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THE METAVERSE: RESHAPING THE VIRTUAL ECONOMY TO SOLVE REAL-WORLD PROBLEMS

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ABSTRACT

The concept of the metaverse has gained attraction among tech enthusiasts and futurists alike in recent years. Often described as the virtual world which is completely interactive and immersive, the metaverse has the potential to revolutionize the way we play, work and live. One of the most exciting aspects of the metaverse is its potential to solve some of the most pressing real-world problems that we face today, from overpopulation to climate change. One of the most significant ways that the metaverse can help address real-world problems is through its impact on the virtual economy. In the world of metaverse the users can able to sell and buy digital assets such as clothing, virtual real estate and even currency. This virtual economy has the potential to address some of the most significant issues we face, including overpopulation, traffic, pollution, and infrastructure.

Keywords: Metaverse, Virtual World, Real-World, Problems, Interactive

1. INTRODUCTION

The Metaverse is the Vision and post-reality universe in which the persistent and perpetual computational multiuser environment where the physical reality is integrated with digital virtuality. The universe is the convergence of many technologies for enabling multisensory interactions with humans, digital objects, and virtual environments that include augmented reality and virtual reality [1]. Therefore, the metaverse is the networked immersed environment and interconnected social web in the platform consisting of persistent multi-users. It is considered the unified and seamless technology for user communication in dynamic interactions and real-time problems along with digital artifacts. The web of the virtual world is referred to as the first iteration in which the avatars have the ability to teleport. The contemporary iterations featured immersive VR, social platforms compatible with AR collaborative spaces, open game worlds and massive online multiplayer video games [1].

Innovations in computer science play a significant role in day-to-day life that changes and enriches social transactions, communication and human interactions. From the end user's perspective introduction of mobile devices, the Internet and personal computers are the three waves of technological innovation. In computing innovation, the fourth wave is unfolding the immersive and spatial technologies that include augmented reality and virtual reality. The wave expects the outcomes of the computing paradigm called Metaverse and has the potential in transforming education, entertainment, remote work and business. Metaverse is the compound word of Meta and Universe [2].

Figure 1.1 New Future with Metaverse

1.1 Research Problem

The problem of the research study is to reshape the virtual economy using Metaverse for solving real-world problems.

1.2 Research Objectives

The objectives of the research study are given below;

1. The metaverse can help alleviate the problem of overpopulation
2. The metaverse can help address traffic and pollution
3. The metaverse can help solve infrastructure problems
4. The metaverse can help address climate change and global warming

2. LITERATURE REVIEW

Neal Stephenson coined the term "metaverse" in 1992 from the science fiction book Snow Crash is about an immersive and alternate virtual world where the internet-connected cosmos becomes a reality [3]. The metaverse is an online 3-dimensional (3D) virtual environment where users interact with one another using avatars that are either representation of their "real" or idealized selves [4]. In other words, a virtual world transformed into the real world for a parallel existence in which avatars or digital profiles engage in social interactions and virtual cultural events while still maintaining a separate economic existence. Four major subcategories of metaverse architecture and technology exist: virtual reality, mirror world, lifelogging and augment reality [4].

Few urban sectors as well as urban life domains become more permeated by the governance models economic process and data infrastructure of the digital platforms. The dynamics which have led to the emergence of civilization in platforms where platforms infiltrated the fabric nature of metropolitan societies is known as platformization. The global platform project Metaverse have been started by Meta which is previously known as Facebook. It is the global platform firm is the best example of platformization. The concept of Metaverse is fictitious like the Parallel virtual world that symbolizes the lifestyles for working and living in virtual cities

as the alternative to the futuristic smart cities. Certainly, the metaverse has the potential ability in redefining the cities designing the service and activities provisioning for increasing the quality performance, accountabilities and urban efficiencies. This is due to the emergence of innovative technologies in the metaverse that include Digital twins, the IoT, Big Data and Artificial Intelligence that provide datasets as well as advanced computation for understandings like that of human behavior [5].

Some studies have looked into the topic of telework which has the ability to reduce the pressure on the population in mega cities even though the number of teleworkers were rising as well as unsustainable issues such as overpopulation, and environmental pollution faced by megacities because of stress in population. The investigation suggests that telework can relieve megacity population pressure by luring residents to leave the megacity. It does this by conducting a scenario-based experiment. The study categorized telework into non-metaverse and metaverse telework which shows the positive influence of both types of telework on the intention of a person in relocating from the mega city to a non-megacity specifically given the increased number of businesses which has been adopting the metaverse in teleworking office [6].

The term "metaverse" is broad and can include all future digital objects. To maintain their accessibility and longevity, life domains like education and learning with redirected systems for adopting metaverse. Numerous publications have examined the system of the metaverse and the applications which operates based on it as well as the historical developments that driven the current state of the metaverse. However, it is still unclear how the metaverse is organized and what exactly makes up each part. Although there has been a growing need for e-learning systems as technology has advanced, the architecture of the systems that are now on the market depends upon metaverse which is poorly specified as well as in the scenario of best case in the simple 3D environment. The study looks for the earlier studies for determining the unique technologies which use the framework of metaverse that can offer and talk about the complete and entire framework of metaverse when it is used in the e-learning environment [7].

The quarantine and lockdown during COVID-19 made possible ways to circumvent space restrictions and physical time to access the non-face-to-face services in the metaverse [8]. The term e-learning refers to the learning and educational application types that include online learning, distance learning, virtual learning, blended learning, m-learning and e-learning can successfully use the metaverse as the solution for subjects that completely depend upon the convergence as well as it cannot be taught through distance or online learning like engineering and medical courses. Even though, there are many types of environments in e-learning [9] systems based on metaverse can be utilized for providing productive work-secured learning environment by implementing virtual technologies as well as through continuous research for widening the use of best learning experiences [10]. As a result, the virtual learning environment uses metaverse technologies which act as the prerequisite for the current and existing learning system. Moreover, the metaverse integrates with the Internet and online technologies along with extended reality additionally being added to the virtual reality environment [9,11]. Although few researchers reported that the roadmap of the metaverse has been categorized into the virtual world, mirror world, lifelogging and augmented reality. The four dimensions of external, augmentation, intimate, and simulation are used to divide these four sections. Additionally, simulation is a crucial component that either creates a virtual world which is

entirely different from the mirror image [11, 12]. Users can evaluate or experience content and offer users personalized services depending upon the metaverse without any limitations for time as well as location by indirectly or location experiencing, storing, as well as matching the keywords in E-learning for the content generated in a 3D environment through their mobile devices [8].

3. METHODOLOGY

3.1 Metaverse in Solving Overpopulation

First, the metaverse can help alleviate the problem of overpopulation. As more people move to urban areas, cities become more crowded and congested, leading to a range of problems, including increased pollution and traffic. In the metaverse, however, people can interact with each other without being physically present in the same location. This means that individuals can participate in economic and social activities without adding to the physical population density of a given area.

3.1.1 Study Design

This study used a crossover design within the subject scenario based on the experiment, where types of work for reducing overpopulation in metaverse as well as metaverse in the metaverse vs. non-telework were changed. In the study context, telework is a kind of work that has been recently adopted in India for reducing overpopulation. As a result, at this stage of the adoption process for telework, the experimentation is done for manipulation as well as control over the variables [14]. The dependent variables of the study assess the individuals' desire to move to a non-megacity from a megacity. Action is volitional as well as people have the knowledge to modify their behavioral intents, behavioural intention is an excellent predictor of future conduct in people [15].

3.1.2 Study Population

The study's participants are young adults from three colleges who are business school students in India and who range in age from 20 to 35. Participants in COVID-19 have had the opportunity to engage in online learning, which enables students to take courses using ICT that include cellphones, virtual conferencing tools, tablets, and personal computers like Zoom) from any location with an internet connection. Participants in the study are students who already had online learning experiences and a solid awareness of the advantages of virtual working using metaverse in the workplace. Through Qualtrics, the trial was carried out. 95 young individuals in all took part in the study. Few data are missed in some responses so a filled questionnaire is taken for the study, 20 replies are eliminated from further analysis; 75 useful answers were gathered; The participants' average age was 24.2 years, with a male participation rate of 34.7% (n = 26) and a female participation rate of 65.3%.

3.2 Metaverse in Solving Traffic and Pollution

Second, the metaverse can help address traffic and pollution. By allowing people to interact with others in the virtual space, the need for physical transportation can be reduced. This, in turn, can help reduce carbon emissions and other pollutants associated with transportation.

The introduction of the metaverse is positively correlated with a decrease in air pollution since fewer transfers result in fewer car emissions. To provide long-term solutions to address climate change, future research and technological advancements for defining the digital twin globally [16]. In a sense, this should be a "planet laboratory" that enables researchers to forecast, model,

and examine the potential environmental effects of various scenarios. For instance, utilizing AI and satellite images would be able to create a digital twin of a specific city for simulating the present scenario as well as identification of urban solutions to solve problems like traffic congestion and pollution [17] Such an approach might also be developed with the aid of the metaverse, whether on a macro or micro scale (e.g., investigation of climate change) or both. [18] provides a realistic illustration of emissions reduction utilizing virtual spaces: A three-day, 1474-person national conference generates 55 times fewer carbon emissions when held online than one that is done in person.

Therefore, the metaverse might be advantageous in terms of lowering CO2 emissions for conferences (where there are typically plenty of international guests). Additionally, the ability to incorporate a digital twin into the metaverse enables the real world to be improved by keeping an eye on an online-replicated process. A further benefit of the metaverse is that it can help minimize the footprints of real estate [19]: manufacturing facilities, goods in digital twins and processes to cut down carbon emissions from buildings by 50%. Customers can thus opt to use sustainable products using online products rather than visiting stores can help to minimize emissions and reduce the real estate footprint. However, given that cities now account for 70% of emissions [20], they represent the greatest sustainable opportunities in the metaverse. City managers can gain knowledge from digital twins of cities and structures to create cities that are more sustainable and efficient. Numerous studies show that it is possible to cut carbon emissions by 50% from a building, increase maintenance and operating efficiency by 35%, boosting up of productivity by 20% among workers, and 15% increase utilization of space [21].

3.3 Metaverse in Solving Infrastructure Problems

Third, the metaverse can help solve infrastructure problems. Worldwide, infrastructure is inadequate and non-existent making it more difficult to access basic services such as healthcare, education, and commerce. In the metaverse, however, infrastructure can be created virtually, allowing people to access these services regardless of their physical location.

Before the COVID-19 pandemic, telehealth offered healthcare facilities to 43% of hospitals but after the pandemic, telehealth has increased by 95% of the hospitals [22]. Using technology to communicate while not physically present, patient and doctor interactions are referred to as "telemedicine" in general. It comprises text messages, emails, video chats, and phone calls. M-Health, E-health, Telehealth and digital medicine are other names for telemedicine.

Patients and physicians will be able to meet the 3-dimensional hospital atmosphere wherever it is done thanks to Metaverse's ability for supplementing the meeting with the use of a virtual office [23]. Figure 8 of India shows a case study of how the metaverse might connect people from remote places to reach medical facilities at a single finger touch [24]. The patient who has been identified as suffering from conditions like "eczema" may visit a local clinic. The clinic doesn't have a treatment for such a situation. Using metaverse, consulting doctors can video conference with several panel doctors located in district hospitals and multi-specialty hospitals throughout the world to get their thoughts and suggestions. This would facilitate the patient's rapid access to medical care. Second, it would lessen the improvement in doctor-to-doctor communication and consultation. Thirdly, there is less of a need for big multi-specialty hospitals everywhere.

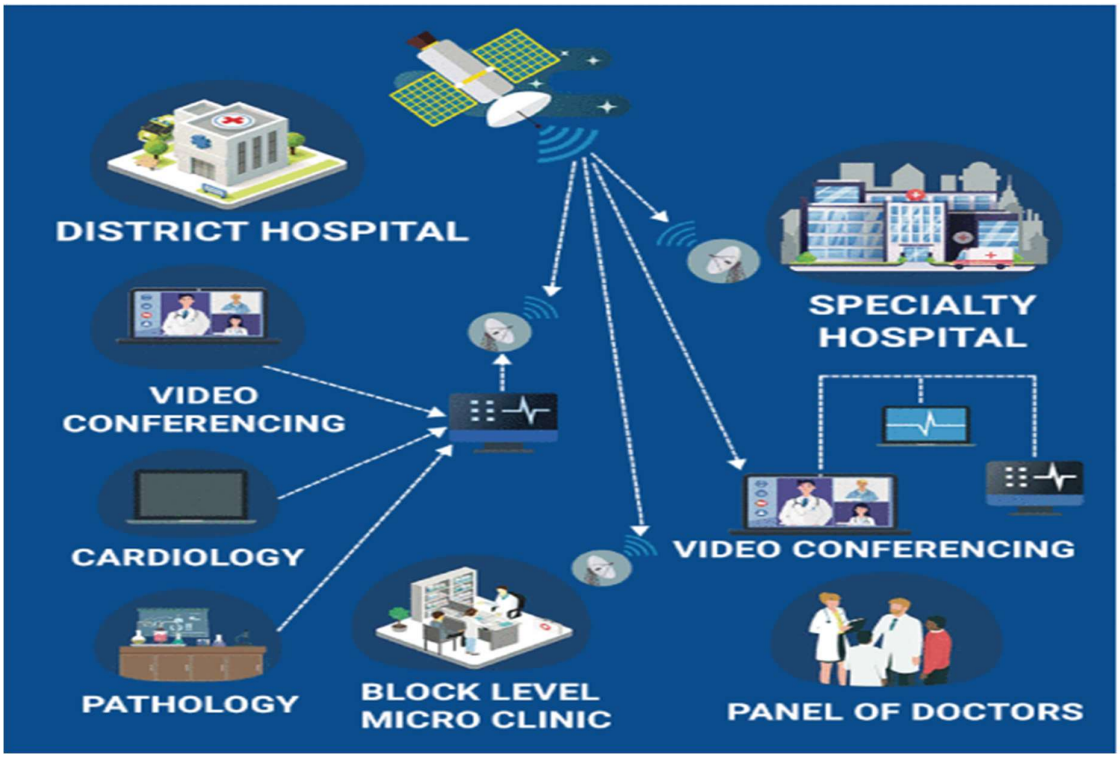

Figure Application of Metaverse Telemedicine in India

3.4 Metaverse in Climate Change

Finally, the metaverse can help address global warming and climate change. By reducing the need for physical transportation and infrastructure, the metaverse can help reduce carbon emissions and other pollutants associated with human activity. Additionally, the metaverse can facilitate the development of new, sustainable technologies that can help mitigate the impact of climate change. There are advantages and disadvantages to any new technology. Because the metaverse helps in reducing human travel needs by offering everything digitally, it will also result in the creation of new jobs and a considerable decrease in global warming. There is no doubt that these will lower accidents and pollution. By making subjects seem more engaging, pleasurable, and fun, Metaverse has the potential to enhance home-schooling and education, which is another big shift it can offer [13].

Since customers have high expectations for traceable, tradeable, reusable, and repurposed items, each stage of the product life cycle has become crucial to the customers. This makes digital transformation a top priority. Because reducing global warming and climate change is a challenging aim to attain by 2030, institutional investors and governments need sustainable goods and services that can cut carbon footprints internationally. When goods and services are digital, they can be tracked, and purchasing and production patterns are clear [25]. Clear statistics are required to shift behavior in the direction of a good influence. Any industry can develop sustainable and profitable options by using a data-driven approach. There are a lot of variances in fashion and textiles owing to brand variation, and geo-location, and this is a very complicated web jumble to develop a clear plan.

3.5 Metaverse Economy

3.5.1 Metaverse driven by demand

Because there are an infinite number of digital resources available, the Metaverse is demand-driven because digital things may be manufactured largely without any limitations. Products are produced on demand. According to a survey, more than 1/3rd frequently or sporadically enter game worlds for social rather than gameplay purposes, with the percentage being twice as high in people under the age of 18 than in people over the age of 35. More than two-thirds of respondents who were asked for activities they would be extremely interested in shifting to the Metaverse included common social activities including seeing friends and family, watching movies, throwing events and birthday parties, and going to concerts. Before access to user-generated or free material and transcendentalism between applications, respondents who were asked which Metaverse characteristics they were most interested in cited the freedom in selecting the physical appearance [26].

3.5.2 Preferences for Switching

There is always a demand for services and goods of Metaverse, as well as for its way of life and employment, which will decide how it develops. For instance, the progressive movement in Gen Z's tastes toward employment that people find meaningful rather than monetarily hybrid types of labor referred to by some as the "Great Reshuffle" will impact the works in the Metaverse [26]. There will be less of a barrier to employment in high-wage countries as a result of remote work choices in the virtual world. New professions and business models will emerge as a result of the metaverse, including those for smart contract lawyers and digital fashion designers. Regarding organizational inclinations, many Gen Zers despise corporate hierarchy and are more likely to participate in emerging forms of organization in the metaverse with lower hierarchy.

3.5.3 Sustainability in Society

Additionally, the Metaverse might benefit social inclusion. For instance, virtual identities are not constrained by the limitations of their physical identities. For example, AR/VR devices may make up for impaired eyesight so that such people could participate in things in the virtual world that they couldn't in the real one [1]. Avatars belonging to the metaverse world will be free of ethnicity, sexual orientation and gender, unlike in the physical world, which makes them a powerful means to combat social bias [26].

Sustainability of the environment and economic growth. Economic growth and environmental sustainability are compatible with the metaverse. In the real-world economic expansions, may lead to the loss of more natural resources but it will not happen in the metaverse world since it offers pure digital air digital forests [11] and digital oceans which are limitless so that the environment has sustainable activities. This calls for the ability to move such activities into the Metaverse and the guarantee that the Metaverse's energy use will not have a negative net impact on the environment. Indeed, demonstrates that eco-friendly blockchain-based platforms are more desirable to crowd-investors.

3.5.4 Improvised policymaking

Additionally, the Metaverse might function as a bootstrap approach to enhance model- and decision-making based on humans. "Small economic data from the real economic system can be transformed into large virtual economic data in the MetaEconomic system (i.e., the Metaverse), and then artificial intelligence algorithms such as machine learning, deep learning,

and reinforcement learning can be used to transform virtual economy big data into deep intelligence [27]." Economic simulations are assisted by metaverse in the virtual environment for enhancing the interventions of targeted policy and policy-making for solving real-world problems.

4. RESULTS AND DISCUSSION

4.1 Model for Measurement

The reliability and convergent validity of the construct were assessed to evaluate the measurement model of the dependent variable. By analyzing the significance and Average Variance Extracted, convergent validity was assessed. Each factor loading above 0.9 (i.e., 0.91, 0.93, and 0.95) was significant at p 0.001 for all factors. Given that the AVE of 0.864, excellent convergent validity is shown [28]. The dependent variable's Cronbach's alpha is 0.95, which indicates very good dependability. The mean value and standard deviation are, respectively, 3.03 and 1.68.

4.2 Testing Hypotheses

Initially, the intention of the people to move to non-megacity from non-megacity in the manipulated conditions was assessed, as well as the homogeneity of variance about the dependent variables and the normality of sample distribution. The statistical analysis shows that do not exhibit homogeneity and normality of variance. The study employed SPSS to test the hypothesis for the collected bootstrap samples from students of India to know the mean difference and confidence intervals. First, it was determined how the intentions to transfer to non-megacity from the megacity under the metaverse conditions as well as those who intend to go in the other direction under non-telework conditions is 1.50 with 95% confidence intervals with 1.046 and 1.958 exclude zero for supporting H1. Additionally, when people telework in the metaverse office as opposed to working in the conventional physical office, they are likely to move to non-megacity from mega city due to overpopulation [6].

Table 4.1 Intention for Relocation due to Overpopulation

Type of City	Intention for relocation due to overpopulation
Metaverse City	3.68
Non-Metaverse City	3.3
Non-technological telework	2.1

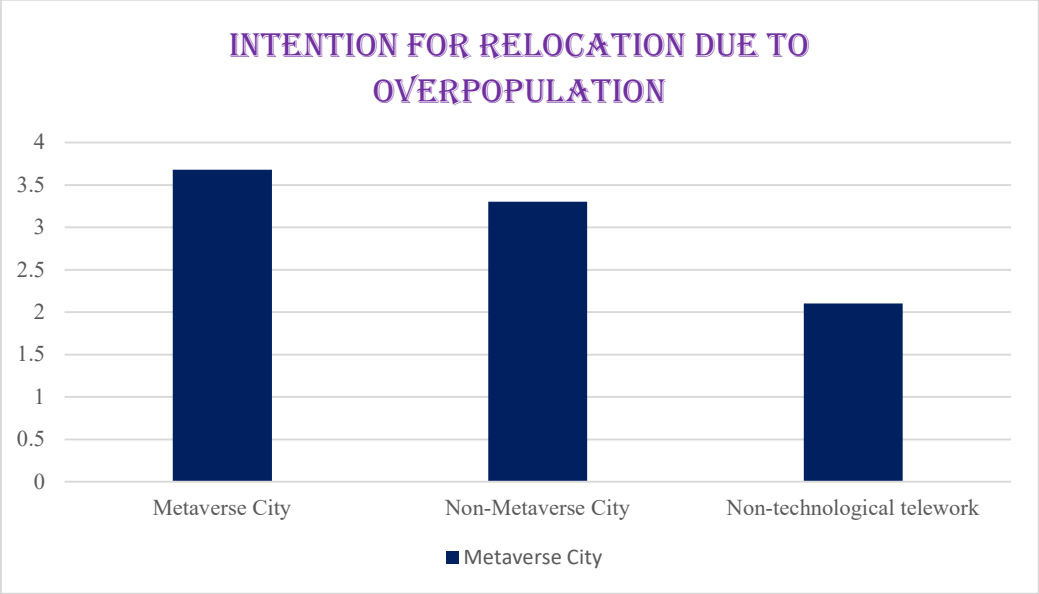

Figure 4.1 Intention for relocation due to overpopulation and metaverse in reducing overpopulation

Second, it was determined that the intention to move to a non-megacity from a megacity under non-teleworking conditions was considered as hypothesis 2. The desire to move under the telework condition is hypothesis one which can be differentiated. The main difference between the mega city's intention to move to the north mega city under non-delivery condition and deliver condition is adjusted to 1.242 both the upper and lower-level bias is supported by 95% confidence intervals that exclude 1.681, 0.807. When people work remotely in the non-metaverse office as opposed to the regular physical office the people are more likely to move from the megacity to a non-mega city

Thirdly, the differences between the people's intention to move to non-megacity from mega city due to overpopulation under metaverse deliver condition and the non-metaverse telework condition (H3) were looked at. The mean difference under the non-metaverse telework condition is 0.26. The 95% confidence intervals for the upper and lower-level bias corrected results that do not encompass zero (0.093, 0.423) by supporting H3. Thus, when people work remotely in a metaverse workplace as opposed to a non-metaverse office, they are more likely to want to move from a megacity to a non-megacity due to stress with overpopulation [6].

4.2 Traffic and Pollution Control

The public has recently begun to pay more and more attention to the metaverse. In the real world, it creates a virtual environment where we can live as a different person. Developing and run this virtual world, however, will result in a staggering quantity of carbon emissions from computing, networking, displaying, and other activities. This unavoidably makes it more difficult for our society to achieve carbon neutrality, burdening the planet severely. The economic layer, the interaction layer and the infrastructure layer are the three key levels of the metaverse, and in this study, we first give a green perspective of the metaverse by looking at the carbon issues in these three layers and estimating their carbon footprints in the near future. Then, to decrease the energy consumption and carbon emissions of the metaverse, we assess a variety of present and developing green technologies for discussing the limitations of

supporting the workloads in the metaverse [29]. Then, in light of these restrictions, we talk about significant ramifications and present several new ideas and potential future possibilities for making every metaverse layer greener by controlling pollution and traffic [29]. Then, we examine green technologies from the viewpoint of governance, taking into account both user regulation online and public rules in the real world, and we suggest the Carbon Utility (CU) indicator to gauge the level of service provided by a user activity per unit of carbon emissions. Finally, we identify an issue that affects the entire metaverse and offer three solutions: (1) an in-depth examination of critical performance measures, (2) an examination of all relevant layers and internal components, and (3) a novel mechanism for measuring, recording, and regulating user activity carbon footprints. The user behaviors in the metaverse could be controlled by our suggested quantitative indicator, CU [29].

4.3 Metaverse in Infrastructure

The metaverse helps in solving the problems in Infrastructure in which the people feel more difficult to access the physical infrastructure [30]. Metaverse provides the virtual infrastructure. The results and findings show that the bridging gap between the doctor and the patient, the metaverse can revolutionize the healthcare sector.

Table 4.2 Metaverse in Infrastructure

Year wise Growth	Metaverse in Health Care
2021	1
2022	1.25
2023	2.5
2024	2.92
2025	4.17

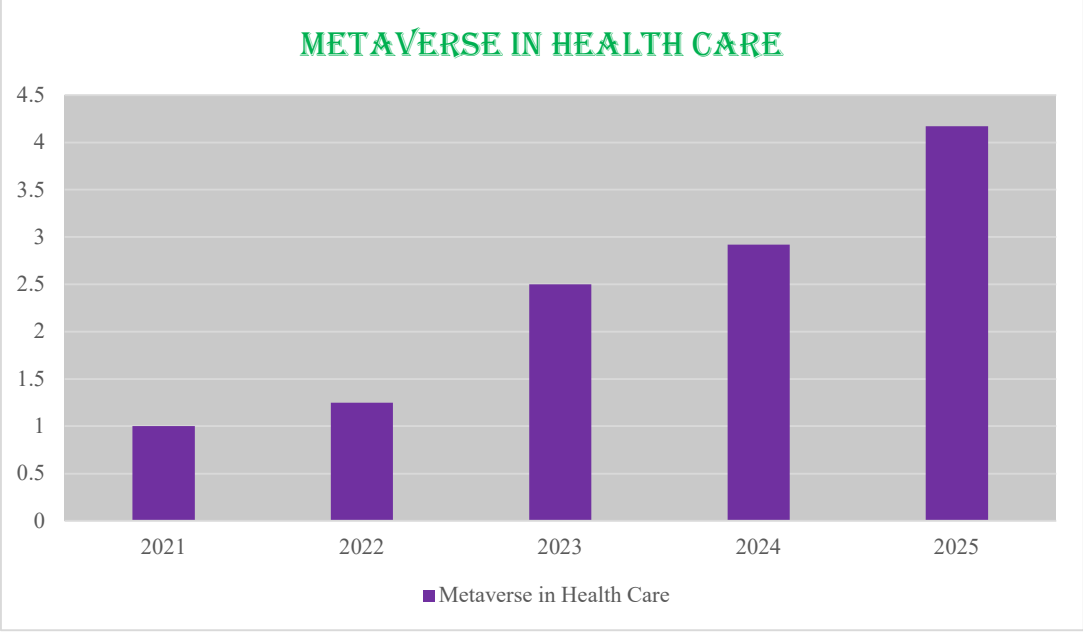

Figure 4.2 Metaverse in changing the infrastructure with a virtual hospital

The following are some benefits that metaverse can provide to the field of telemedicine:

❖ Most people feel uncomfortable reaching the hospital and visiting the doctor often. While maintaining patient convenience, Metaverse helps patients and healthcare professionals communicate. Additionally, telemedicine allows for the secure transmission of medical data and reports from one place to another. Therefore, people can have faith in this system and confidently ask for its help [30].

❖ Due to the poor healthcare infrastructure existing in these locales, problems arise in rural areas, far-off places, and post-disaster situations. To provide emergency medical care in such locations or situations, telemedicine may employ the metaverse. Patients can receive clinical care at home without making a difficult trip to the hospital.

❖ The discussion and sharing of crucial information about medical cases among healthcare professionals in many locations have been made possible by contemporary information technology breakthroughs like mobile collaboration.

❖ Since telemedicine has made it possible to monitor patients via phone, tablet, and computer technology, healthcare costs have decreased. Doctors can now verify prescriptions and supervise medication monitoring.

❖ The risk of transmission of infectious diseases between medical professionals and patients is decreased through telemedicine [30].

a. Global Warming

It is crucial that we, as mental health practitioners and researchers, adjust our habits on both an individual and social level because global warming and its effects have been demonstrably hurting mental health [31]. According to recent studies, each person who attends a scientific conference is estimated to contribute between 1.2 and 1.8 tons of CO2 [32,33]. This amount is roughly equal to the CO2 emissions from energy combustion per resident in mainland France in 2020. Reducing conference travel would have an effect because hosting a virtual conference might cut emissions by up to 99.97% compared to an in-person one [34].

Even though efforts have been put to enhance the experiences using virtual conferences [35], these gatherings have drawbacks, such as few opportunities for networking. Additionally, the solution is rarely to switch from their model of in-person meetings exclusively to complete virtual meetings to reduce traffic and pollution. Therefore, creating a new "slow conferencing" approach is necessary. Decentralizing national or international conferences into regional or local conferences that take place concurrently and are connected by a video are possible choices for such a paradigm, as well as holding conferences in the metaverse [36].

b. Reshaping the Virtual Economy

Since the Web turned out to be generally utilized during the 1990s, cyberspace has kept on creating. Informal communities, video conferencing, virtual 3D universes like VR Chat, increased reality programming like Pokémon Go, and non-fungible symbolic games like Upland are only a couple of the PC-intervened virtual conditions we have created. These virtual universes, despite being transient and detached, have worked with different degrees of advanced change. To speed up the advanced change of all aspects of our genuine life, the expression "metaverse" has been created. The possibility of a vivid Web as a tremendous, coterminous, enduring, and shared space is at the core of the metaverse. The computerized "big

bang" of our cyberspace [37] isn't too distant, the metaverse's advanced appearance, which is being fuelled by state-of-the-art innovations like Extended Reality, 5G, and Artificial Intelligence. This review article addresses the principal endeavor to give an exhaustive system that surveys the latest metaverse improvement with regard to state-of-the-art innovation and metaverse environments, and it features the potential for the computerized "big bang." First, technology is what makes the switch from the current Internet to the metaverse possible [11]. Therefore, the thorough analysis of metaverse in reshaping the virtual economy [26] enabled with 8 different technologies that include Future Mobile Networks, Cloud and Edge Computing, Robotics and IoT, Computer Vision [37], Blockchain Technology, Artificial Intelligence, Human-Computer Interaction or User Interactivity and Extended Reality [1]. The metaverse ecosystem enables the human user application-wise to reside and enjoy themselves within the self-sustaining, enduring and shared reality. The 6 user-centric criteria that explode in the metaverse environment are accountability, trust, privacy and security, social acceptability, virtual economy and content criterion. Thus, the metaverse helps in solving real-world problems.

5. CONCLUSION

To conclude the present research study, the metaverse has the ability to change and update the real world. By reshaping the virtual economy, the metaverse can help address some of the most significant real-world problems we face today, including overpopulation, traffic, pollution, infrastructure, and climate change. As the technology behind the metaverse continues in evolving innovative solutions even in the conventional methods emerges completely in the upcoming years. Government metaverses could end up becoming where we work if they are taken too far. In the metaverse, there are many innovative ways to generate revenue, including property ownership, employment in a metaverse community, and of course investment opportunities. An actual play-to-earn Metaverse exists today. Voting, passport renewal, efforts to improve street safety by altering lighting and traffic patterns, and other measures to reduce greenhouse gas emissions should all be expected soon.

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