverse evolves from an experimental space into an interoperable extension of public services and urban governance.

Evidence suggests that countries have adopted varying approaches to the metaverse in line with the four stages of the digital public service innovation framework (Kshetri et al. 2024), revealing differences in ambition, scope, and institutional integration. However, these early efforts mark only the beginning of a broader exploration into how the metaverse can serve as a tool for societal resilience, institutional innovation, and economic transformation.

Equally important as understanding the motivations behind governmental engagement is analysing how countries conceptualize the metaverse itself—whether it is treated as a mere channel for information dissemination, or as a comprehensive, interactive ecosystem embedded within national digital strategies. This line of inquiry allows for a more nuanced understanding of how different states envision the metaverse’s technological, institutional, and societal roles in the years to come. Therefore, this research adopts a qualitative, exploratory and comparative design, based on the systematic analysis of national and supranational strategic plans.

Table 2. Metaverse initiatives and their stages of development.

City/Country	Framework Stage	Metaverse Application Description
Seoul, South Korea	Emergent	Residents in Metaverse Seoul can access tax support through the platform’s ‘Tax Square’ feature. There, users interact with a virtual assistant named IZY, which links directly to the Seoul Internet Tax Payment System (E-TAX), enabling them to compute various taxes, including those related to vehicles, property, and acquisitions.
Ajman, UAE	Enhanced	The Emirate of Ajman in the UAE has developed a Metaverse environment that incorporates spatial audio and visual sensing, enabling users to approach an official’s virtual representative and engage in real-time inquiries.
Port Said, Luxor, Ismailia (Egypt)	Enhanced	Virtual tours of healthcare facilities to support medical tourism and service awareness.

Seoul, South Korea	Transactional	Metaverse Seoul offers administrative services. Administrative services spanning five key areas—economic affairs, education, taxation, public administration, and communication—are provided. Also, resident registration certificate and issuing proof of citizenship.
Sharjah, UAE	Transactional	Sharjaverse provides a Virtual Transaction Center for document processing and tourism services. Customer service agents process the documents for their users and provide information about government services.
Orlando, Las Vegas, Boston (USA)	Connected	Use of digital twins for urban simulation (e.g., energy planning, infrastructure risk assessment).
Seoul, South Korea	Connected	City-wide digital twin used for scenario simulation and urban planning.
Dubai, UAE	Connected	Digital twin initiative for retail and real estate simulation prior to physical implementation.
Seoul, South Korea	Connected	Future Metaverse services aimed at foreign investment attraction and international outreach.
Israel (Embassy in South Korea)	Connected	First Metaverse embassy to foster diplomatic engagement in virtual environments.
UAE (unspecified)	Connected	Plans to use the Metaverse for signing bilateral agreements with foreign nations.

Source: adapted from Kshetri et al. (2024).

2. Materials and Methods

This research adopts a qualitative, descriptive, and comparative design, based on the documentary analysis of national and supranational strategies on the metaverse. This approach was chosen because, at present, most strategic plans are not fully accessible to the public or remain under development (most strategic plans have not been implemented or remain under development). In this sense, the aim of this work is to identify how governments conceptualize the metaverse and what motivations support its inclusion in digital transformation agendas.

This study constitutes an original qualitative and comparative research based on documentary analysis, a recognised empirical approach in communication and policy studies. Although the data derive from official strategic documents, the coding and categorisation process generated new analytical insights into how governments conceptualise and strategically frame the metaverse.

The corpus analysed was composed of seven official documents that explicitly address national policies or strategies on the metaverse (Table 3). These texts were obtained through the Virtual Dimension Center (2025) database and official governmental sources.

The selection of documents was made according to two criteria: (1) the document presents an official political position or strategic framework related to the development of the metaverse; (2) the document includes specific information on objectives, fields of application, or governance mechanisms.

National and supranational strategic plans were selected because they represent the most authoritative and comprehensive policy frameworks currently available. As most specific metaverse initiatives are still under development or lack public access, these documents provide the only comparable evidence of governmental intent and strategic direction.

Likewise, the set of selected cases includes countries from Asia, Europe, and the Middle East, which makes it possible to achieve geographical and political diversity, to compare different institutional approaches to the development of virtual ecosystems. Although the corpus is composed of public strategic documents, most of these explicitly connect metaverse development to industrial innovation and digital economy agendas. Therefore, the analysis considers both public-service and industrial dimensions, reflecting the dual logic that characterises contemporary governmental approaches to digital transformation.

This corpus constitutes the empirical foundation for the qualitative coding process described in the following subsection.

Table 3. Summary of the primary data sources analysed.

Country/City	Report	Description
Germany	White paper “CyberLÄND”	The CyberLÄND platform integrates 2D/3D web applications, community engagement tools, interactive participation formats, and AI-driven knowledge exchange. It serves as a virtual hub for innovation across sectors such as business, science, education, government, and the creative industries. Its primary objective is to support the development of the Industrial Metaverse, particularly by empowering the manufacturing sector.
China	Three-year action plan for the innovative development of the metaverse industry (2023–2025) in China	Its primary objective is to support the development of the Industrial Metaverse, particularly by empowering the manufacturing sector.
Dubai	Dubai Metaverse Assembly 2022. Assembly outcomes report.	Dubai is leveraging the metaverse across both government and business sectors, identifying tourism, education, public services, retail, and real estate as leading areas of adoption. The city aims to position itself as the global “crypto-capital.”
Europe	An EU initiative on Web 4.0 and virtual worlds: a head start in the next technological transition. 2023.	The plan aligns with key pillars of digitalisation: people and skills, business and public services. European strategies for virtual worlds and Web 4.0 aim to help citizens and enterprises work, learn, and interact in immersive environments.
Finland	Metaverse Initiative by the Finnish Ecosystem Virtual Potential into Real-World Impact.	In Finland, a national Metaverse Initiative envisions global leadership in the field, grounded in values like well-being, openness, and trust. The strategy runs through 2035 and seeks to implement initiatives around: technology enablers (infrastructure, standards, platforms, interfaces and devices for immersive and virtual experiences), business networks (creation of a metaverse ecosystem covering all main segments of the value chain with Europe and global partners), metaverse society (familiarizing the Finnish society with the Metaverse and educating them about new use cases and business opportunities), metaverse health (promoting the physical, mental, and social inclusion and wellbeing of our citizens), industrial metaverse (applying the metaverse technologies to various industrial sectors such as manufacturing, maintenance, construction, built environments, defence, logistics and transport).
Japan	Japan Metaverse Strategy	Japan is developing Ryugukoku, a metaverse operated by JP Games, where users navigate interconnected digital cities via avatars. It functions as a multipurpose platform enabling companies to share technologies.
South Korea	Metaverse and virtual tech in South Korea	South Korea aims to become the fifth-largest metaverse market by 2026. Its national strategy emphasizes private-sector leadership in technology development—such as VR, AR, and motion capture—supported by public policy, legislation, and institutional frameworks. The plan includes both national and local initiatives, such as the Seoul’s metaverse deployment.

Source: own elaboration.

Coding

Building on prior research that has explored corporate reasons for engaging with the metaverse (Kniazeva et al. 2023), as well as public sector approaches to the metaverse as a vehicle for service innovation (Kshetri et al. 2024), this study extends the analysis to examine how governments conceptualize and strategically position the metaverse within their digital agendas. Particularly, this analysis focuses on understanding the motivations driving governmental engagement with the metaverse, as well as the strategic approaches adopted by different countries within this emerging digital ecosystem. This analytical procedure was systematically applied to the seven official documents described in the previous subsection, ensuring consistency in the examination of each case.

The research underwent inductive and deductive qualitative content analysis. The inductive analyses consisted of a three-stage coding procedure: (a) open coding; (b) axial

coding; and (c) selective coding. During the initial coding stage, we read the data and identified relevant fragments or units related to our research questions of motivations. We primarily employed *in vivo* codes, which are words extracted directly from the data. For example, we used terms like “value chain”, “consumer needs” as open codes. Duplications were eliminated such as “enhancing circularity” maintained as “circular economy”. We created axial codes by grouping open codes that related to common themes. The coding framework and categories were entirely developed by the authors based on the corpus, following grounded theory logic. They were not adapted from any pre-existing typology.

Within the qualitative coding process, two main selective categories were established to structure the analysis of the documents: the social metaverse—understood as the set of strategies oriented toward inclusion, public service delivery, and the creation of social value in virtual environments—and the industrial metaverse—linked to economic development, technological innovation, and business competitiveness. These categories group together a series of themes and subthemes derived from the open and axial coding procedures, which made it possible to organise the motivations identified in governmental strategies related to the metaverse.

Within the social metaverse, four main themes emerged. The first, sustainability, encompasses concerns related to climate protection, green transformation, and the pursuit of a sustainable virtual era associated with well-being and social responsibility. The second theme, citizen relationships, includes references to inclusion, education, democratic participation, and the delivery of public services in immersive environments, such as Metaverse Seoul. Governments emphasise accessibility, diversity, and cultural richness, highlighting how virtual worlds can foster civic engagement and improve quality of life. The third theme, independence from large platforms, reflects a strong commitment to decentralisation, privacy, and digital sovereignty. Many strategies call for responsible governance frameworks based on European values, interoperability, cybersecurity, and user autonomy, expressing concern about corporate dominance in metaverse infrastructures. Finally, the theme of competitive advantage connects the social metaverse to broader goals of innovation, efficiency, and state competitiveness in areas such as education, health, and public administration.

The industrial metaverse, on the other hand, focuses on economic and business imperatives. The theme of consumer relationships highlights efforts by businesses to redefine user interaction through immersive and interactive environments that promote participation and feedback beyond physical and temporal boundaries. Sustainability reappears here, but oriented toward industrial transformation—reducing emissions, promoting circular economies, and developing new sustainable business models. Competitive advantage emerges as a dominant driver, encompassing industrial modernisation, cross-sector innovation, and global competitiveness. Governments frame the metaverse as a catalyst for productivity, talent development, investment, and economic growth. The theme of independence from large platforms mirrors similar concerns found in the social sphere, focusing on building autonomous and decentralised metaverse ecosystems that strengthen technological sovereignty. Finally, image and notoriety appear as a secondary and minor motivation, especially in regions seeking to reinforce their visibility and leadership within emerging digital economies. Taken together, these categories illustrate how state-led metaverse strategies pursue a dual logic: promoting social inclusion and public value creation while simultaneously reinforcing national competitiveness and technological self-determination.

In the second phase, we carried out a deductive analysis focused on how countries conceptualize the metaverse as an innovation in digital public services, drawing upon the four stages of the Digital Public Service Innovation Framework proposed by Kshetri et al.

(2024). This framework allowed researchers to reveal how countries with varying institutional and economic contexts are conceiving the metaverse by leveraging it across four main stages: emergent, enhanced, transactional, and connected. The coding framework was jointly developed for this research and adapted to the specific characteristics of the corpus and the research objectives.

In the emergent stage, the metaverse is referred to as a channel for information (such as documentation, available services, policies, laws...in an interactive format). Similarly, the enhanced stage is characterized by one or basic two-way communication between parties offering shaped by different audiovisual and narrative features: “Using the Ministry of Economy as an example, the vision for delivery of government services in the future was shared. Users will be able to get help from the comfort of their homes and have a conversation with a service agent (as they would in real life) on the Metaverse” (Dubai Future Foundation 2022, p. 32). The transactional stage involves a two-way communication channel and involves handling processes, i.e., “Creating Dubai’s digital twin and enabling a global immersive shopping experience through Metaverse-friendly retail and real estate policies” (Dubai Future Foundation 2022, p. 32). The most advanced connected stage supports integrated services and inter-agency collaboration, for example: “The metaverse represents the further integration of the digital and real economies that will define the next generation of the digital economy” (Government of the People’s Republic of China 2023) (Table 4).

Table 4. Synthesis of countries’ interpretations of the metaverse as an innovative platform for business and citizens.

Category	Sub-Category	Codes
Emergent	Industrial-Oriented Metaverse	Not found
Enhanced	Industrial-Oriented Metaverse	Integration of information technologies, blockchain, cloud computing, virtual reality, meeting rooms, virtual business offices, holographic real-time communication, 3D reality maps, interactive virtual mapping space for the industry, immersive experiences program, immersive digital life, accessible for everyone in hubs, AI helpers.
Transactional	Industrial-Oriented Metaverse	Virtual marketplaces, digital services, marketing platform, virtual training system, immersive sales, training environment, metaverse events, metaverse tourism taskforce, global immersive shopping experience, retail and real estate policies, crypto capital, marketplaces blockchain, digital twin for merchants, global scale, attract more customers, remote work and telework, teleoperation, collaborative robotics, digital shopping guide, virtual shopping centres.
Connected	Industrial-Oriented Metaverse	Global net export hub, international exchange and cooperation, international governance, leadership, mutual benefits, win-wins, co-operation between industry, colleges, research institutes and universities, deep integration of the innovation, capital and talent chain, humane production conditions and lifestyles, identity authentication, circulation of datasets in important national science and technology projects ecosystem, SMEs are integrated, upstream and downstream sectors of the value chain collaborate and innovate, industrial parks for the metaverse, industrial cluster, open-source communities, actively participate, simulation platform to design and validate the Industrial Metaverse, assembly line, effectiveness of design planning, efficiency of industrial production, maintenance methods, production lines and their inspection, predictive maintenance, operation and inspection efficiency, service quality, personalized management systems for the entire life cycle of various products, material formula optimisation, process simulation, process planning, material calculation, material tracking, mechanisms for identifying, pricing, trading and distributing industrial data rights, monetizing value chains, supply chain financial services, equipment and order data, overcoming data barriers, industrial parks based on the comparative advantages of each region, R&D co-operation, connecting local businesses with foreign investors, collaboration among enterprises, creators, consumers and citizens, European Blockchain Services Infrastructure, open and secure Metaverse infrastructure, safe and stable use

		of identity authentication, various payments, data infrastructure, data streams into value streams, insurance, infrastructure to companies and government agencies outside of Japan, “Japan Metaverse Economic Zone”, Web3-related technologies, digital data rights management, creative industries and gaming sector, IA.
Emergent	Social-Oriented Metaverse	Suitable educational and information services, information technologies, useful information.
Enhanced	Social-Oriented Metaverse	Areas to life for visitors, immersive display systems, XR headsets, glasses-free 3D, brain-computer interfaces, cutting-edge products, richness of detail and intelligence, virtual exhibition halls, gesture control, eye movement, head tracking, motion capture, somatosensory interaction technologies, audio, emotional interaction technologies, natural interaction, field synchronisation, multi-channel sensory interaction, 5G-A/6G, optical gigabit networks/ten thousand gigabit networks, FTTR, high-speed WLAN, satellite Internet, convergence of cloud networks and other network technology innovations, online communication platforms, immersive technology, youth counselling, chat service, virtual Avatar Counselling Centre help, increase access, health care for everyone, personalized information on health care, hobbies, and other topics, personalized information in each Metaverse space.
Transactional	Social-Oriented Metaverse	Society, education, showroom and workshop for science, administration, education, culture and tourism, digital collections, XR guides products and services around cultural venues, tourist attractions, festivals, “cloud tourism”, program production and broadcasting system, tax support, document issuance, high-quality education, training programs, educate the general public, public services, pain management, mental health treatment, rehabilitation, remote diagnosis, surgery guidance, patient education.
Connected	Social-Oriented Metaverse	Prediction of disasters and accidents, emergency response and disaster recovery, virtual and digitized real floodplains, virtual construction of hazardous chemical parks and digital mines, efficiency of urban management, action for politics, administration, Europe-wide metaverse ecosystem, digital twin of the European electricity grid, realistic interaction and encounters, administration, open-source communities, actively participate, cross-platform circulation technology for data assets, international exchange and cooperation, global innovation resources, mutual support, national and international level, public private partnerships, integrated into the city’s daily operations, citizens within decentralised digital contexts, local digital twins, smart communities, optimise spatial planning and management, social, architectural, sustainable and cultural heritage dimension, virtual human twin, research and healthcare data, European Health Data Space, clinical decision-support systems, personal health forecasting tools, user-friendliness in the real world, smart city.

Source: own elaboration.

To ensure reliability, both authors independently reviewed and compared the emerging categories, discussing any discrepancies until reaching full agreement. This iterative review process strengthened the internal coherence of the analysis.

3. Results

3.1. Divergent Strategic Visions: The Metaverse as a Tool for Social Good vs. Economic Innovation

As this research is based on a qualitative documentary analysis, the results aim to identify and interpret how governmental strategies frame the metaverse within their digital policy narratives, rather than to provide quantitative evidence. The findings are therefore presented as textual evidence—quotes, categories and cross-country contrasts—rather than numerical indicators.

As the concept of the metaverse gains traction on global policy agendas, governments around the world are articulating strategic objectives that frame this emerging digital space as more than just a technological innovation. Strategic plans acknowledge the pivotal role of governments undertaken a series of proactive measures to accelerate the

development of a metaverse ecosystem. These efforts include the formulation of strategic frameworks, the provision of regulatory support, and the advancement of technological infrastructure (ICDK Seoul 2024).

Consistent with our coding, national strategies converge around two analytic dimensions: a social metaverse—public value, inclusion, services—and an industrial metaverse—competitiveness, innovation, markets.

National strategies reveal that the metaverse is not merely a platform for social engagement, but a tool for economic restructuring (Table 5). The metaverse is increasingly being constructed as a multipurpose ecosystem, whose value lies in its capacity to fulfil both public sector goals and economic ambitions. It is conceived as a virtual infrastructure capable of hosting public services, enhancing civic participation, and improving quality of life, while simultaneously enabling new business models, new modes of production, innovation, and market expansion.

This dual orientation of metaverse (industrial or business metaverse and social metaverse)—toward social utility and industrial opportunity—highlights the metaverse as a contested yet convergent space where state-led digital agendas meet both citizen-centric goals and competitive market strategies. Understanding the rationale behind these agendas requires unpacking the intertwined social and economic imperatives that shape governmental interest in metaverse development.

South Korea's case demonstrates how governments can adopt a dual approach to metaverse development, balancing social objectives aimed at public well-being, inclusion, and digital ethics, with economic objectives focused on industrial leadership, market growth, and strategic global positioning. The social perspective of the metaverse in South Korea is reflected in its use as a tool to improve public services, foster citizen inclusion, and promote ethical standards in virtual environments: "Metaverse Seoul was launched providing administrative services in the area of economy, culture and tourism, education and civil services" (ICDK Seoul 2024, p. 3). This illustrates the social dimension—municipal service delivery and inclusion—coexisting with an industrial push.

The industrial perspective is evident in viewing the metaverse as a driver of economic growth, R&D investment, technological innovation, and national competitiveness in the digital economy: "The regional hubs will provide advisory services for South Korean SMEs looking to pursue international opportunities" (ICDK Seoul 2024, p. 5).

The European Union and northern European countries, including Finland, frame the metaverse through a human-centric, values-driven lens without forgetting the industrial metaverse. Finland's national strategy explicitly seeks to position the country as "a role model in how to use the Metaverse for enhancing our quality of life, education, culture, and democracy" and to "mitigate the harmful effects of the Metaverse on our health, privacy, security, and environment" (Business Finland 2023, p. 4). The Finnish approach is underpinned by ethical principles such as well-being, freedom, openness, and trust, treating the metaverse not only as an industrial metaverse alone but as a shared public infrastructure. This inclusive model also ties in with the country's broader social policy commitments, reflecting an intention to democratize access and prevent digital exclusion.

A robust EU ecosystem is needed to integrate virtual worlds and the Web 4.0 value chain with broader industrial ecosystems, thereby fostering coherence, innovation, and scalability. This integration should be guided by a comprehensive industrial and technological roadmap for virtual worlds, aimed at aligning research, development, and deployment strategies across sectors. The European Union's strategy builds on the concept of Web 4.0 and virtual worlds to ensure that "virtual worlds reflect EU values and principles and fundamental rights, where people can be safe, confident and empowered" (European Commission 2023a). It highlights ethical governance, digital accessibility, and sustainability as cornerstones, asserting that virtual worlds "will impact the way people live, work,

create and share content” and must therefore prioritize inclusion and public trust (European Commission 2023a).

The Commission aims for a Web 4.0 and virtual worlds that reflect EU values and principles and fundamental rights, where people can be safe, confident and empowered, where people’s rights as users, consumers, workers or creators are respected, and where European businesses can develop world-leading applications, scale up and grow. The European Digital Identity will give users full control over their digital identities (European Commission 2023a).

Baden-Württemberg promotes the metaverse not only as a technological tool but as a social and business infrastructure grounded in European values and inclusive development. “CyberLÄND offers a concrete space for exchange, co-creation and knowledge transfer between business, research, the creative industries and administration” (Baden-Württemberg Ministry of Economic Affairs, Labour and Tourism 2025, p. 17). Baden-Württemberg sees the metaverse as a lever to reinforce its industrial innovation and competitiveness, especially in high-tech sectors: “There is a great opportunity to successfully transform an economic structure that has so far been strongly oriented towards industry [...] towards a broader technology-oriented and networked competitiveness” (Ibidem, p. 18).

Dubai aims to become a global economic leader in the metaverse, using it as a growth engine across strategic sectors (Dubai Future Foundation 2022). The city aims to be one of the top global metaverse economies: “The strategy aims to establish Dubai as ‘a leading Metaverse economy, and a major hub for the global Metaverse community’” (Dubai Future Foundation 2022, p. 32). However, the plan also presents the metaverse as a human-centered transformation, with significant focus on digital public services. Government services are integrated into the metaverse to increase accessibility: “Users will be able to get help from the comfort of their homes and have a conversation with a service agent [...] on the Metaverse” (Dubai Future Foundation 2022, p. 32).

Countries like China and Japan present the metaverse as a strategic economic domain, one that will determine future competitiveness, sovereignty, and industrial leadership. China’s Three-Year Action Plan emphasizes that the metaverse will “define the next generation of the digital economy” and aims to achieve “breakthroughs in metaverse technologies, industrial and administrative applications by 2025” (Government of the People’s Republic of China 2023). The overarching goal is to establish a “world-leading industrial metaverse ecosystem”, integrating digital twins, AI, blockchain, and immersive tech to transform manufacturing, logistics, and city governance (Government of the People’s Republic of China 2023).

Japan’s vision is equally ambitious. The creation of the “metaverse business” “Japan Metaverse Economic Zone” is framed as an industrial digital transformation initiative that leverages gamification and Web3 technologies to update the national economy. The infrastructure “Ryugukoku” is designed not only as a virtual space but as a multi-purpose economic platform that enables “interoperability between different metaverse platforms” and offers “identity authentication, payments, data infrastructure, and insurance” (Virtual Dimension Center 2023, p. 2). The intent is to expand this model globally and attract international companies to Japan’s digital economy.

Table 5. Description of the strategic plans analysed.

Country/Region	Key Objectives and Strategic Aims
Germany (Baden-Württemberg)	<ul style="list-style-type: none"> - Develop an open, decentralized metaverse ecosystem - Lead in XR, AI, VFX, digital twins - Support cross-sector innovation, legal clarity, and education - Build a sustainable metaverse economy and society

South Korea	<ul style="list-style-type: none"> - Become 5th largest metaverse market by 2026 - Invest in talent, infrastructure, governance, and ecosystem - Promote Metaverse Seoul as a digital public service model - Establish ethical guidelines and a legal framework
China	<ul style="list-style-type: none"> - Build a globally influential industrial metaverse by 2025 - Integrate AI, blockchain, 6G, digital twins - Promote immersive digital life and digital governance - Achieve sovereignty through innovation and standards
Dubai (UAE)	<ul style="list-style-type: none"> - Rank among top 10 global metaverse economies - Add \$4B to GDP, create 40,000 jobs by 2030 - Focus on tourism, education, gov services, retail/real estate - Drive openness, regulation, business use cases
European Union	<ul style="list-style-type: none"> - Lead globally in Web 4.0 and open virtual worlds - Ensure ethical, inclusive, interoperable digital ecosystems - Apply metaverse in education, culture, industry, healthcare - Advance standardisation, skills, sustainability, and user rights
Finland	<ul style="list-style-type: none"> - Be a global metaverse role model by 2035 - Embrace openness, well-being, trust, and sustainability - Drive adoption via 5 programs: Tech Enablers, Business Networks, Society, Health, Industry - Promote education, R&D, and international cooperation
Japan	<ul style="list-style-type: none"> - Establish “Japan Metaverse Economic Zone” using Ryugukoku infrastructure - Promote industrial digital transformation via gaming and Web3 - Enable interoperability, identity authentication, secure transactions - Address privacy, fraud, and platform responsibility with legal reforms

Source: own elaboration.

3.2. Social and Economic Drivers for Engaging with the Metaverse

3.2.1. Sustainability

The metaverse offers possibilities for environmental sustainability, particularly by reducing the need for physical travel, optimizing resource use, and facilitating virtual collaboration. These features can contribute to climate protection goals, aligning digital transformation with ecological responsibility. However, governments are increasingly acknowledging the multidimensional potential of the metaverse to support sustainability efforts—not limited to environmental aspects but also encompassing the social and economic perspective. This broadened understanding positions the metaverse as a strategic tool for advancing comprehensive sustainability agendas.

From a social perspective, the metaverse is seen as a tool to promote individual and collective well-being, by enabling inclusive access to public services, fostering community engagement, and supporting mental and emotional health through immersive environments. By contrast, the rationale for developing an industrial metaverse is rooted primarily in economic sustainability.

Governments and industries view the metaverse as a strategic enabler for sustainable industrial development, aiming to support the transition toward low-carbon and circular economies. Virtualisation of production processes or remote collaboration are expected to reduce emissions, enhance resource efficiency, and promote industrial circularity. Furthermore, the industrial metaverse facilitates the emergence of new sustainable business models by enabling innovation in how goods and services are produced, distributed, and consumed. These efforts contribute to broader sustainability goals by aligning industrial

activity with principles of economic resilience, environmental responsibility, and technological adaptability. In this sense, while the social metaverse emphasizes societal well-being and access, the industrial metaverse focuses on creating an economically sustainable infrastructure that advances climate goals through digital innovation and efficiency.

3.2.2. Building Relationships with Citizens and Consumers

Governments are increasingly exploring the development of metaverse environments to strengthen their relationship with citizens, particularly by addressing individual needs (personalisation), engaging the younger generation and involving civil society. Metaverse becomes a platform for citizens to connect to public services. The Seoul Metropolitan Government's 'Metaverse Seoul' illustrate how public authorities are deploying virtual platforms to deliver public services at the municipal level, encompassing administrative procedures, civil services, education, culture, and tourism.

Decentralized metaverse models are being explored as governance frameworks that enhance transparency, accountability, and participatory policymaking. These models promise not only scalable public service delivery but also ensure alignment with national values and priorities.

Citizen relationship building is based on national and supranational values. Some governments seek to use metaverse to promote human rights, democratic development, and international cooperation. In doing so, the metaverse becomes a space through which the public sector can foster social cohesion, uphold welfare systems, and ensure that all citizens—regardless of their background or identity—have equitable opportunities to participate, learn, and thrive. "Virtual worlds can enhance democratic participation by offering new possibilities for people to voice their ideas, opinions and concerns in more engaging ways" (European Commission 2023a).

The metaverse also enables companies to establish dynamic and interactive relationships with their stakeholders by fostering an active participation, facilitating direct customer engagement, and supporting real-time feedback and advisory interactions. Through immersive digital environments, businesses can obtain interesting information from their customers (Crespo-Pereira and Sánchez-Amboage 2025), besides providing comprehensive information about their product offerings and extend access to services beyond traditional opening hours. Moreover, the metaverse opens pathways to engage with new target groups, giving rise to an emerging demand segment characterized by the "Metaverse consumer"—a digitally native, experience-oriented user profile that seeks personalized, immersive, and continuous brand interactions within virtual ecosystems.

The metaverse presents new opportunities for consumers to actively engage in the creation of value. It necessitates a transition toward a consumer-centric model of value generation. Shifting from a product-oriented to a co-creative, consumer-driven approach fundamentally redefines the processes through which firms innovate and deliver value. Within the context of the Metaverse, this shift implies that value is co-produced through continuous and interactive exchanges between businesses and their users, underscoring the significance of personalized experiences and flexible strategies as critical factors for sustained competitiveness. Notably, the strategic plans devote limited attention to the cultivation of customer relationships.

3.2.3. Technological Independence: Web 3.0 and Web 4.0

The first so-called metaverse platforms (proto-metaverses) have largely operated under centralized architectures, wherein data, user interactions, and governance are controlled by a single corporate entity (JPMorgan 2022). This model, emblematic of the Web 2.0 era, emphasizes platform-centric ecosystems where users contribute content but relinquish control over their data. In contrast, the emerging vision of the metaverse is

increasingly aligned with the principles of Web 3.0, which advocates for decentralisation, user sovereignty, and blockchain-based governance.

Web 3.0 is the third generation of the World Wide Web. Its main features are openness, decentralisation, and users’ full empowerment enabling them to control and realise the economic value of their data, manage their online identities and participate in governing the web. Semantic web capabilities allow linking data across webpages, applications and files. Decentralized technologies and digital twins enable peer-to-peer transactions, transparency, data democracy and innovation along entire value chains. (European Commission 2023a)

In Europe, particular emphasis is placed on developing a future-oriented Web 4.0 infrastructure aligned with the European Union’s normative frameworks (Table 6). This is the only report found that emphasises the idea of transition from Web 3.0 to Web 4.0.:

Web 4.0 is the expected fourth generation of the World Wide Web. Using advanced artificial and ambient intelligence, the internet of things, trusted blockchain transactions, virtual worlds and XR capabilities, digital and real objects and environments are fully integrated and communicate with each other, enabling truly intuitive, immersive experiences, seamlessly blending the physical and digital worlds. (European Commission 2023a)

“Virtual worlds are an important enabler of Web 4.0 that can significantly revolutionise the daily lives of people and open a wide range of opportunities in many business and industrial ecosystems” (European Commission. 2023b). In this regard, virtual worlds (also metaverses), refer to “persistent, immersive environments, based on technologies including 3D and extended reality (XR), which make it possible to blend physical and digital worlds in real time” (European Commission 2025a).

The evolution of virtual worlds reflects a trajectory from early 2D digitisation to 3D virtual worlds to Web 4.0 in which the use of technologies such as VR/AR, holograms blend physical and digital realms and boost increasingly immersive, intelligent, and personalised digital environments by pervasive intelligence and real-time adaptation (European Commission 2025b).

Table 6. The evolution from Web 3.0 to Web 4.0, as conceptualised by the European Union.

Feature	Web 3.0	Web 4.0
Generation	Third generation of the World Wide Web	Fourth generation of the World Wide Web
Core Principles	Openness, decentralisation, user empowerment	Advanced artificial and ambient intelligence, integration, seamless interaction between digital and physical worlds
User Control	Users control their data, manage identities, and participate in web governance	Integration of advanced technologies to enable seamless and immersive experience. Users experience integrated, intuitive and immersive interactions through intelligent, context-aware systems.
Technological Foundations	Semantic web, decentralised technologies, digital twins, AI, blockchain, machine learning.	Maturity of immersive technologies i.e., AR/VR. Virtual worlds (metaverse). Technologies that blend physical and digital world, AI & machine learning, ambient intelligence, IoT, XR, blockchain, 5G/6G, quantum computing, BCI, multisensory modalities.
Data Handling	Semantic capabilities enable linking data across platforms; promotes data democracy	Real-time communication between digital and physical environments; supports trusted and integrated data exchange
Interactivity and Immersion	Focus on enabling peer-to-peer interactions and transparency across value chains	Emphasis on immersive, fully integrated environments where digital and physical entities interact fluidly
Governance and Innovation	Facilitates participatory governance and decentralised innovation	Driven by AI-enabled automation, pervasive intelligence, and advanced human-machine symbiosis

Source: Web 4 hub (2024); European Commission (2025b).

3.2.4. Decentralized Metaverse to Safeguard National Values and Public and Private Interests

As states increasingly acknowledge the strategic significance and sovereign implications of digital infrastructures, there is a marked shift toward the development of decentralized metaverse ecosystems that operate beyond the control of third parties. This transformation reflects broader geopolitical concerns, particularly the imperative to guarantee citizens' digital autonomy while simultaneously protecting national political and economic interests within emerging virtual environments.

The transition from the centralized logic of Web 2.0 to the decentralized architectures of Web 3.0—and its anticipated evolution toward Web 4.0—signals not only a reconfiguration of technological frameworks but also a profound reshaping of the digital economy and user agency. In this context, decentralisation is not merely a technical preference but a strategic imperative for reinforcing national digital sovereignty and ensuring equitable participation in digital ecosystems.

Governments, as supporters and regulators, play a key role in establishing enabling frameworks that support autonomous metaverse ecosystems, particularly in areas such as law, data governance, and cybersecurity. Consequently, governments are increasingly aligning their metaverse-related strategies with the foundational principles of Web 3.0, positioning decentralisation as a core pillar for promoting technological self-determination and governance. For instance, countries such as Finland have framed their metaverse policies around values of openness, transparency, and citizen empowerment, while others, like China, have leveraged metaverse infrastructures to strengthen centralized political direction and strategic digital orientation. These approaches highlight how the design and governance of virtual environments are intertwined with distinct political perspectives.

The networking of different ecosystems, the breaking up of data silos and the facilitation of cross-industry cooperation are therefore crucial components of a decentralized, open and free metaverse in which no one occupies a dominant market position or determines the formation of public opinion...Wait and see is certainly not a good strategy if we want to be co-creators as well as consumers. (Baden-Württemberg Ministry of Economic Affairs, Labour and Tourism. 2025)

On the other hand, the Chinese government states that:

We are promoting the establishment of a metaverse as a program production and broadcasting system. To this end, we are establishing a pool of virtual production and integrated VR tool, as well as a public service platform. We promote the iterative innovation of program production tools to create new forms of future television, to expand the capabilities of media services to enrich people's mental world (Government of the People's Republic of China 2023).

The capacity of states to shape, regulate, and control these spaces will determine not only their technological competitiveness but also their ability to uphold national or supra-national values. Thus, debates surrounding user autonomy, infrastructure decentralisation, and digital governance are no longer confined to the realm of technology policy but are increasingly central to the broader contest over geopolitical power in the digital age.

In the current geopolitical landscape, the pursuit of digital sovereignty and strategic oversight over virtual infrastructures is becoming essential to long-term economic resilience and national security. The decentralized metaverse fosters greater technological autonomy, allowing public sector and enterprises to reduce reliance on dominant intermediaries and align their operations with open standards and interoperable infrastructures. Interoperability makes possible to interconnect digital public services:

Examples of services that can benefit from this include recognition of diplomas or professional qualifications, exchange of vehicle data for road safety, access to social security and health data, information exchange related to taxation, customs, public tender accreditation, digital driving licenses, or commercial registers. (European Commission, Joint Research Centre 2024)

The decentralized metaverse is not merely a technological evolution but a source of significant business value, offering firms a pathway to innovate, differentiate, and lead in emerging virtual economies. By participating in the design and governance of metaverse infrastructures, firms can secure influence across critical segments of the value chain, from digital identity and immersive experience design to transaction systems and virtual asset management.

3.2.5. Decentralized Metaverse to Ensure Users' Digital Autonomy

The metaverse can be conceptualized as a complex and expansive digital ecosystem, underpinned by a convergence of foundational technologies such as Artificial Intelligence (AI), the Internet of Things (IoT), Big Data, and Extended Reality (XR) (Bibri and Allam 2022). Web 4.0 environments rely on extensive personal data—including physical, neurological, behavioural, and emotional information—combined with advanced AI algorithms to deliver highly personalised and predictive services (European Commission 2025a). AI-powered technologies—encompassing natural language processing, machine vision, blockchain, advanced networking, digital twins, and neural interfaces—exhibit considerable potential to enhance metaverse platforms by enabling more intelligent, responsive, and immersive environments (Lnenicka et al. 2024). These technologies collectively facilitate the large-scale collection, processing, and analysis of user data, shaping hyper-personalized experiences and redefining modes of interaction in virtual spaces (Lnenicka et al. 2024; Crespo-Pereira and Sánchez-Amboage 2025).

While access to digital content and user data is essential for improving user experiences and enabling the hyper-personalisation of public and private services, the increasing reliance on data-intensive technologies such as AI and big data introduces critical ethical, legal, and security concerns (Crespo-Pereira and Sánchez-Amboage 2025).

Certainly, previous research evidences four key areas of concern in metaverse governance involving people: surveillance risks, regulatory and legal issues, data management, ethical concerns, implications for individuals (Wan and Ho 2024), privacy, safety and inclusion (Egliston et al. 2024).

Technologies may be exploited to manipulate user behaviour, construct deceptive digital identities, or spread coercive and emotionally targeted content. Various actors, including private companies, governments, and malicious entities, could misuse digital identities, surveillance tools, and algorithmic amplification to suppress dissent, distort public discourse, and create harmful echo chambers. The misuse of biometric and behavioural data heightens the risk of emotional manipulation, harassment, and even real-world violence (European Commission 2025a).

Key challenges include the protection of personal information, mitigation of algorithmic bias, and assurance of transparency and accountability in automated decision-making systems. These concerns become particularly salient in metaverse contexts, where the immersive and decentralized nature of interactions complicates data governance and oversight. The integration of AI, blockchain, and digital twins in public service provision through the metaverse amplifies these challenges, necessitating the implementation of robust regulatory frameworks, advanced technical safeguards, and the development of normative standards that guide ethical data usage (Lnenicka et al. 2024).

MMP is an authentication certificate with a payment function that allows users to freely travel to and from Metaverse services within RYUGUKOKU (TBD). In addition to ID authentication and payment methods, MMP can register useful information for users to spend time in the virtual world, such as NFT, items, avatar skin, and avatar memory. This information will also be used to improve user-friendliness in the real world. (Virtual Dimension Center 2023, p. 3)

In this context, user autonomy—understood as the individual’s ability to control their data, decisions, and digital presence—emerges as a critical axis of analysis. Unlike conventional digital platforms, existing privacy control mechanisms may be inadequate for the complexities of social interaction in the metaverse. For example, when users participate in commercial activities such as browsing or purchasing virtual goods, their avatars’ behaviours, movement histories, and transaction records may be tracked and stored. If misused, such data could be exploited to infringe upon user privacy. Moreover, the metaverse generates and accumulates vast quantities of highly granular personal data—including user preferences, behavioural patterns, and communicative interactions—requiring the integration of advanced privacy and security protocols from the outset of system design (Wang et al. 2023).

To safeguard user autonomy in this evolving digital paradigm, developers must implement stringent data access controls and establish mechanisms that allow users to manage their own data profiles. Furthermore, as the metaverse becomes a cornerstone of next-generation digital infrastructure, it is essential to develop flexible and adaptive legal frameworks that can respond to the pace of technological advancement while ensuring the protection of fundamental rights (Wang et al. 2023; Lnenicka et al. 2024). Such frameworks must not only guarantee privacy and data security but also reinforce the user’s role as an active agent within immersive virtual environments—empowered to make informed choices, negotiate consent, and assert control over their digital identity.

3.2.6. Social and Industrial Metaverse as a Competitive Advantage Platform

The industrial metaverse exemplifies a multidimensional innovation landscape that cuts across operational processes, product development, marketing strategies, and business models. Its deployment not only enhances industrial performance but also reshapes the very foundations of how businesses generate value and maintain competitiveness in the digital age (Cristache et al. 2024).

The industrial metaverse refers to a digitally constructed environment designed to replicate and simulate physical assets such as machinery, manufacturing facilities, urban infrastructure, energy grids, and transportation networks. Through the convergence of advanced technologies—including cloud and edge computing, industrial artificial intelligence, and digital twin systems—this concept enhances process optimisation and fosters the implementation of sustainable practices, extending its relevance beyond simulation into the realm of transformative industrial innovation (Siemens 2025).

For process-oriented manufacturing industries such as iron and steel, textiles and electricity, we are promoting the application of the Industrial Metaverse in key scenarios such as material formula optimization and process simulation, and expanding the capacity of predictive services such as process planning, material calculation and material tracking. This will strengthen the predictive capabilities of process planning, material calculation, material tracking, etc. (Government of the People’s Republic of China 2023)

The strategic significance of the industrial metaverse lies in its capacity to secure future competitiveness and promote economic resilience through digital infrastructure development. All forms of innovation converge to generate competitive advantage, which

is understood as the combination of distinctive attributes, strategies, or resources that allow a firm to outperform competitors in a market context (Arjang et al. 2023). The metaverse functions as both a technological enabler and a strategic framework for value creation, offering firms opportunities to redefine their operations, customer relations, and innovation strategies. For example, in cultural and creative industries virtual worlds provide alternative ways to create, promote and distribute content and engage audiences (European Commission 2023b).

At its core, the industrial metaverse represents a profound form of process innovation. Metaverse is anticipated to strengthen cooperation between suppliers and manufacturers and stimulate cross-sector innovation, contributing to a more resilient business ecosystem. By enabling real-time simulation and monitoring of industrial systems, it allows for early identification, analysis, and resolution of potential issues—often even before they arise. This predictive and preventive capability enhances the efficiency, resilience, and safety of industrial operations across sectors.

As applications for virtual worlds expand, there is a wealth of opportunities for European businesses, to develop products, services and high-value content catering to the needs of different users, and take advantage of innovative new business models (...). A range of new industrial applications is emerging focusing on different areas of production, such as product designs, quality testing, engineering, manufacturing, maintenance and training (...). (European Commission 2023a)

While process optimisation is central, the industrial metaverse also enables product innovation through immersive and interactive technologies such as Extended Reality (XR) and Virtual Reality (VR). In doing so, it supports broader goals of decarbonisation and dematerialisation in product design (Siemens 2025). These tools facilitate the development of new offerings that are not only more tailored to consumer demands but also more effectively visualized and tested before deployment. The advancement of core technologies enabling a hyper-realistic metaverse is expected to drive significant innovation within the creative industries (live entertainment, media, film, and gaming industries) (ICDK Seoul 2024; Baden-Württemberg Ministry of Economic Affairs, Labour and Tourism 2025).

The industrial metaverse further enables marketing innovation by transforming how companies engage with clients and stakeholders. Through virtual platforms and immersive interfaces, businesses can co-create experiences that align more closely with evolving consumer expectations. The convergence of physical and digital environments fosters new forms of interaction, such as virtual marketplaces and digitally delivered services, which redefine how value is communicated and exchanged (Baden-Württemberg Ministry of Economic Affairs, Labour and Tourism 2025).

As a strategic component of state-led digital transformation initiatives, the metaverse enhances governmental capacity to innovate and compete in key domains such as education, healthcare, and the overall quality and efficiency of public services. This is particularly salient in the Western countries under analysis, where the integration of immersive technologies and inter-institutional collaboration align with broader objectives to modernize the public sector, strengthen institutional networks, and deliver citizen-centred services through digitally enabled infrastructures.

3.2.7. Metaverse as a Platform for Brand Image and Notoriety

The metaverse offers firms novel channels for audience engagement, narrative construction, and reputational differentiation within highly digitized consumer environments. The academia points out metaverse as a powerful tool for branding, enhancing brand awareness and reinforcing corporate image through immersive and interactive

experiences (Barrera and Shah 2023; Kniazeva et al. 2023; SanMiguel et al. 2024). However, the analysis reveals that this rationale is only marginally addressed in strategic plans. Specifically, only one of the documents in the corpus explicitly highlights the benefit of the metaverse to strengthen brand visibility: “Improvement of the company image and brand awareness” (Baden-Württemberg Ministry of Economic Affairs, Labour and Tourism 2025).

The metaverse’s function as a branding platform remains underexplored in strategic plans. While company image and brand awareness are among the less frequently cited motivations for adopting metaverse technologies, they nonetheless represent a relevant strategic consideration. The immersive and interactive nature of the Metaverse allows firms to project their brand identities in novel and engaging ways, fostering deeper emotional connections with users and enhancing visibility in increasingly digital marketplaces.

3.3. Understanding the Strategic Approach of the Metaverse

3.3.1. Metaverse as a Connected Platform

Drawing upon the adaptation of the four stages proposed by Kshetri et al. (2024) to metaverse as national and supranational strategic ecosystem, it becomes evident that the metaverse is conceptualized within its most advanced phase—the connected stage.

The metaverse is intended to foster a synergistic industrial ecosystem grounded in multi-stakeholder collaboration and interconnected value creation. The metaverse is envisioned as an ecosystem where public–private cooperation that promotes mutual benefits and win-win collaborations among industries, small and medium-sized enterprises (SMEs), institutions, research institutes, universities and consumers and citizens, ensuring the deep integration of technological innovation, capital, and talent.

We will create industrial innovation consortia and build an ecosystem where large enterprises and SMEs are integrated, develop, and where upstream and downstream sectors of the value chain collaborate and innovate. We will promote the establishment of pioneer zones, science, technology and industrial parks for the metaverse. We will create innovations and applications based on our industrial base in order to create distinctive metaverse industrial clusters (Government of the People’s Republic of China 2023).

This stage is characterized by the provision of integrated services and enhanced inter-agency collaboration, reflecting a mature and interconnected digital ecosystem. In this regard, EU’s Web 4.0 is expected to profoundly transform numerous sectors through the integration of advanced artificial intelligence, real-time data exchange, and seamless interaction between digital and physical systems (European Commission 2025b).

In health care, Web 4.0 promotes remote patient monitoring, AI-assisted diagnostics, and even robotic or remote surgery. The education sector will benefit from highly personalised and virtualised learning environments tailored to individual needs and cognitive profiles. In manufacturing and industry, IoT sensors combined with AI-driven analytics will optimise production processes, enable predictive maintenance, enhance supply chain transparency, and allow real-time tracking and inventory control. Entertainment and gaming will see increasingly immersive and realistic 3D simulations alongside customised gaming experiences. Financial services will leverage AI for real-time fraud detection and ensure secure, transparent financial transactions through blockchain and other trust-based technologies. Transportation systems will evolve with the deployment of autonomous vehicles capable of communicating with each other and with smart traffic infrastructure, forming the backbone of intelligent mobility networks. Within smart cities, traffic flow and energy consumption will be dynamically managed through interconnected urban infrastructures. Energy management will rely on smart grids capable of balancing energy supply and demand across regions. Environmental monitoring will become more

precise, enabling the detection of air and water quality changes and providing early warnings for natural disasters. In the realm of public safety, predictive policing and AI-powered surveillance systems will be used to predictive policing applications. Finally, smart homes will allow residents to remotely control lighting, heating, security, and appliances, enabling greater efficiency, comfort, and autonomy in everyday life (European Commission 2025b).

The concept of digital twins has emerged as a pivotal component in the development of advanced digital ecosystems, offering accurate 3D virtual replicas of physical entities that enable real-time monitoring, simulation, and optimisation (European Commission 2023b). Their application spans various domains, with particularly significant implications in the social and industrial sphere, with the aim to provide advance knowledge and to make informed, data-driven decisions.

For industrial purposes, in manufacturing, digital twins play a crucial role in process optimisation (Ball 2022). By creating a virtual representation of machinery, production lines, or entire facilities, companies can continuously analyse performance, detect anomalies, and predict maintenance needs. This leads to reduced downtime, improved productivity, cost savings and sustainable practices (European Commission 2023b).

Digital twins act in the context of smart and sustainable cities and communities, (i.e., CitiVerse) and for the development of the Virtual Human Twins (in the EU). In the context of smart communities, local digital twins serve as dynamic platforms for managing urban infrastructure, energy systems, transportation networks, and public services. These localized models integrate data from IoT devices, sensors, and urban management systems to provide a real-time overview of city operations. By simulating different scenarios—such as traffic flows, energy consumption patterns, or emergency responses—local digital twins empower policymakers and urban planners to make data-driven decisions that enhance efficiency, improve quality of life, and promote sustainable urban development.

Virtual environments make it possible to optimize traffic circulation through real-time simulations, which helps reduce congestion and lower pollutant emissions (European Commission 2023a). Also, digital twins enable innovation in personalized healthcare and clinical decision-making through health forecasting via the development of sophisticated virtual models.

In the field of public health, the Commission will support the development of the European Virtual Human Twin, which will digitally replicate the human body, by bringing together cutting-edge digital technologies, access to high-performance computing and access to research and healthcare data facilitated by the European Health Data Space. This Virtual Human Twin flagship will serve clinical decision-support systems, personal health forecasting tools and personalised medicine approaches (European Commission 2023a).

By recreating emergency situations and surgical procedures, as well as enabling three-dimensional interaction with the human body, students and professionals can be trained for specific medical scenarios, surgical complication risks can be minimized, and diagnostic accuracy can be enhanced. (European Commission 2023a).

Digital twins also enable innovation in cultural heritage preservation. They “can support the preservation or reconstruction of cultural heritage buildings, such as for Notre Dame Cathedral in Paris” (European Commission 2023a).

3.3.2. Metaverse as a Transactional Platform

The metaverse is also envisioned as a transactional platform through which citizens and consumers engage with public services or private enterprises to carry out processes and transactions in an immersive digital environment. The transactional features of the metaverse collectively establish it as a dynamic space for public service delivery,

positioning it as a platform that enables innovation in the provision of administrative and bureaucratic functions.

Within this immersive environment, users—whether citizens (G2C) or organisations (G2B)—can interact with virtual interfaces to complete tasks such as processing official documents, submitting applications, or accessing government services. It functions as a virtual hub for public services, including tax support and document issuance. This transformation reflects a shift from static, institution-centred models to user-oriented digital ecosystems, where the metaverse facilitates real-time, seamless transactional interaction between service providers and users.

In the field of education, the metaverse provides high-quality training programs and educates the general public providing immersive training environments.

“In education and training, a more experiential learning process can help learners grasp abstract or complex subjects more easily, accelerating their learning and understanding of the world” (European Commission 2023a).

The transactional features of the metaverse collectively position it as a dynamic and evolving economic space, functioning as transformative business infrastructure that enables real-time trade and knowledge exchange with an international audience that transcends physical and geographical limitations. Within this framework, digital twins play a pivotal role for merchants. Immersive sales environments—featuring digital shopping assistants, interactive product displays, and virtual shopping centres—redefine traditional consumer experience and the very nature of commercial spaces. Moreover, the integration of virtual marketplaces and blockchain-based platforms facilitates transactions at a global scale, underpinned using cryptocurrencies and digital financial services that ensure secure exchanges. Collectively, these elements underscore the metaverse’s potential as a transformative arena for global economic activity.

3.3.3. Metaverse as an Enhanced Platform

The categorisation of actions within the “enhanced” stage—following the framework proposed by Kshetri et al. (2024)—relies on the identification of bidirectional communication that does not necessarily involve transactional or connected approaches. In this context, enhanced stage refers to the bidirectional transmission of information enriched by sensory technologies associated with the metaverse. Unless interaction is explicitly linked to connected or transactional processes, it remains classified within the enhanced stage.

Metaverse technologies facilitate the creation of highly interactive and immersive environments to promote bidirectional communication in virtual spaces such as meeting rooms, virtual business offices, and virtual exhibition halls. AI helpers and immersive display systems (XR headsets, VR, brain-computer interfaces...) enhance the richness of detail and intelligence and offering immersive interaction in real time. 3D reality maps and interactive virtual mapping spaces also provide an immersive digital life accessible to users. Thus, the metaverse redefines communication by merging metaverse-related technologies (VR, AR, XR) with intelligent systems (AI) to foster continuous tailored immersive and sensorial interaction.

We strive for breakthroughs in gesture control, eye movement, head tracking, motion capture and other somatosensory interaction technologies as well as audio, and emotional interaction technologies. We design pioneering new displays, myoelectric sensing, etc. to achieve natural interaction based on people and objects, field synchronisation based on natural interaction. We promote the development of the fusion of multi-channel sensory interaction. (Government of the People’s Republic of China 2023)

Online and immersive communication platforms and AI helpers provide users counselling and chat services to access personalized information on health, hobbies, and other areas of interest. “For example, the Virtual Avatar Counselling Centre helps young citizens find support with issues that can be intimidating to speak face-to-face” (ICDK Seoul 2024).

4. Discussion

The metaverse can be referred to as a strategic channel for both public administration and industry, offering distinct yet complementary modes of engagement aligned with the stages defined in the Digital Public Service Innovation Framework (Kshetri et al. 2024) (Table 7).

In the public sector, there are three prevailing approaches: enhanced, transactional and connected. The enhanced stage is characterized by the enriched transmission of information through immersive technologies and bidirectional communication facilitated by AI-driven virtual assistants. This modality enables more dynamic citizen interaction. In parallel, a transactional approach is emerging, wherein the metaverse serves as a digital interface through which citizens can complete administrative procedures, access services, and navigate public-sector processes in a more intuitive and personalized manner. Moreover, elements of a connected approach are beginning to materialize through the implementation of digital twins—virtual replicas of public assets and infrastructures—which support data-driven decision-making and resource management, thereby fostering greater inter-agency coordination and systemic efficiency in many domains (health, culture, public resources management).

Besides the importance of citizenship in the plans analysed, the role of the people as active participants in democratic processes within virtual environments is largely absent from current strategic discourse. Explicit references to the metaverse as an active space for public opinion polling or the extraction of strategic insights are absent.

Table 7. Metaverse approaches. Matrix by sector.

	Public sector	Industrial sector
Enhanced	Bidirectional communication with AI helpers	-
Transactional	Administrative procedures via immersive platforms	Global commercialisation through immersive marketplaces
Connected	Digital twins for data-driven public resource management	Digital twins for process optimisation and supply chain collaboration

Source: own elaboration.

In the industrial domain, the metaverse functions as a strategic ecosystem aligned with both connected and transactional logics. The connected model is reflected in the deployment of industrial digital twins, which allow for real-time monitoring, predictive analytics, and optimisation of production processes. These digital representations enable collaborative decision-making across the value chain, integrating upstream and downstream actors in a seamless, data-informed workflow.

The transactional dimension of the industrial Metaverse facilitates direct-to-consumer engagement through immersive, borderless marketplaces that enhance global commercial outreach. Through virtual storefronts, blockchain-enabled transactions, and immersive product experiences, firms can expand their market presence and deliver value in novel, consumer-centric ways. However, metaverse characterizes as an ecosystem facilitating user interaction and trade across various domains.

Metaverse allows users to participate in the digital economy by creating and monetizing their created assets. The Generation Z will be the principal force driving this economic shift, contributing approximately US\$33 trillion in digital expenditure over the next decade, largely within the Metaverse environment (Dubai Future Foundation 2022). A thorough review of the uploaded strategic documents revealed some references to user participation in content creation: "...encourage users to actively participate in technological innovation and the production of metaverse content" (Government of the People's Republic of China 2023). Nevertheless, users' active participation in the digital economy is rarely theorized as central to the metaverse strategic ecosystem. "Users can collaborate, socialize, communicate, and trade freely in the metaverse. The interaction can become more inclusive and combine multiple spaces, both physical and digital." (Business Finland 2023). On the other hand, European Commission say that "Virtual worlds in video games already provide spaces where millions of people can create and monetise content and explore and have meaningful interactions" (European Commission 2023a).

Individual users can also become a creator for avatars or contents. They can create items for avatars such as clothes and accessories or customize or repaint the avatars. Through these activities, the creators can monetize and contribute to activation of the platform. Monetisation is done through ZEM, a virtual currency within Zepeto (ICDK Seoul 2024).

Metaverse has the potential to incorporate the user as a central element in the digital economy yet reports analysed fail to develop this notion as a strategic component. Emphasizing the role of users in generating and monetizing content would align with emerging trends in digital ownership, decentralized platforms, and participatory economies.

5. Conclusions

Web 3.0 and Web 4.0 emerge as the paradigmatic foundations reshaping national digital ecosystems through the principle of digital sovereignty and technological integration. Countries aspiring to lead the technological transition toward the metaverse emphasize decentralisation as a means of preventing concentration of power in the hands of a few actors. Decentralisation is therefore conceived as a pathway to establish global standards for open, secure, fair, inclusive, and interoperable virtual worlds that serve both business and citizens. Beyond sovereignty, governments also promote the metaverse in pursuit of broader social and business objectives, including social and environmental sustainability, competitive advantage, and stakeholder relationship building.

In response to RQ1, the analysis shows that national governments are increasingly promoting the development of metaverse ecosystems as part of broader digital transformation agendas. However, their motivations differ: while some frame the metaverse as a social infrastructure to enhance public services, participation and inclusion—South Korea, Finland, EU—others emphasise its role as an industrial infrastructure for competitiveness, innovation and digital sovereignty—China, Japan, Dubai.

Regarding RQ2, governments adopt two main strategic approaches: a human-centric model grounded in ethical governance and accessibility (EU, Finland), and a techno-industrial model focused on market growth, industrial leadership and geopolitical positioning (China, Japan, Dubai). Most strategies exhibit a hybrid pattern, combining civic and economic rationales within a connected policy framework.

The metaverse can be categorized along two complementary dimensions: the social metaverse, oriented toward improving public service delivery, and the industrial metaverse, focused on business and economic applications. National strategies diverge in their prioritisation of these dimensions: while the European Union adopts a balanced approach that integrates both, China primarily emphasizes business-oriented applications, despite acknowledging potential for public-sector uses.

For industry, the metaverse serves as a strategic channel. A connected approach enables data-driven decision-making and coordination across upstream and downstream segments of the value chain. A transactional approach provides a direct route for global commercialisation to consumers. In the public sector, the metaverse functions as a strategic channel under three complementary approaches. The enhanced approach is characterized by rich, bidirectional information exchange mediated by AI assistants. The transactional approach enables citizens to access e-government services and complete administrative procedures. The connected approach integrates digital twins, supporting data-driven decisions in the management of public resources.

Although some strategic plans acknowledge the involvement of various stakeholders in shaping the strategic plans, reports rarely assign a central and participatory role to users/citizens/prosumer/consumer themselves within the metaverse ecosystem. Interestingly, strategic plans rarely articulate the explicit role of citizens in democratic or institutional process participation and overlook the user as a co-creator of value within the evolving digital economy. This reflects a predominant role of institutions and industry on the conformation of a metaverse ecosystem, with limited emphasis on fostering meaningful, user-centred participation in both democratic and economic dimensions of virtual worlds.

This suggests that future public strategies should move beyond institutional design to embrace citizens as active co-creators within virtual governance ecosystems.

6. Limitations

This study presents several observations that should be acknowledged. First, the strategic plans and reports analysed were sourced from secondary materials, which had been translated into English by the original provider. Consequently, there is a possibility that linguistic nuances and context-specific meanings present in the original language may have been lost or modified during the translation process, potentially affecting the accuracy of the analysis. The study offers an aggregated information of strategical plans to enable a general interpretative framework. Future research may build upon this foundation by conducting a comparative analysis of the sample, offering more granular insights into national-level approaches and divergences. The sample of strategic plans reflects the current availability of documents at the time of analysis. It could be expanded in future research as more national or regional strategic plans are published and made accessible.

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