

Exploration of the future of the metaverse and Intelligent cities

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Abstract -In 2022, the metaverse emerged as one of the most significant technology trends, as "The Economist" highlighted. This trend is exemplified by milestones such as the listing of Roblox on NASDAQ, marking it as the "first Metaverse stock," the establishment of a "Metaverse city" in Seoul, and the introduction of "inter-temporal interviews of Metaverse" during the National Assembly sessions in China. The discourse surrounding the metaverse has evolved beyond conceptual interpretations to explore its potential applications, diversifying topics and subjects. Despite being a relatively new research field, academic inquiry into the metaverse has made substantial progress, propelled by interdisciplinary efforts worldwide. This paper systematically compares current research hotspots on the metaverse globally and domestically, offering prospective insights into its integration and development with smart cities. Doing so aims to provide theoretical references and inspire future research endeavors. The metaverse is transitioning from conceptual and theoretical exploration to practical implementation and industrial application, setting the stage for its rapid development and integration with innovative city initiatives.

Keywords: Metaverse, technology trends, Roblox, NASDAQ, intelligent cities, interdisciplinary research, academic inquiry, industrial application.

I. INTRODUCTION

The metaverse has recently taken off on the Internet and quickly expanded into other domains. Numerous domestic and international Technology companies are opening up shops in areas relevant to the metaverse. For instance, the metaverse concept was first mentioned in the prospectus of the "Sandbox" game platform "Roblox" as early as March 2021, when it was listed on the New York Stock Exchange in the United States and became a "dark horse" in the global stock market when its closing price increased by 54% on the first day and its market worth surpassed 40 billion US dollars. This strong growth in associated metaverse technological idea equities both domestically and internationally followed. Microsoft's Chairman and CEO, Satya Nadella, pledged to "build the enterprise metaverse" in July 2021. "In October 2021, Facebook CEO Mark Zuckerberg announced the creation of "metaverse" product team and later updated the

name of the parent company to "Meta." "Baidu launched "XiRang," the first metaverse space product in China, in December 2021. ByteDance also made investments in the metaverse space, leveraging its extensive product matrix; Tencent leveraged its design + content to establish the metaverse field; NVIDIA introduced the Omniverse, a real-time simulation and collaboration platform that allows businesses to create a shared virtual three-dimensional world; and gaming companies like NetEase, MiHoYo, and ZQGame are also making inroads in this domain. Prominent global consulting businesses, exemplified by Price Waterhouse Coopers and Bloomberg, are optimistic about the metaverse's growth and prospects. Bloomberg predicts the metaverse market will grow to \$1.5 trillion by 2030, from \$800 billion in 2024. Topics about the metaverse are quickly breaking out from one another and are receiving a lot of market and social attention. This demonstrates how the metaverse has quickly gained popularity due to people's attention drawn to it. The "metaverse" period is here and now, not some distant future [1].

A. THE METAVERSE'S ORIGIN AND CONCEPTS

The phrase "Metaverse" refers to a three-dimensional space that is separated from and parallel to the physical world, and it first appears in the science fiction novel "Snow Crash" by well-known American science fiction author Neal Stephenson in 1992. Through "avatar" digital images, users can engage with the online virtual world and live and work there. Science fiction authors began to acknowledge the existence of a virtual network world called the "metaverse," which is parallel to the real world, after "Snow Crash" gained widespread attention. The book's depiction of a technologically simulated society allowed readers' imaginations to run wild. But neither the critic nor the author could have predicted that thirty years later, the idea. [2]



Fig. 1. Development timeline of the Metaverse.

Science fiction movies began constructing the metaverse, and "The Matrix" from 1999 presented yet another virtual universe. The virtual environment discussed before was further developed and explained in Tron, a movie released in 2010. Spielberg's science fiction picture "Ready Player One" popularized the idea of the metaverse. It will become a part of human society in the future, and those who lack motivation in real life use the metaverse as a platform for self-expression and venting. Numerous games have also fully included the metaverse. One example is Linden Lab's "Second Life," released in 2003, which describes a revolutionary and unique virtual environment where users may interact, shop, construct, and conduct business. It is more than a game now; it is an advanced, wealthier virtual economy. It has become more than just a game and now features a sophisticated virtual economy. Games based on metaverse themes, such as "Ninth City," "My World," "Village of Hope," and "Second Galaxy," are currently in full swing. The metaverse landscape has undergone constant enhancements and expansions Fig. 1. The ideal metaverse is more likely to be unlimited in scope, with these systems forming a relatively complete civilization with one another rather than being restricted to entertainment, trade, and social interactions. [3]

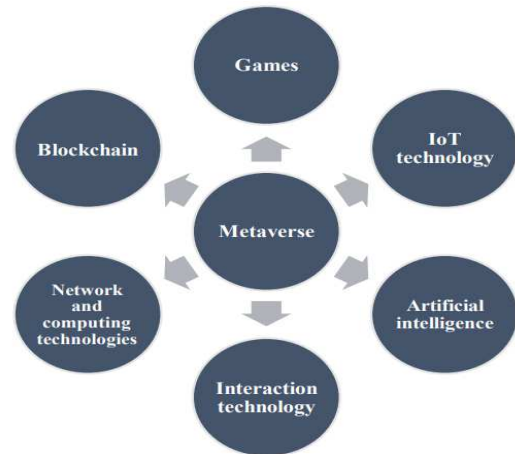
II. THE CONCEPT OF THE METAVERSE

The "metaverse" is not universally understood, and the major Internet companies have differing perspectives. The "metaverse" created by Mark Zuckerberg combines the virtual and the real. They are reducing the distance between the planet and us. NVIDIA's "metaverse" aims to enhance industry planning and practical efficiency by bringing the real world into the virtual realm through total replication. According to MiHoYo, the "metaverse" is a living

community that continues. According to Roblox, eight components comprise the "metaverse": identity, friends, immersion, low latency, diversity, anywhere and anytime, economic system, and civilization.

The "metaverse" consists of three virtual realms: an online virtual world replicating the real world, a virtual space that exists independently of the natural world, and an increasingly lifelike digital realm. In a research paper on the evolution of the metaverse from 2020 to 2021, the New Media Research Center at Tsinghua University's School of Journalism and Communication provided a commonly accepted definition of "metaverse": The term "metaverse" describes a brand-new category of social media and Internet applications that combines blockchain, artificial intelligence, interaction, and virtual space technologies with other cutting-edge innovations. Its foundations include digital twin technology, which creates a mirror image of the natural world; extended reality technology, which offers immersive experiences; and blockchain technology, which creates an economic system that closely combines the virtual and physical worlds in terms of identity, social, and financial systems and lets each user create and modify content. Virtual space provides the opportunity for sociability, blurring the line between reality and virtual reality due to the tremendous growth of cyberspace and the quick development of extended reality technologies, particularly under the influence of COVID-19. [4]

The line separating real and virtual space is becoming hazier since virtual space allows for socialization. The following are the primary core technologies of the "metaverse," which is not a technology but an idea and concept that calls for integrating various new technologies Fig. 2.



Source: This study.

Fig. 2. Overview plot of metaverse.

A. Games:

the metaverse's first landing scene Players can rely on this virtual identity to socialize within the game, which is essentially the beginning of a metaverse. The game is often regarded as the first portal to the metaverse.

B. Blockchain:

the fundamental design that allows for a decentralized economy The metaverse requires the creation of a separate, autonomous economic system. Blockchain technology ensures the transparent and practical application of system

rules and can be used to realize the flow of value inside the metaverse through intelligent contracts.

C. Technologies related to networks and computers

Edge computing with 5G/6G for reduced latency High synchronization and minimal latency are necessary for the metaverse to provide consumers with a flawless, seamless, real-time experience. [5]

The metaverse depends on a robust communication infrastructure and demands fast transmission of massive volumes of data. The actual 5G transmission rate may find it challenging to reach its design level due to base station constraints, but 6G latency is predicted to be reduced to one-tenth of 5G, and the transmission rate to get 50 times 5G, which is anticipated to truly realize the critical feature of low latency in the metaverse. These predictions are based on the Japanese and Korean 6G network technology outlook. Furthermore, edge computing is frequently seen as a crucial component of the metaverse's architecture, assisting users in recharging their local computing resources, enhancing processing effectiveness, and lowering the danger of network latency and congestion by implementing an open platform close to the data source and offering the closest service end nearby. [6]

D. Technology for interaction:

enhance user immersion; metaverse must progress How a game operates has evolved, starting with the first mouse and keyboard and continuing with modern VR/AR gadgets. Players can enjoy an immersive virtual reality by using a range of gadgets, including body suits and fully automated haptic chairs, that gather player data and provide players with real-time input. This allows players to map in the virtual realm more realistically. The ultimate form of development is to use brain-computer interface technology to actualize perceptual experiences like taste and smell while allowing users to interact with the virtual environment freely and extensively, increasing immersion and realism.

E. Synthetic intelligence:

A supplementary technology for creating virtual environments, the metaverse now has diversity and immersion because of advancements in computer vision, machine learning, natural language processing, and intelligent speech. These technologies have also given the metaverse a combined virtual and realistic picture. [7]

F. Internet of Things technology:

Satisfying the need for a variety of metaverse access methods/IoT technology can enable the metaverse to sense external sources of information while satisfying the need to access the metaverse in various ways, at any time and from any location. Easy access is one of the criteria of the metaverse, so people's interactions with the Internet will extend beyond computers and smartphones to include a variety of wearable gadgets, cars, homes, and other linked objects. Furthermore, IoT sensors represent an expansion of the human senses, which can guarantee that the metaverse world gathers more data on the external environment. [8]

III. CURRENT RESEARCH AND APPLICATIONS OF METAVERSE

The Metaverse Study Scholars, both domestically and internationally, have studied the metaverse extensively since its launch in 2021, focusing on three primary areas.

- Investigating the ontology of the metaverse mainly relates to studies on the idea, mode, technology, and other facets of the metaverse, which is the primary area of interest for early-career academics. According to Wright et al., the metaverse is a new kind of interaction space for augmented reality created when several nodes in the natural and virtual worlds come into contact and overlap. According to Lingzhi Fang et al., virtualization is the pinnacle of Internet progress, and the metaverse is the inevitable path of social informatics.
- Examination of the metaverse theoretically mainly relates to the investigation of the particular representation of theoretical models built in conventional contexts in the metaverse.
- Studying information and users as the two primary subjects can help us better understand how metaverse users behave when using information, which will help us promote metaverse applications.
- By analyzing the ideal order of the metaverse, policy recommendations for metaverse governance can be obtained by comparing the governance structures of four distinct degrees of interconnectivity using incomplete contract theory.

In practice, research on the metaverse mainly involves investigating the effects of its creation and growth across multiple domains. Researchers from both domestic and international universities have extensively studied the metaverse's use in commerce, politics, entertainment, education, and other fields. Nonetheless, most previous research has focused on theoretical framework discussions, and few studies examine the metaverse realization path from a requirements viewpoint. [9]

A. Utilizing the Metaverse

The "metaverse" has emerged as the industry and capital market's latest darling. Many businesses promise to transition to the "metaverse" and a flood of cash. The "metaverse" has emerged as a new hotspot almost immediately within the Internet sector. Since "metaverse" technology is still in its early stages of development, it is essential to approach its implementation and any future developments with reason and practicality. With the advancement of technology, the use of the metaverse will become more complex. In the short term, offering users immersive experiences in education, cultural and tourism activities, and social entertainment and training will be the primary "metaverse" technology application scenarios. Providing a technology simulation platform for technology research and development will most likely be the primary use case for "metaverse" technology in the medium term. Long-term "metaverse" technology applications will probably be significant in information, earth, space, life, material, and marine sciences. [10]

The industry's current formats can be improved via the "metaverse." The evolution of information technology and its applications, from "Internet+," "Big Data+," "Artificial Intelligence+," and "Metaverse+," will undoubtedly revolutionize the way that information technology is integrated with the economy and society.

Several things must be considered when creating and promoting "metaverse" technologies. While growing the "metaverse," more research must be done on the "metaverse" application scenarios that affect service comprehensiveness

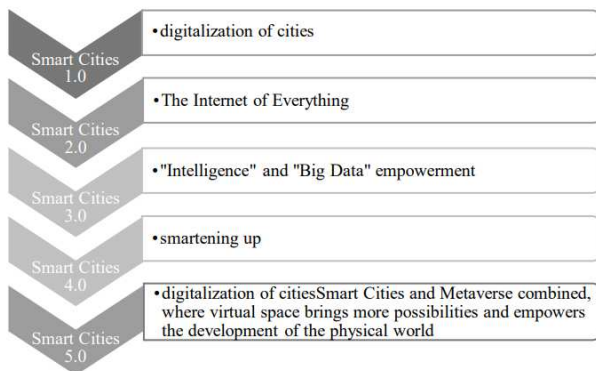
and technology application substitution. Without first knowing the needs, do not disregard the user experience, social value, economic worth, or regulatory constraints. Second, advancing technological innovation is critical. Information technology development and application innovation led to the "metaverse's emergence, so we should keep coming up with new ideas in the areas of information perception, data processing, data modeling, software definition, virtual reality simulation, scene rendering, artificial intelligence, information security, and other related technological areas. We should also encourage the comprehensive integration and use of these technologies in the metaverse environment. Thirdly, the creation and use of "metaverse" technologies must consider the application's economic worth in addition to its social value in real-world situations, and they must consider input-output ratios throughout the long and short term. [11]

IV. EXPLORE THE NEW WAYS OF METAVERSE AND SMART CITIES

People's limitless imaginations are the primary cause of the metaverse's explosion. The building of smart cities is booming at the moment. The growth of the metaverse idea will undoubtedly give smart cities a fresh life and propel them forward by creating more application scenarios. The metaverse is an entirely new idea, and there are still far too many questions about how it will grow when combined with smart cities. Nonetheless, it is undeniable that the convergence of smart cities and metaverse will occur. The difficulties surrounding the development of smart cities and the metaverse, as well as upcoming technology and application scenarios, are covered in this article.

A. The Evolution of Smart Cities

Based on their level of development, today's smart cities can be categorized into four phases, with a fifth stage to be reached in the future Fig. 3.



Source: This study.

Fig. 3. Development stage of smart cities.

B. Benefits of Metaverse Technology in Smart Cities

Combining cutting-edge technologies and smart cities has become essential due to factors including digitization, intelligence, and wisdom. Technology has also emerged as a critical tool for boosting the efficacy of smart cities. One emerging trend in the design and development of smart cities is applying metaverse technology Fig. 4.



Source: Baidu pictures.

Figure 4: Metaverse and smart cities.

Fig. 4. Metaverse and smart cities.

Many issues in the actual world can be avoided since people in the metaverse interact in the digital domain as virtual images. The benefits of applying metaverse to intelligent cities are as follows:

- Improved accessibility, allowing users in various physical locations to share the same information and experience
- Improved diversity, providing various user groups with a space to coexist without physical resources
- Improved equality, providing users of different racial, ethnic, and linguistic backgrounds with equal opportunities for growth
- Improved humanity, allowing human culture to be passed on more wholesome and everlastingly. The metaverse might serve as a crucial foundation for upcoming technological advancements.

C. Disbenefits of Metaverse Technology in Smart Cities

While the Metaverse presents numerous benefits for smart cities, it is essential to consider the potential disbenefits that accompany its implementation:

- **Privacy and Security Risks:** The extensive data collection inherent in Metaverse applications can lead to significant privacy concerns. Data breaches and unauthorized access to sensitive personal information are risks.
- **Digital Divide:** The requirement for advanced technology and high-speed internet can exacerbate the digital divide, leaving behind populations without access to these resources.
- **Economic Displacement:** Automation and virtual environments could lead to job displacement in various sectors, impacting livelihoods and economic stability.
- **Technological Dependency:** Increased reliance on advanced technologies can lead to vulnerabilities if these technologies fail or are disrupted.
- **Environmental Impact:** The energy consumption required for maintaining and operating Metaverse infrastructure can contribute to environmental degradation and increase carbon footprints. [12]

D. Utilization of Smart City Metaverse Planning and building in urban areas

The metaverse has the potential to enhance scientific planning and intelligent urban building. The metaverse exists naturally and is a dynamic site for scientific virtual experiments that offers a workable route for building practical, intelligent cities. Utilizing actual city data and multidimensional social data, people in the city are asked to live virtually in a town with various scenarios to reproduce the city in the metaverse. This allows people to find planning flaws and difficulties and to sample planning consequences flexibly, which can be evaluated, investigated, compared, and chosen. The city builder can offer specifics on the public amenities' layout, building structure, greenery planting, etc., of the city construction after deciding on the best planning scheme for the city. In the metaverse before the commencement of building, potential urban issues that might surface for the benefit of engineers, builders, and managers may be inferred, ultimately creating precise, dynamic, stakeholder-engaged, and sustainable smart cities.

E. Economic Development

The virtual goods of the metaverse can partially replace the commodities in the real world; in fact, their usefulness can even surpass that of the physical world's goods, thanks to the coordinated development of the metaverse and the smart city. Because of the enormous inventiveness of the things in the metaverse that have been generated in this way, the overall economic volume will now include both the scale of the metaverse economy and the amount of the physical world. Furthermore, the metaverse's partial replacement of the natural world would somewhat lessen pollution and carbon emissions. As a result, the metaverse economy will grow and support intelligent cities' economic growth. [13]

F. Life daily and schooling

The metaverse and intelligent cities will partially absorb life and education from the physical world. People's travel will steadily decline as smart cities grow and more tasks can be completed from home. This will lead to better mobility and more predictable usage of resources like gas, electricity, and water. The real world's information and culture will be mirrored in the metaverse, and new knowledge and cultures will also be developed there. Humanity will encounter new experiences and a new way of life as the metaverse and smart cities grow.

G. Operations of Smart Cities and Emergencies

A virtual realm that exists alongside the real world is called the metaverse. It serves as a mapping of the natural world to imitate city operations. In the virtual world, issues that are difficult for us to see or identify in the real world are more accessible to locate, giving us early warning. The simulation of urban production, management, and other issues in the metaverse enables people to predict the course of events and make informed decisions; it replicates actual emergency events, such as earthquakes, fires, floods, and viruses, and accurately captures the tense and crucial real-life scenes along with the personnel's quick response, enhancing urban resilience and emergency response capabilities. [14]

H. Prospects for Metaverse and Smart Cities' Future Technology

Though they have limitless growth potential, the metaverse and intelligent cities also rely on developing the following technologies. Presently available and potentially useful future technologies include:

- Quantum computing and biocomputing, among other computing platforms, offer mathematical backing for the metaverse's ongoing growth. A metaverse city is a networked area, and future metaverse cities will have more efficient connections than existing ones. Nonetheless, the metaverse's network depends on the natural world's network. Simultaneously, the physical world's network is necessary for communication between the metaverse and the real world. China has been at the forefront of 5G network construction and technology worldwide. This has established a solid basis for the growth of metaverse cities; however, 5G technology can only sustain the metaverse's initial phases, and as it develops further, the network's needs will essentially increase.
- Brain-machine interface: As this technology matures, it will allow for not just the connection between the brain and the machine but also the machine to read, comprehend, and even retain brain data, which is significant. [15]

V. EXPERIMENTAL INSIGHTS

In writing this article, we reviewed and analyzed previous studies to understand the practical and disruptive implications of Metaverse technology in smart cities. These studies revealed several key insights:

- Pilot Projects: Previous studies involving pilot projects in various cities demonstrated both the potential and the challenges of integrating Metaverse applications in urban planning and management. For instance, a study conducted in Tokyo highlighted the efficiency gains in traffic management but also revealed significant concerns related to data privacy and security breaches.
- User Feedback: Feedback from users involved in these pilot projects indicated mixed reactions. While many appreciated the enhanced interactivity and real-time data access, there were significant concerns regarding cognitive overload and the overwhelming nature of constant connectivity. A study in Seoul reported that 40% of users experienced cognitive fatigue after prolonged use of Metaverse applications.
- Impact Assessment: Evaluations from these studies provided a broader perspective on the disruptive impacts of Metaverse technology. For example, a project in Amsterdam showed increased efficiency in public services. Still, it highlighted issues such as the digital divide, where lower-income communities could not access and benefit from these advanced technologies.
- Cognitive Impact on Users: Studies revealed that the immersive nature of the Metaverse could lead to cognitive overload, where users experience difficulty processing vast amounts of information. A study conducted in New York City found that extended use of Metaverse applications could negatively impact

attention spans and memory retention, affecting overall cognitive performance.

- **Social Relations:** Research indicated that the Metaverse could alter social interactions, changing how individuals communicate and form relationships. While it can foster new connections, it might also reduce face-to-face interactions, impacting traditional social dynamics and community cohesion. A study in London noted that increased virtual interactions could lead to social isolation and decreased community engagement[16]

VI. THE METAVERSE CAMPAIGN FOR SMART CITIES

Human civilization's social, political, economic, cultural, and living systems will progressively move into the virtual world due to the "metaverse," which significantly virtualizes the globe. By extension, the evolution of the entire "metaverse" world will be impacted by the virtualized and digitalized products that

come from the diverse applications of different industries. In summary, the "metaverse" will fundamentally alter how society is organized and functions by fusing the actual and virtual worlds, creating a new style of living that incorporates both worlds and giving rise to a brand-new class of online and offline-integrated intelligent cities.

The advancement of metaverse technology supports the tendency toward multi-governance in smart cities. Diverse urban subjects can view, engage in, and experience different facets of urban construction, management, and operation from various perspectives in the metaverse. This simulates each subject's gaming and cooperative process in urban operation, presents a model of urban operation close to reality, and helps subjects discover the laws, implicit order, and influence mechanisms that govern cities and their inhabitants. In the metaverse, even city dwellers can design their cities and implement their approaches to urban governance. Then, city administrators and policymakers may pool popular expertise to capitalize on people's assets, maximize urban development, and create innovative urban governance models. [17]

The metaverse places a strong emphasis on human participation. Users can extend the natural world and create virtual worlds by adding new dimensions and domains to the meta-universe. This helps cities develop and optimize themselves accurately and realistically, provides reliable experimental data and a governance foundation for intelligent actual towns, and offers solutions to problems that arise during the construction of smart cities. The metaverse's realistic qualities facilitate virtual-real interaction, which is helpful in the development of smart cities. A realistic human society can be built in the metaverse thanks to realizing scenario functions such as ready login, low latency, immersion, intense sociality, free trade, and free creation. The metaverse is a virtual reproduction of reality. The metaverse can comprehensively map all city issues and is livable by management and city people. [18]

The fundamental operational structure of human society consists of a stable monetary system, a pluralistic cultural system, an open and accessible social environment, and immersive user interaction in the metaverse. Within this framework, city dwellers can engage in multi-level interactive feedback and virtual-real interaction with the urban system by manipulating space and time within the

virtual city. We can anticipate changes in the environment, model the process of resolving issues, and offer a workable pre-treatment plan for the real world by tracking the dynamics of events in the meta-universe. Pre-formulate the best reaction plan for real-world urban problems and achieve the city's unified schedule and cooperative governance. [19]

VII. POTENTIAL CHALLENGES AND RISKS

As we explore integrating the Metaverse into smart cities, it is crucial to consider the potential challenges and risks that could arise. Proactively addressing these issues will ensure the successful and sustainable adoption of Metaverse technologies. [20]

A. *Privacy and Security Concerns*

The Metaverse will generate vast data, raising significant privacy and security concerns. Protecting sensitive personal information from breaches and cyberattacks is paramount. Smart cities must implement robust cybersecurity measures and ensure compliance with data protection regulations to safeguard citizens' privacy.

B. *Digital Divide and Accessibility*

The digital divide remains a significant barrier to equitable access to the Metaverse. Not all citizens have the technology or internet connectivity to participate fully in digital environments. Efforts must be made to bridge this gap by providing affordable access to the required technologies and promoting digital literacy programs. [21]

C. *Regulatory and Legal Challenges*

The rapid development of Metaverse technologies has outpaced the creation of regulatory and legal frameworks. This lack of regulation poses risks related to intellectual property, digital identities, and virtual real estate. Policymakers must develop comprehensive regulations to address these issues and ensure the fair and ethical use of the Metaverse. [22]

D. *Economic and Social Impacts*

The Metaverse could profoundly impact urban populations. While it offers opportunities for economic growth and innovation, it also poses risks, such as job displacement due to automation and changes in social interactions. Policymakers and city planners must consider these impacts and develop strategies to support affected communities.

E. *Technological Limitations and Reliability*

The successful implementation of the Metaverse in smart cities relies on advanced technologies and infrastructure. Technological limitations, such as bandwidth constraints and hardware requirements, could hinder widespread adoption. Ensuring reliable and scalable technology solutions will be essential for overcoming these challenges. [23]

F. *Strategies for Mitigation*

Smart cities should adopt a multifaceted approach to address these challenges. Critical steps include implementing robust data protection measures, promoting digital literacy, developing comprehensive regulatory frameworks, and investing in reliable infrastructure. Fostering public-private partnerships and engaging with stakeholders will also be essential for creating a sustainable and inclusive Metaverse ecosystem. [24] [25]

VIII. CONCLUSION

Smart cities aim to promote a harmonious cohabitation of people and cities through intelligent driving, smart technology restructuring, and innovative governance scenarios that ease urban difficulties. The creation of smart cities is greatly aided by metaverse technology. Examining the "metaverse + smart city" intelligent governance model carries human thinking about the urban governance model and the city's future form. The metaverse offers a systematic approach for people to envision the metropolis of the future. It is important to remember that the metaverse is still in its early phases. On the one hand, more technological advancement bolsters the integration and complementarity of many technologies, smart city development, and a rational understanding of virtual and truth. In contrast, people actively participate in the use of technology in a smart city driven by technology. However, there is frequently a great deal of uncertainty and ambiguity in the application of technology because of the variations in human thinking, cognition, and interests. It is essential to conduct thorough research on coordinating people, technology, and city relationships in smart cities. There is still more work to be done in the future, and the metaverse and smart city concrete manifestation road is still in the exploration stage.

The "metaverse" is currently in its early stages of research and development. The term "metaverse" refers to a subject with multiple applications that should be thoroughly examined, investigated, and comprehended, creating new things during practice. Many high-tech businesses have already made significant financial investments in research and development to prepare for the technology. Building smart cities and the metaverse aims to enhance the economy and compensate for the physical world's limitations. The "metaverse" offers a new route for the ultimate realization of smart cities. The metaverse has boundless imagination, and its integration with smart cities has a promising future and will shape new production and lifestyles and a new social form.

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