...::KENT AKADEMİSİ | URBAN ACADEMY

Volume: 16 Issue: 3 - 2023 | Cilt: 16 Sayı 3 - 2023

ARTICLE INFO | MAKALE KÜNYESİ
Review Article | Derleme Makalesi
Submission Date | Gönderilme Tarihi: 09.01.2023
Admission Date | Kabul Tarihi: 22.06.2023

CITATION INFO | ATIF KÜNYESİ
Arslan, M. (2023). Metaverse, Innovation (Meta Innovation) and Urban Interaction, *Kent Akademisi Dergisi*, *16*(3):1374-1397.
https://doi.org/10.35674/kent.1231475

Metaverse, Innovation (Meta Innovation) and Urban Interaction

Metaverse, İnovasyon (Meta İnovasyon) ve Kent Etkileşimi

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Öz

Üç boyutlu, radikal inovasyonlar bütünü olarak adlandırabileceğimiz Metaverse, henüz hayata geçmemiş olmasına rağmen olumlu ve olumsuz yönleriyle gündemdeki yerini korumaktadır. Metaverse'in temellerini atan teknolojiler ise son hızla birçok alanda insanların yaşamını değiştirmeye devam etmektedir. Dijital ikiz, blockchain, IOT, yapay zekâ, XR teknolojileri kent yönetimleri tarafından da benimsenerek belediye hizmetlerine uygulanmaya başlanmıştır. Metaverse inovasyon ekosistemi olarak kapılarını kent hizmetlerinin daha kaliteli, verimli, etkin sunumu için açmış durumdadır. Metaverse yaygınlaştıkça kent hizmetlerinin bu ekosisteme adapte olması, ihtiyaç ve sorunlara yönelik etkin ve verimli hizmet sunumunun metaverse inovatif ekosistemiyle gerçekleştirilmesi söz konusu olacaktır. Bu çalışmada kent hizmetlerinin metaverse ve inovasyon boyutunda gelecekte neye evrileceği dünyadan ve Türkiye'den örneklerle ifade edilmiştir. Çalışmada nitel araştırma yöntemi kullanılmış, bu alanda literatür taraması ve doküman analizi kapsamında kent yönetimlerine yol gösteren teknolojilere ve inovatif uygulamalara değinmeyi amaçlamakta, belediyelere bu alanda izlenecek politikalar konusunda öneriler sunmakta, meta-inovasyonun kentlerde ne tür etkiler yaratacağı ortaya konulmaya çalışılmaktadır. Ele alınan örnekler üzerinden ulaşılan sonuçlar, kentlerin metaverse teknolojilerini; turizm, yerel kalkınma, kültür, sağlık, eğitim alanlarında uygulamaya başladığını göstermektedir.

Anahtar Kelimeler: Metaverse, Inovasyon, Akıllı Kent, XR Teknolojisi, Dijital İkiz

ABSTRACT

Although the Metaverse, which we can call a set of three-dimensional, radical innovations, has not yet been realized, it maintains its place on the agenda with its positive and negative aspects. The technologies that laid the foundations of metaverse continue to change people's lives in many areas at breakneck speed. Digital twin, blockchain, IOT, artificial intelligence, XR technologies have been adopted by city governments and started to be applied to municipal services. Metaverse has opened its doors as an innovation ecosystem for better quality, efficient and effective delivery of urban services. As the metaverse becomes widespread, it will be the case that city services will adapt to this ecosystem, and that effective and efficient service delivery for needs and problems will be realized with the metaverse innovative ecosystem. In this study, the future evolution of urban services in terms of metaverse and innovation is presented with examples from the world and Türkiye. Qualitative research method was used in the study and document analysis (documentary screening), which is the data analysis method, literature review were used. Within the scope of literature review and document analysis in this field, the study aims to address the technologies and innovative practices that guide city governments, offers suggestions to municipalities on what to do in this field, and tries to reveal what kind of effects meta-innovation will create in cities. The results obtained from the examples show that cities have started to apply metaverse technologies in the fields of tourism, local development, culture, health, education.

Keywords: Metaverse, Innovation, XR Technologies, Smart City, Digital Twin

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INTRODUCTION

Innovation is the process of creating added value in urban life, including ambitious innovations that improve the quality of life of citizens. The healthy functioning of this process requires the responsibility of municipalities, which are obliged to observe the needs and expectations of the public and to find solutions to the problems faced by the public. In this regard, cities are the center of innovation and creativity under the management, and the sustainability of this advantage is possible by following appropriate policies and strategies and adopting a proactive perspective. With the increasing penetration of computers and the internet into the vital sphere, cities have become the scene of digitalized services by municipalities on the one hand, and on the other hand, they have become the laboratory of the smart city concept, which is one of the goals of the technology age. While the process of smartening of cities by municipal actors continues, the concept of metaverse has recently come to the agenda and it has started to be discussed how cities will take place in the metaverse and how municipal services will adapt to the metaverse by going beyond the smart city concept. As the three-dimensional internet of the future, the metaverse, which is preparing to appear with many components adapted to our lives over time, will cause many changes in urban services as an innovation ecosystem. In the aforementioned process of change, further integrating metadata with innovation depends on the following factors: the information and communication infrastructure of cities, the creation of a culture of innovation, the qualification of municipal staff, the competence and vision of the management, the allocation of financial resources to this area, and many other factors.

In this study, the concepts of metaverse and innovation will be discussed, the relationship between these two concepts and how they will be reflected in municipalities and thus in cities will be discussed, and existing examples will be given. In this regard, the definitions, technological components, layers, history, advantages and disadvantages of the metaverse are discussed. The connection between the metaverse and innovation is explained through the technologies that are components of the metaverse. In terms of their impact on the city, how municipalities can make use of this innovation environment is explained through prominent examples from the world and Türkiye.

1. Metaverse Concept, History and Metaverse Wheel

Metaverse is a word that is not yet included in the Current Turkish Dictionary of the Turkish Language Institution. However, there are debates on which words the word corresponds to in Turkish. Accordingly, the metaverse can be expressed with the words other universe, virtual universe, fictional universe. The word is defined as "three-dimensional of pictorial" (Terzi, 2022). Metaverse is an ecosystem that started with gaming platforms and includes many digital technologies based on virtual currency (Jiaxin & Gongjing, 2022). According to Arslan (2022), the metaverse is "a set of three-dimensional universes where users can play games, participate in socio-cultural activities with their avatars (virtual icons), visit many cities of the world as tourists, experience learning by living, shop with virtual money in sectors such as e-commerce, art, real estate and many virtual experiences together. Metavers is a set of three-dimensional, open source, gamification philosophy-based innovations consisting of blockchain, artificial intelligence, internet of things components, presented to users with Web 3.0 internet infrastructure." (Arslan, 2022). The Metaverse is a virtual space where users can interact (McKinsey & Company, 2022). The Metaverse is "an environment where users utilize augmented and virtual reality technologies that enable them to interact seamlessly in real and simulated environments using avatars, holograms" (Dwivedi, 2022).

Despite many developments, the metaverse is still just an idea at the technological and production level (Jiaxin & Gongjing, 2022). The so-called metaverse, the final stage of the Internet, is in its infancy and does not yet seem to have reached the level of implementation.

Metaverse has been a constantly curious concept lately. It has been determined that 7200% of searches have been performed on the term Metaverse since 2021, which is the date of its emergence. (McKinsey Quaterly, 2022). Metavers invests in many large companies for its ecosystem. It is estimated that a $13 trillion industry will be created by 2030 with more than 160 metaverse projects in the pipeline (Thomason, 2023).

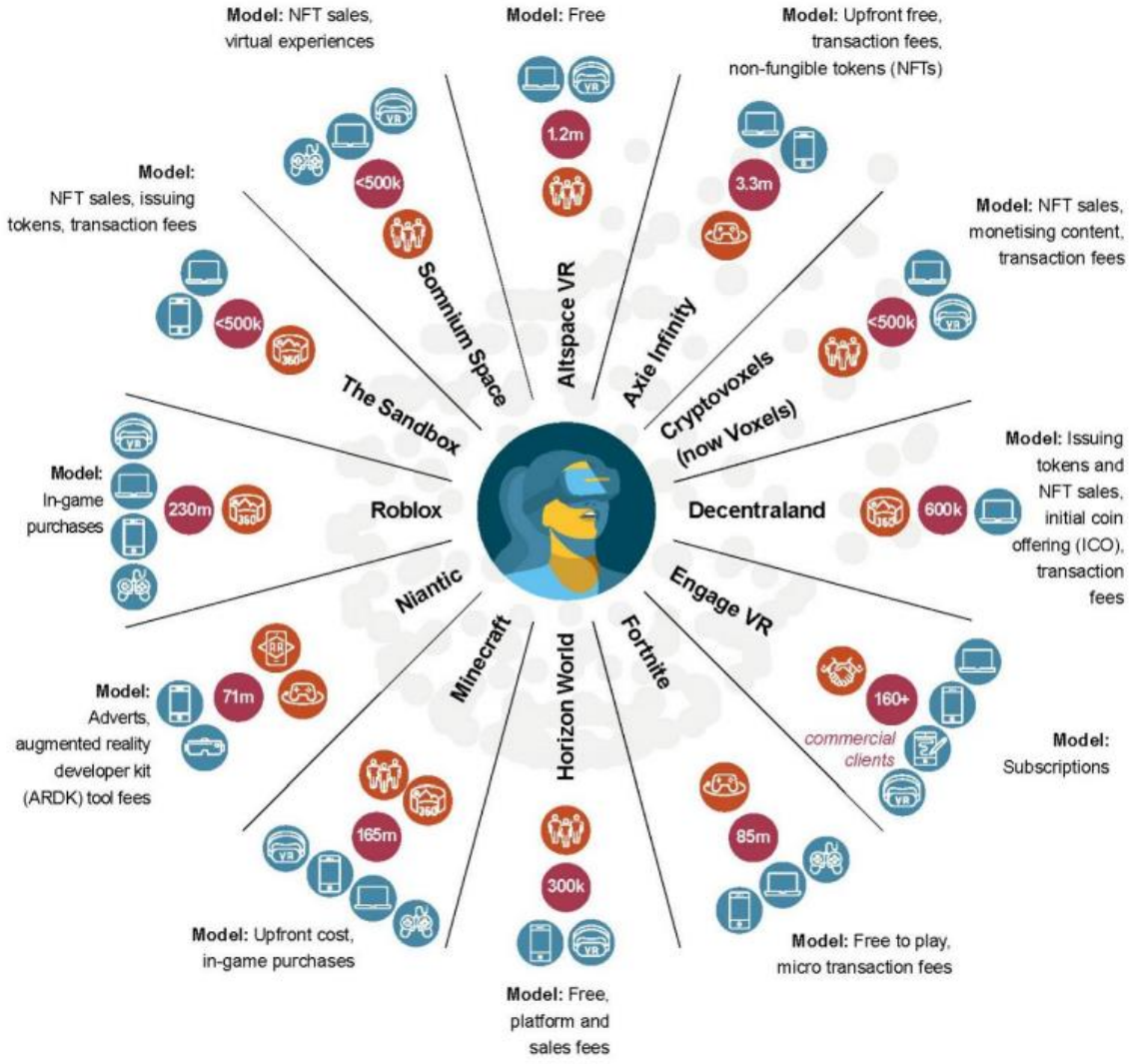
What the metaverse is, its features, how to log in, virtual economy, buying land in the metaverse, etc. are constantly occupying search engines.

The characteristics of Metaverse are expressed below (McKinsey Quaterly, 2022):

- It is an environment where virtual and augmented reality technology is used extensively.
- In addition to virtual and physical worlds, many platforms exist in the Metaverse.
- Metaverse is generally based on a virtual economy. Cryptocurrencies, non-replaceable NFTs, digital goods and digital assets are components of this economic structure.

The Metaverse continues to grow, expand and influence sectors with technologies, gaming platforms, NFTs, concert activities, exhibitions, fashion shows, brand promotions and virtual currency economy. The twelve sample platforms in the metadata as of July 2022 are shown in the following Figure (HSBC Global Research, 2022):

Figure 1. Twelve example platforms in the Metaverse

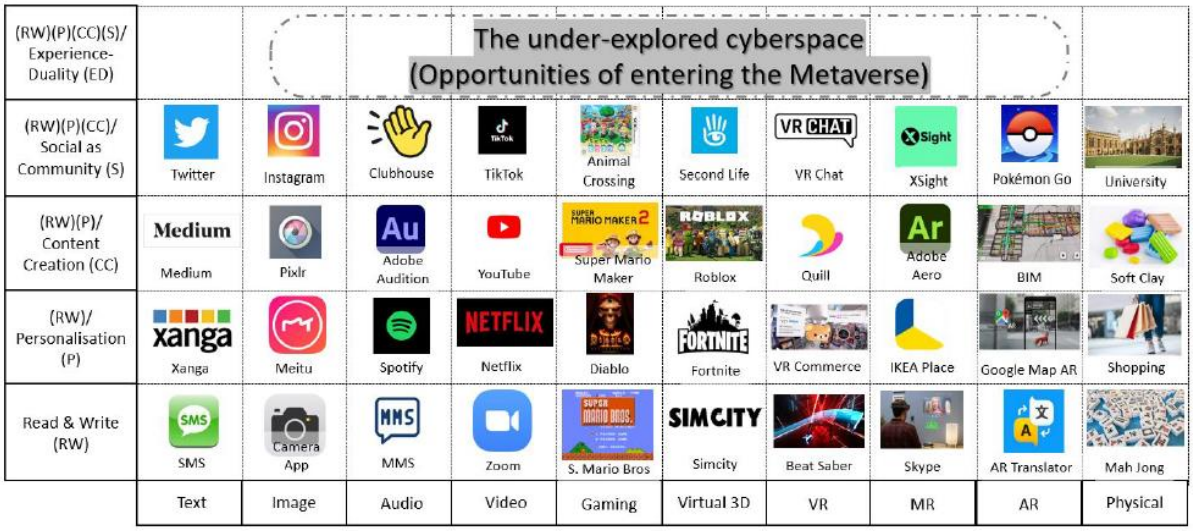


Source: (HSBC Global Research, 2022)

Accordingly, these platforms in metaverses are named as AltSpace VR, Axie Infinity, Cryptovoxels, Decentraland, Engage VR, Fortnite, Horizon World, Minecraft, Niantic, Roblox, The Sandbox, Somnium Space and the technologies they can be used with are explained.

Many virtual environments, social media tools, content producers, game platforms and communication channels that we use in Metaverse Web 2.0 will be subject to change (See Table 1)

Table 1. Virtual environments that will change with Metaverse



Source: (Lee et al., 2021)

1.1. Metaverse History

The Metaverse is an ecosystem that has come up with many sciences fiction films. The first film about the parallel virtual universe was "Electronic World Warfare", which was released in 1982. In 1999, "The Matrix" and later "Ready Player One" went down in film history as the closest films to the metaverse universe. These films shed light on the future state of the social structure (Jiaxin & Gongjing, 2022). Metaverse is a structure that is currently being shaped, but the technology that forms the basis of metaverse dates back to the 1938s.

Figure 2. Metaverse history

Source: (Lawton, 2022)

The most important events of the history of metaverse are explained below (See. Figure 2):

- In 1938, French writer Antonin Artaud used the term virtual reality in his work "The Theater and its Double".
- In 1962, Morton Heiling realized his motorcycle riding experience by using 3D film, vibrating chair and giving odor to the environment. It provides this environment with a machine called Sensorama. Sensorama takes its place in history as the most advanced machine that reveals what the virtual environment is.
- In 1984, the first VR headphones and data gloves were developed.
- In 1989, British computer scientist Tim Berners-Lee created the World Wide Web.
- In 1992, science fiction writer Neal Stephenson used the term metaverse in his book Snow Crash to describe the 3D world in which rich people escape.
- In 1993, Moni Naor and Cynthia Dwork invented software to prevent spam attacks. This software forms the basis of the blockchain.
- It was introduced by Second Life Linden Lab, which was defined as a 3D virtual world in 2003.
- In 2006, Roblox, a multiplayer gaming platform, was launched. Now it has over 200 million users.
- In 2007, Street View was launched by Google. This application is presented to users in the form of a virtual version of the real world.
- In 2009, the first public blockchain was introduced under the pseudonym Satoshi Nakamoto.
- In 2010, Gacha video game was introduced.
- In 2011, Ernest Cline's Ready Player One, a novel about humanity's escape to a virtual world called the OASIS in the 2040s, was published.
- In 2012, Entrepreneur Yoni Assia wrote a blog post called "Colored Coins" in which he described the initial features of bitcoin and how to create, buy, sell and own assets on the blockchain.
- In 2012, entrepreneur Palmer Luckey launched Oculus as 3D hardware on Kickstarter.
- In 2014, Facebook acquired Oculus.
- In 2014, the first NFT was created by Kevin McCoy and Anil Dash, marking a critical milestone for the metaverse.
- In 2015, Vitalik introduced Buterin and Gavin Wood Ethereum. This development has given a tangible atmosphere to the purchase of NFTs and smart contracts.
- In 2016, Pokemon Go came to the fore with AR games positioned above the real world. The logic of the game is based on finding, capturing and fighting virtual beings.
- In 2016, DAO, which also has a decentralized autonomous structure, was launched based on Ethereum.

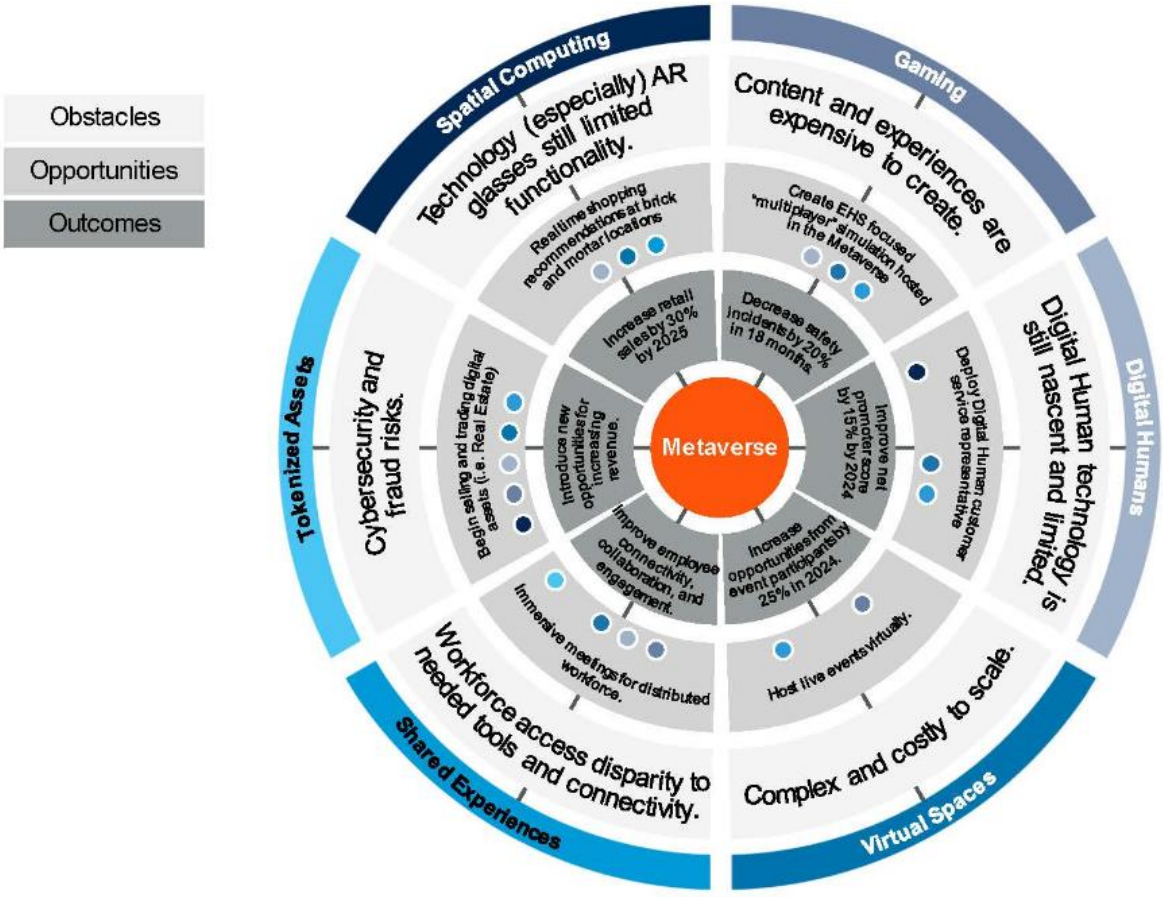
- In 2018, the play-to-earn game named Axie Infinity started to be run integrated into the Ethereum blockchain. It had more than 2.7 million users in 2021.
- Fortnite which was founded by Epic Games in 2019 reached 250 million users. In 2020, the concert by Travis Scott affected more than 12 million people.
- In 2021, Facebook changed its name to Meta. In this process, it has been determined that more than 10 billion dollars have been invested.
- In 2021, Microsoft took meetings with Mesh to a new platform, combining filmmaking workflows with the metaverse experience.
- In 2022, Siemens and Nvidia formed a partnership for the Digital Twin platform.

1.2. Metaverse Wheel

It was determined that 7200% of the searches were made in 2021, the date of its emergence regarding the metaverse term (McKinsey Quaterly, 2022). Research shows that in the next five years, four hours a day will be spent in a metaverse environment. (McKinsey & Company, 2022).

Metaverse consists of many layers and technology components. The metaverse, which has a complex structure, contains many obstacles, opportunities and outputs in this direction (See. Figure 3).

Figure 3. Metaverse Wheel



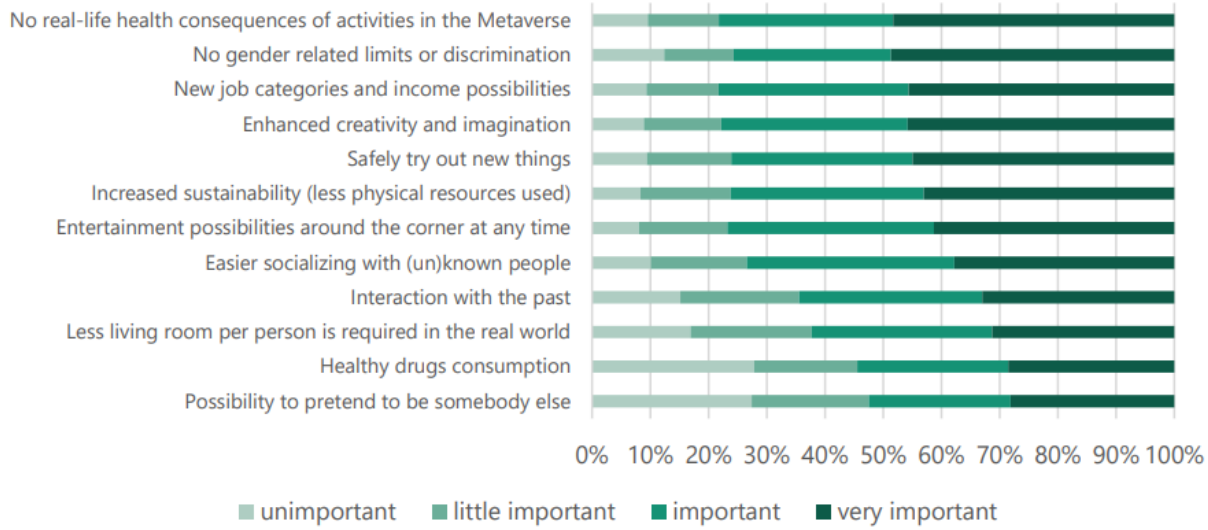
Source: (Gartner. 2022)

As can be seen on the screen: Metaverse is located in tokenized Assets, shared experinces, virtual spaces, gaming, digital humans, spatial computing layers. Security and privacy problems, constraints in the field of technology, its complex structure and the fact that it is an expensive technology, etc. refer to the obstacles encountered in metaverse. A three-dimensional meeting area holds many opportunities for the business world. Increased participation in activities, etc. are expressed as the outputs of the metaverse.

2. Possible Advantages and Disadvantages of Metaverse

The development of visual-based technologies has enabled the virtual world to mature and evolve into a parallel universe (Jiaxin & Gongjing, 2022). Metaverse is a universe that emerges with the development of these technologies. When the metaverse is implemented, it is predicted that it will create changes in many areas, especially in the socio-economic field. The advantages and disadvantages of the metaphor are discussed below.

Graphic 1. Possible Advantages of Metaverse



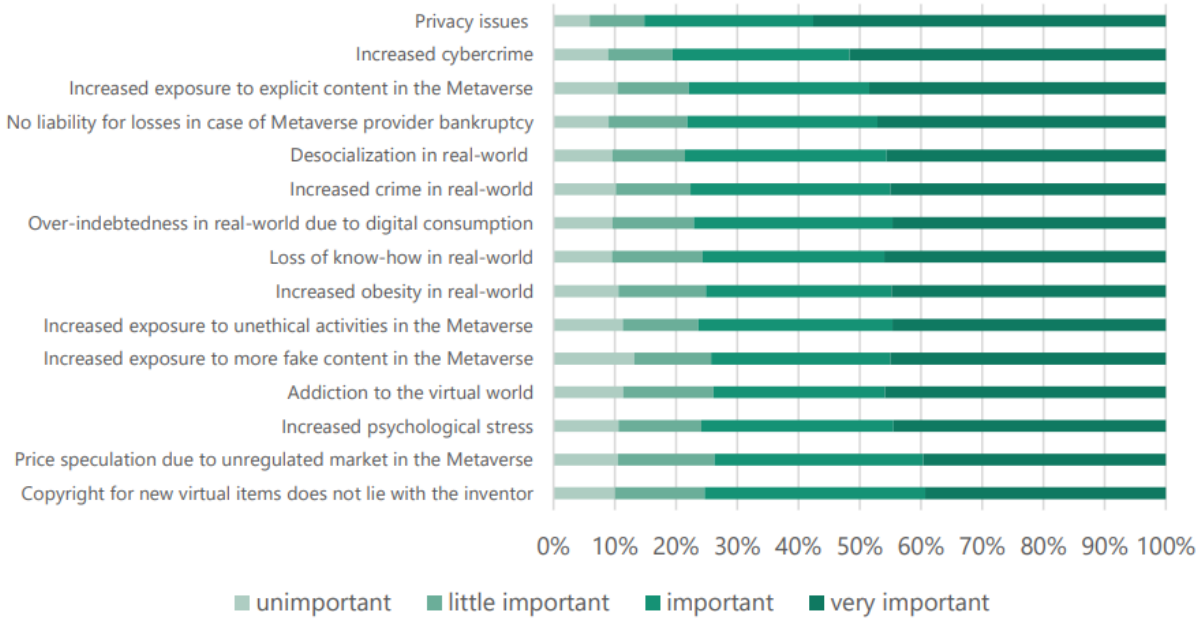
Source: (Duwe et al., 2022)

According to the graph, the activities carried out in the metaverse do not affect health in real life. In other words, buying a drink there does not affect the user biologically in real life. There is no discrimination on gender. In this field, many countries may have limitations on the grounds that they are contrary to their traditions and beliefs. Metaverse new business categories will emerge and income opportunities will increase in this direction. Imagination and creativity will find further development in this universe. Since it is a virtual environment, it will be possible to try new things with confidence. Since there will be less physical resource use, the goal of being sustainable will find more realization opportunities. There will always be the possibility of encountering activities that give the entertainment-oriented metaverse the opportunity to have fun. Socialization can happen more easily. There may be interaction with the past. It may be possible to pretend to be someone else.

Metaverse learning disables obstacles by providing a democratic environment without a geographical area limit on issues such as education and development (McKinsey & Company, 2022). Metaverse provides a diversification of experiences, especially in education, and enables education to be more efficient than traditional methods. Innovations in some sectors require continuous training of

employees in that sector. In this regard, AR glasses enable trainings to be more efficient than traditional methods (McKinsey Digital, 2022).

Graphic 2. Possible Disadvantages of Metaverse



Source: (Duwe et al., 2022)

According to the chart, the Metaverse is a structure that is open to improvement in terms of privacy issues. It seems likely that there will be some problems in this area. There is a high probability of an increase in cybercrime. Decrease in socialization rates in the real world, increase in obesity rates, exposure to unethical activities, exposure to fake content, increase in dependency on the virtual world, and increase in psychological stress rates are among the issues predicted. There may be an increase in crime rates in the real world. Metaverse societies will have the power to be influenced. In addition, it is predicted that it will have effects such as trust, privacy, disinformation, and prejudice. When evaluated in terms of metaverse children and the elderly, it is predicted that it will cause intergenerational conflicts. Older people may find it difficult to use advanced technology. Children can interact with harmful virtual content (Dwivedi, 2022).

3. Metaverse, Innovation (Meta Innovation) and Urban Interaction

Innovation is a tool that increases service efficiency in cities, produces creative solutions to urban problems, and is used to increase citizen satisfaction (Arslan, 2022). Innovation is the process of solving problems from an innovative perspective. In this regard, in studies on municipalities in Canada, Germany and France, it has been revealed that the motivation of municipalities to innovate is due to the following factors (Seker, 2022);

1. Improving the quality of life of citizens
2. Saving costs
3. Ensuring that environmental problems are solved
4. Increasing the attractiveness of the city

5. Increasing the attractiveness of municipalities so that qualified employees are the reason for preference

The priority of these factors may vary from municipality to municipality. For some municipalities, the priority is to innovate in services aimed at improving the quality of life of citizens, while another municipality can innovate in order to improve environmental conditions.

In some municipalities, innovation is adopted as a routine business and represents a proactive perspective. In this context, municipalities can exhibit behaviors towards solving problems with innovative methods, using scarce resources at the optimum level, and finding innovative solutions. Some municipalities also carry out innovation when it is necessary. In cases where the solution needs to be found quickly, municipalities are necessarily innovators (Seker, 2022).

Innovation is an indispensable tool for cities. Meeting needs, finding solutions to problems, budget constraints, technological developments have made innovation necessary for cities. By adopting the innovation culture, municipalities improve their processes and try to contribute to urban innovation. Metaverse should be seen as an innovation ecosystem. Cities will have to use the metaverse ecosystem for efficient and effective service delivery. Because the metaverse offers attractive technological opportunities to cities, city managers and municipalities. metaverse; It affects smart city services such as smart health, smart education, smart tourism, e-Society, smart people, smart management, governance, smart environment, smart economy, smart energy, smart structures, smart transportation. Disabled, elderly, etc. It is possible for the undesirable urban segments to live a more comfortable life with the metaverse. With the metaverse ecosystem, which includes technologies that will warn cities in advance about disaster management, it is possible to increase urban resilience against disasters. It contributes to local democracy with its governance mechanism. On the other hand, the emergence of many business areas and the growth of the entrepreneurship ecosystem together with the metaverse create effects that will contribute to the urban economy. So the metaverse is important tool for the cities as an innovation ecosystem.

When we look at the development process of Metaverse, which we can call the innovation ecosystem, it is seen that the developments in information technologies help the development of the virtual world. Accordingly, 2021 was declared as the "Year of the Metaverse". Metaverse is defined as the next destructive innovation according to some sources. Trade, gaming and blockchain are components that activate the metaphor and open the door to innovation (HSBC Global Research, 2022).

Metaverse is a structure that incorporates many digital innovations. This structure aims at continuous development. In 2040, it is stated that metaverse will be very popular and inclusive (Stienmetz et al., 2022). The biggest innovation of metaverse is the transformation of images in minds into physical images and the interaction between reality and virtual (Duwe et al., 2022). Metaverse is an area where incremental innovations find a suitable environment and it seems inevitable that it will bring new solutions to problems. Metavers have significant effects on the innovation system. In addition, the metaphor, which combines features such as virtual reality, augmented reality, animations, etc., has the potential to enable many innovations to emerge. In order to make innovation; it is necessary to try the service or product, to have the right environment to produce products and services, to hire the right people to carry out the processes, etc. Since Metaverse provides these opportunities, it is a suitable environment for innovation and encourages innovation (Dwivedi, 2022: 34). On the other hand, the sustainability of innovation is a matter of debate. Because it is important to exchange ideas with people in real life in order to innovate. However, it is predicted that a loneliness environment will occur with the metaverse (Duwe et al., 2022).

Metaverse components are part of the innovation ecosystem. The first of these is cryptocurrencies that create economic value with blockchain technology and this technological infrastructure. Blockchain technology is a product of innovation and it is predicted that it can contribute to problems such as inequality and environmental problems. The future of cities will be determined by blockchain technology (OECD, 2019). Technologies for climate conditions based on accessibility, transparency, accountability and traceability are supported by blockchain technology. Blockchain technology includes technologies that enable the fulfillment of the goals set in the Paris Agreement and the provision of solutions. NFT technology provides solutions on the basis of financial models related to climate change and also provides the participation of new actors in the sector. It is stated that NFTs and smart contract technology can offer new strategies and climate-friendly options for many projects. It is stated that blockchain technology processes can operate with low carbon emissions (Majer, 2022).

Legal regulations are in question with the realization of this technology. A regulation on crypto assets, one of the most important economic elements of metadata, was prepared by the European Commission and adopted by the European Parliament on 14 March 2022. This regulation includes regulations that prevent the protection of consumers and their use for criminal purposes, apart from the objectives of providing supervision and transparency. In addition, there are studies on virtual assets in the USA and the United Arab Emirates (Pryor & Sessa, 2022). Cryptocurrencies have the potential to be used in urban services. According to the results of the research, payment transactions will be easier with blockchain-based payment methods with the metadata transfer of the public sector. Keeping records and archive studies will be carried out in a safer structure (HSBC Global Research, 2022). These developments will significantly change the processes of municipalities other than the central government.

4. Methodology

Apart from the introduction and conclusion sections of the research, the Metaverse Concept, History and Metaverse Wheel, the advantages and disadvantages of Metaverse were carried out under the headings of urban interaction in the context of the Metaverse-Innovation relationship. In this context, the definitions, technological components, layers, and history of the metaphor are mentioned. Advantages and disadvantages are discussed. Metaverse is an innovation ecosystem and in this respect, it is explained through technologies that have a meta- component in connection with innovation. In terms of its effects on the city, how municipalities can evaluate this innovation environment is explained through the prominent examples from the world and Türkiye.

Qualitative research method was used in the study and document analysis (documentary screening), which is the data analysis method, was used. Document analysis is expressed as "accessing the printed and electronic document related to the subject under investigation, examining and evaluating the document" (Bowen, 2009, p. 27). Among the municipalities working on the metaverse, best practice examples that are examples of the urban interaction and innovation of the metaverse were selected. In this direction, the websites of the municipalities, news sites and the reports written on this subject were examined and inferences were made.

5. Findings on Metaverse, Innovation and Urban Interaction

Metaverse has an accelerating effect on innovation in many areas (Stienmetz et al., 2022; Duwe et al., 2022). This effect enables the formation of innovations that also contribute to urban innovation.

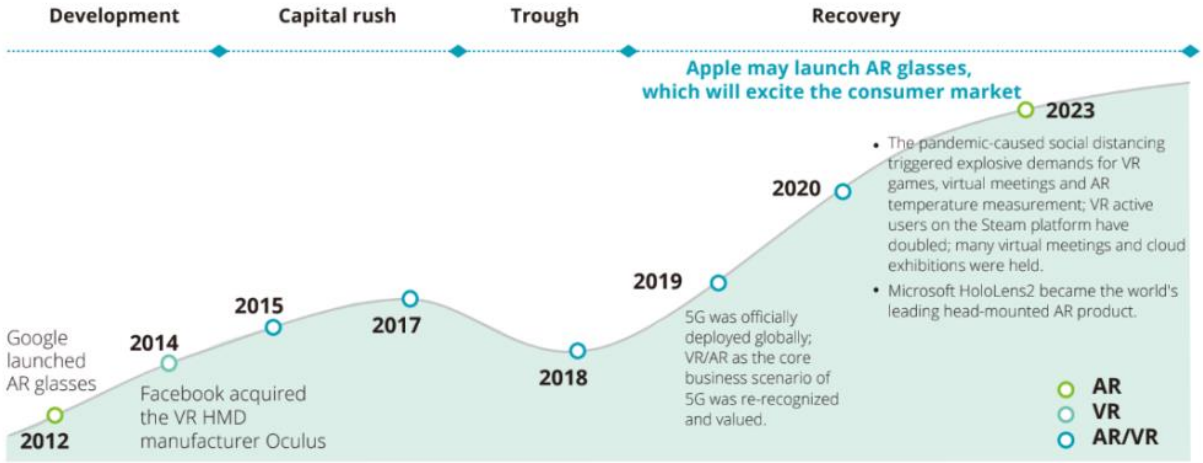
- Municipalities also carry out activities in this field such as creating and selling NFTs and donating the income obtained. For example, Üsküdar Municipality has transformed historical buildings into NFT works (Anadolu Agency, 2022). Datca Municipality converted its tweet

shared on Valentine's Day into NFT and sold it at auction. He donated the income obtained to female students in need (NTV, 2021). The Afşin Municipality of Kahramanmaraş also transformed the natural beauties of the city into NFT and offered them for sale (IHA, 2022). Limitations such as technology addiction and substance addiction negatively affect young people (Fidan, 2015). In this field, the VR-based Healthy Living Therapy Model of Bursa Metropolitan Municipality provides therapy services to young people within the scope of fighting against addiction (www.ankaramasasi.com, 2022).

- One of the innovation activities carried out in the Metaverse universe of the city was carried out by Epic Games. High-quality geographical visualizations were obtained using geographic information systems data. This development enabled the creation of interactive simulations (https://triangraphics.de, 2020). In our country, the General Directorate of Geographical Information Systems of the Ministry of Environment, Urbanization and Climate Change of the Republic of Türkiye has completed the digital twinning of 21 provinces with drone technology (cbs.csb.gov.tr, 2022). Thus, it will be ensured that the digital twin technology is used more effectively and it will be ensured that the city administrations make a preventive plan to solve the urban problems that may arise.

- Another technology and innovation product used in Metaverse is XR technology. There have been major developments in XR technology in recent days (McKinsey & Company, 2022). Cities have started to use this technology for tourism activities.

Graphic 3. Stages of development of XR Technology



Source: (www.TommasoDiBartolo.com, 2022)

As can be seen in the graphic, XR technology has made great progress since its emergence in 2012. In 2012, Google launched AR glasses, and since 2019, it has focused on AR, VR technology. With the pandemic process in 2020-2022, the number of users of this technology doubled. In this period, Microsoft has produced the AR product Hololens.

In the light of these developments, municipalities and urban administrations have also started to use XR technology within the scope of smart tourism activities (See. Figure 4, Figure 5).

Figure 4. Buffalo Olmsted Park

Source: (www.buffalorising.com, 2021)

Figure 5. Buffalo Olmsted Park- Old Version

Source: (www.buffalorising.com, 2021)

As seen in Figure 4 and Figure 5, The Buffalo Olmsted Parks Convervancy in New York has carried out a pioneering project in this regard. The mobile application has been implemented to share the old version of the park with the visitors. Historical and natural beauties have been highlighted by using AR-VR technology. Thus, this contributes to both urban tourism and the local economy (National League Of Cities, 2022).

- XR technology is integrated with popular games and used in tourism activities.

Figure 6. The City of Incheon in Minecraft

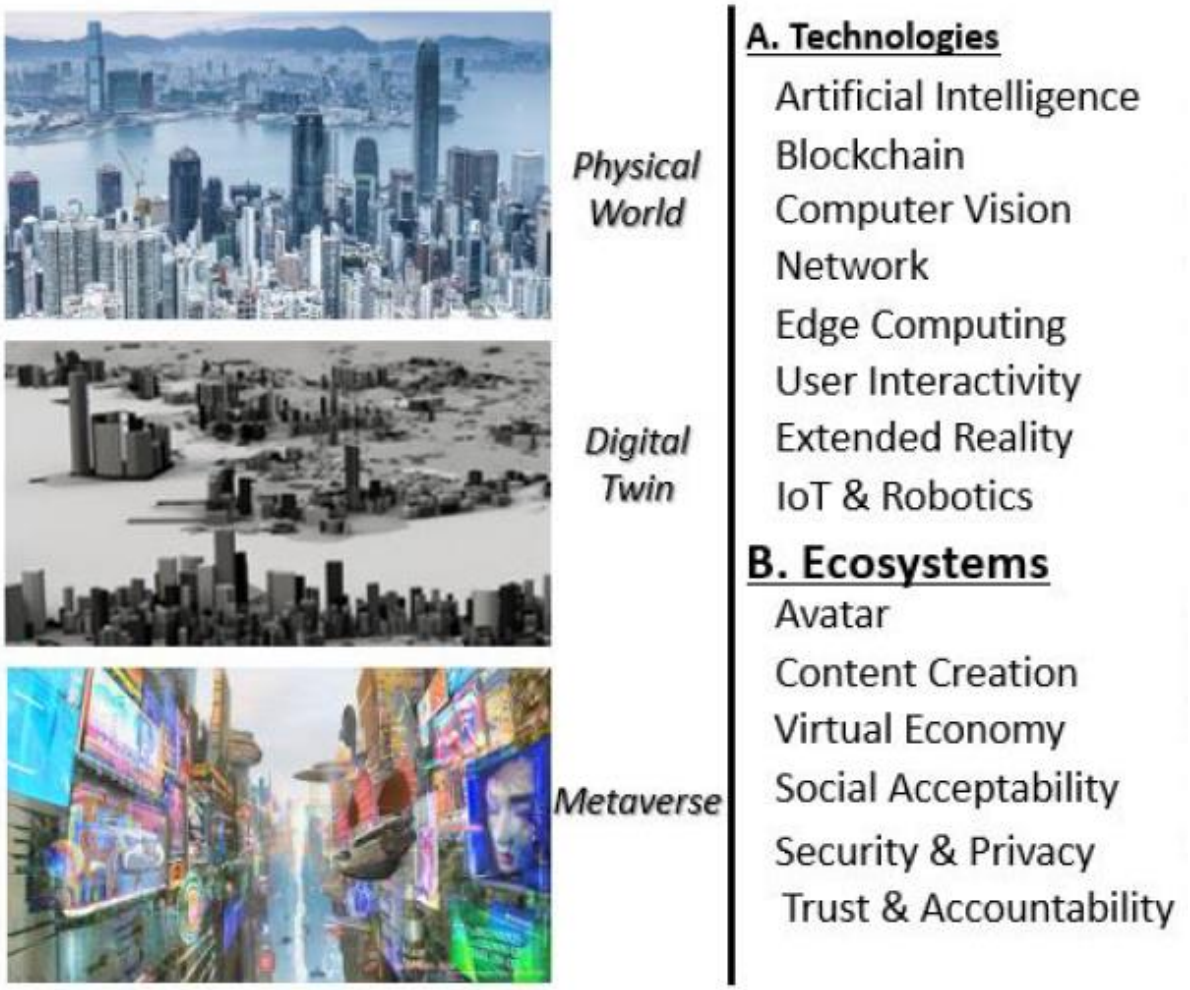
Source: (Stienmetz et al. 2022)

As seen in Figure 6, the[2] city of Incheon, which is famous for its historical places, is integrated with Minecraft game and allows avatars to visit the city. The avatars of the users have the opportunity to experience historical events and learn historical events together with the historical figures created in the meta-verse universe (Stienmetz et al. 2022).

- Digital twin is one of the technologies that occupies the agenda with Metaverse. Digital twin is defined as "the display of a physical entity, person or process in a virtual environment" (McKinsey Digital, 2022). Digital twin application has started to be implemented in many sectors to optimize processes and decisions (McKinsey, 2022). Digital twin technology is expected to be effective in many areas from disaster management, waste management, urban life to health and good living practices (See Figure 7) (Pew Research Center, 2022). Cities use digital twin technology to simulate population density, traffic mobility, climate change, forest fires and energy demands that will be useful for urban planning. Accordingly, it is possible to determine how to prevent negative effects on urban activities and to determine the most appropriate policies (Allam et al., 2022).

Figure 7. Metaverse and urban interaction (Use of Digital Twin Technology)

[2]It is a city in the northeast of South Korea.



Source: (Lee et al., 2021)

- For cities, there are many opportunities for restructuring in metaverse. It offers opportunities that renew the service delivery of the public in order to meet the needs in areas such as education, health, unemployment, planning of public spaces, etc. With the Metaverse, it is planned that municipalities will realize the services they offer under the title of e-Municipality with the avatars of municipal officials in the metaverse universe. The Seoul Administration, which first realized these opportunities, invested $32 million to create the metaverse ecosystem. Development of urban services, planning, management, support of virtual tourism constitute the focus areas of investment (McKinsey & Company, 2022).

  Figure 8. Seoul City Hall in Metaverse

Source: (www.ajudaily.com, 2022)

As seen in Figure 8, Seoul Municipality has created a municipal building in a metaverse environment. Users had the opportunity to visit the lobby of the city hall and the office of the Seoul Mayor with their avatars and make suggestions.

- In America, Santa Monica city administration has agreed with FlickPlay application to enable the city center to be visited with AR, VR technology. In this context, it positioned the "Third Street Promenade" region in the metaphor (Desreumaux, 2022). With AR technology and interactive map, it is aimed to attract tourists to the city center and to ensure their participation in the activities, thus creating added value for local development and introducing the city (See Figure 9).

Figure 9. Santa Monica “Third Street Promenade”

Source: (www.techrepublic.com, 2021)

CONCLUSION and RECOMMENDATIONS

First of all, the metaverse that comes to the fore with the ability to buy land from the virtual geography that everyone wants proves to us a little more every day that it is a structure far beyond this. This structure, in which extended reality, AI, machine learning, 3D engines, cloud, edge computing and 5G connectivity and blockchain technologies are used as components, is called metaverse. Metaverse is an innovation ecosystem.

In the study, in which Seoul, Santa Monica, Incheon, New York applications were examined under the title of meta-verse, innovation and urban interaction, it was observed that cities progressed towards being more innovative by benefiting from meta-verse technologies and contributed to the city. The fact that the Seoul Municipal Government has established a metaverse town hall and allowed citizens to visit the town hall and the mayor's office with their avatars gives clues about the future. Avatars are encouraged to submit suggestions regarding municipal building and municipal services, and thus governance is also highlighted in Metaverse.

Social interaction is one of the innovation dimensions of metaverse (Jiaxin & Gongjing, 2022). In this direction, the use of AR technology in Santa Monica was encouraged and tourists were allowed to share the photos they took using the FlickPlay application on social media. With this application that contributes to urban tourism, social interaction has also been increased to the highest level. The city of Incheon, which is famous for the historical heritage of South Korea, has been integrated into the minecraft game and contributed to the introduction of the history of the city and the understanding of historical events. The Buffalo Olmsted Parks Convervancy example in New York aims to promote the park using AR-VR technology and contribute to tourism. In our country, Üsküdar Municipality has transformed historical buildings into NFT artifacts. Afşin Municipality also presented the natural

beauties of the city with NFT technology. Bursa Metropolitan Municipality provides therapy services to young people with addiction problems with VR technology.

As can be seen from the examples, innovation-based technologies, which are metaverse components, contribute to cities in many respects.

Metaverse is inevitably an innovation platform to be used in the future. Municipalities should use this platform in a way that will contribute to the city as in the examples described above. The road map to be followed for this and the recommendations for the actions to be taken are listed below:

- In order to take part in the metaverse ecosystem, the technological infrastructures of the municipalities must first be integrated with the central government technology programs and complete the technological infrastructure studies.

- It is a meta-verse innovation ecosystem and its understanding and utilization of its facilities is related to the understanding of innovation. In this respect, first of all, municipal administrations should be trained on innovation. Then, all municipal personnel should receive training in this field.

- Innovation should not remain in the education stage, but an organizational structure that encourages and rewards innovation should be constructed. Innovation culture should be widespread and sustainable throughout the organization. For this, suggestion and reward systems should be supported and employees who innovate should be motivated.

- Innovation should be supported by municipalities and reflected in services by working together with stakeholders. It seems inevitable to carry out e-Municipality transactions using this infrastructure today, when the works are started to enter the e-Government with digital identities created with blockchain.

- Innovation has enabled many innovations to be included in our lives especially for a few decades. It is essential that the municipalities make the necessary preparations in advance for the metaverse, which is expected to create revolutions in knowledge, art, education and health.

- Metaverse technologies have been developed for years. It is predicted that these technologies will continue to develop. Based on this prediction, necessary investments should be made and integrated into smart city applications.

- In the Metaverse, social media and game-oriented applications will meet with simultaneous users in the future, and the digital twin structure that optimizes the design of buildings, transportation systems and smart cities will be further supported with data (Lawton, 2022). Municipalities should adopt the principle of working especially in these areas.

- Metaverse is a widely discussed concept in this period. However, what needs to be discussed is what will be changed in our lives by technologies such as blockchain, XR, AI, IOT, etc. which are components of metaverse technology. Municipal services should be integrated with these technologies and offered to the public.

- World states and local governments, which are at the initial level on metaverse, need to develop a strategy in this field. While doing this, it is necessary to clarify the targets on the metaverse, to prepare a road map for the areas that will be most affected, to benefit from trained human resources in this direction, and to provide budget support.

- It may be necessary to provide the necessary support to the disadvantaged groups by the municipalities regarding the meta-verse, which is expected to increase the digital divide.
- Municipalities can implement various psychological support mechanisms to protect children and young people from the harmful effects of metaverse. It can provide stimulating and informative trainings about the game market so that children can play in healthy environments and be protected from harmful content.
- Municipalities can carry out public education activities on the protection of information security and privacy.
- Information activities can be carried out with expert support about how many hours the time spent in the metaphor should be limited in order to maintain the connection with physical reality.
- Training and information activities can be carried out on the purchase of virtual assets and the use of cryptocurrencies.
- Awareness-raising activities can be carried out by raising awareness about the fact that virtual assets can be used in areas such as terrorism and fraud.
- It can carry out training activities on NFT creation, wallet use, blockchain etc. metaverse technologies.
- Municipalities can apply for consultancy support on the use of XR technologies in health, education, agriculture, tourism, etc.
- In-house and external information activities can be carried out on the use of Web 3 technology.
- The management level should receive training on the socio-economic changes that are likely to occur with the Metaverse and vision projects should be produced to change the municipal services in this direction.
- Due to the effects such as bias and disinformation, it is necessary to carry out the necessary information activities in order to prevent the residents of the city from having problems in this area by considering the possibility of social events. For this, plans for working with security forces should be prepared.
- It seems possible for many urban residents to get better education and produce innovative idea-based entrepreneurship projects with the metaverse technologies that are expected to revolutionize the field of education. In this area, mentor support should be given to young people.
- In the future, metaverse education is planned to become a three-dimensional experience and facilitate the learning process. With AR technology, learning method will be applied with simulations and students will have the opportunity to experience new techniques with the animation method (Thomason, 2021:14). The fact that disadvantaged individuals can access the trainings provided by the municipalities with XR technology without going to the training centers, that they receive training in the classroom environment where the avatars are located, that vocational trainings are carried out in virtual factory environments, and that the courses are carried out by entering the environments learned in the university preparation trainings will bring many positive gains.

- It is envisaged that online health services provided by municipalities (psychologists, patient counseling services, etc.) will be provided by three-dimensional avatars and healthcare professionals, remote control and alarm information will be made more efficient and disseminated. Municipalities should produce projects in these areas.

- Keeping health data with blockchain technology will ensure data privacy and security. With the adaptation of artificial intelligence technology to the health services provided by the municipality, it will be possible to determine the possible health problems in the future in advance. In the context of preventive health services, the application of artificial intelligence technology in municipalities' health services is important. Together with digital twin technology, municipalities can share health data of local people for the research of health institutions and thus prevent the emergence of many diseases and deaths.

- Metaverse expands its interaction possibilities in terms of internal and inter-institutional communication with the opportunities it offers. Communication opportunities independent of time and place are offered.

As explained above, it seems inevitable that our life will be more technology-oriented with the recently emerging metaverse technology. In this direction, central governments and municipalities, which are the closest units to the public, have many duties. Municipalities will have to make changes and updates in public service delivery with the transition to the metaverse. Re-evaluating the concept of smart city, which is the last stage of development, which is seen as a reflection of the digital age on the services provided by municipalities, making it compatible with metaverse technologies, and adapting other service items according to this new technology are among the main issues.

Compliance with Ethical Standard

Conflict of Interest: The author declares that there is no conflict of interest.

Ethics Committee Permission: Ethics committee approval is not required for this study.

Funding Disclosure: No financial support was required in this study.

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