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ÖNSÖZ

Dijitalleşme sonucunda hayatın her alanında ve bilimde ulaşılabilir bilgiler web teknolojileri ve bilgisayarlar tarafından okunabilecek şekilde dijital platformlara aktarılmıştır. Bilgilerin analog formattan dijital formata aktarılması hem sosyal yaşamda alışkanlıkları değiştirmiş hem de iş yaşamında son derece kritik öneme sahip bir unsur haline gelmiştir.

Günümüzde, farklı boyutlarda ve farklı alanlarda da olsa dijitalleşme her sektörü ve her boyuttaki işletmeyi, işletme çalışanlarını, bilim dünyasını, akademisyenleri ve araştırmacıları etkilemektedir. Veri güvenliğinden inovasyona tüm dijital platformların etkin bir biçimde kullanılması ve yenilikçi fikirlerin desteklenmesi, yeni meslekleri ve yeni çalışma alanlarını ortaya çıkarmış, yeni iş modellerinin geliştirilmesi ve yenilikçi çözümlerle desteklenmesi iş süreçlerinin de kalitesini arttırmıştır.

Özellikle yapay zekâ teknolojileri işletmelerin iş akışlarını ve faaliyetlerini otomatikleştirmenin yanı sıra, birçok tartışmayı beraberinde getirse de insansı robotlar gibi yenilikçi teknolojiler sayesinde sosyal yaşamın bir parçası olacak kadar geliştirilmiştir.

Artık teknolojinin sınırları hayal gücümüz kadardır. Dijital Türkiye Platformu 2021 raporunda da belirtildiği üzere, Türkiye'nin dijitalleşme yolunda alt yapı, eğitim- uzman ve araştırmacı eğitimi, genç ve yetişkin eğitimi, yeni yetenekler ve meslekler eğitimi ve veri/ açık veri kavramlarında alacağı yollar kaderini belirleyecektir.

Bu eserde, birçok farklı alanda dijital dönüşüm ve dijital teknolojiler ele alınmış ve gerek literatür incelemeleri gerek güncel araştırma verileri ile dijital geleceğin resmi çizilmeye çalışılmıştır. Katkı sağlayan tüm yazarlarımıza ve yayınevimize teşekkür ederiz.

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İÇİNDEKİLER

ÖNSÖZ **3**

İNSAN BİLGİSAYAR ARABİRİMİ **7**
Selim ARAS

DİJİTAL SAĞLIK ve HASSAS TIP **29**
Ümit KARAKAŞ

DİJİTALLEŞME SÜRECİNDE DENETİM **45**
Hamide ÖZYÜREK

GLOBAL TİCARETTE DİJİTAL DÖNÜŞÜM: E-İHRACAT **71**
Günseli ACAR

IMMERSIVE REALITY TECHNOLOGIES AND THE FUTURE OF TOURISM INDUSTRY **91**
Eda AVCI

SPOR YÖNETİMİNDE DİJİTALLEŞME **107**
Hacı Şükrü TAŞTAN

DİJİTAL PAZARLAMADA KARANLIK SOSYAL MEDYANIN (DARK SOCIAL MEDIA) YÜKSELİŞİ **131**
Kazım KILINÇ

DİJİTAL DÖNÜŞÜM VE EKONOMİK SİSTEMLER **153**
Barış SAFRAN

SAĞLIKTA GİYİLEBİLİR TEKNOLOJİLERİN KULLANIMI VE UYGULAMA ALANLARI **183**
Erhan EKİNGEN

IMMERSIVE REALITY TECHNOLOGIES AND THE FUTURE OF TOURISM INDUSTRY

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Introduction

Reality technologies consist of virtual reality (VR), augmented reality (AR), mixed reality (MR), and extended reality (XR). Therefore, in order to figure out MR and XR technologies, it is necessary to comprehend VR and AR that these technologies are based on. VR is a computer-generated virtual environment that is created by combining different types of hardware and allows users to get experiences with the virtual environment completely. As a variation of virtual reality, AR consists of digital content on a physical reality that allows users to experience the virtual and real-world at the same time. MR is a hybrid form of VR and AR in which virtual and physical worlds are combined under a single technology by using various devices and wearable computers. A fusion of real and virtual worlds and human-machine interaction, XR combines all reality technologies and possibly future technologies. (Kunkel and Soechting, 2018).

When the literature is examined, it is noteworthy that reality technologies are also named immersive reality technologies and the term XR is used not only to define the capacity of these technologies but also to interpret the future variable (Mann, et al., 2018). As a comprehensive term, immersive reality technologies usually refer to different dimensions of a phenomenon that presents between the real and the simulated world. These technologies have the potential to provide humanity to create everything virtually, to experience them in virtual and real worlds, and to create experiences beyond imagination in the future (Accenture, 2018).

Immersive reality technologies and their market are widely discussed nowadays, it is estimated that the total market size of them is $80 billion in 2020, $209.2 billion in 2022 $569 billion in 2025, and $2.16 trillion by 2035. Considering these estimates, it is seen that the total future growth of the market will be + 370% (Citigroup, 2018; IDC, 2018). Therefore, immersive reality technologies have great potential for many industries including tourism in the future.

The Concept of Immersive Reality Technologies

Reality technology, which started as a concept in the 1930s, became reality with the device called Sensoma, which Morton Leonard Heilig patented in 1962. Invented by computer scientist Ivan Sutherland and his

student Bob Sproull in 1968, the Damocles Sword was the first VR head-mounted display (HMD) system. However, neither Sensorama nor Sword of Damocles devices were called Virtual Reality because the term Virtual Reality was first used in 1987 by a classical music writer, computer scientist, and co-founder of VPL Research, Jaron Lanier (Sekerci, 2017).

Since the 1970s, with rapidly developing processor capacities and computer hardware, the practical applications of Virtual Reality and Augmented Reality technologies have started to be seen in various fields. The term Mixed Reality, which has just started to be heard in comparison with AR and VR, was first used in 1994 by Paul Milgram ve Fumio Kishino. Extended reality (XR) that combines virtual reality, augmented reality and mixed reality is accepted as the future of reality technologies. These technologies have the potential to provide humanity to create everything virtually are also named immersive reality technologies that refer to different dimensions of a phenomenon that presents between the real and the simulated world. (Handa, et al., 2012). Immersive reality technologies are an integration of virtual content with the physical environment in a way that allows the user to engage naturally with reality. And they expand and create an interaction between the physical and digital worlds by using 360 spaces (Pavithra, et al., 2020).

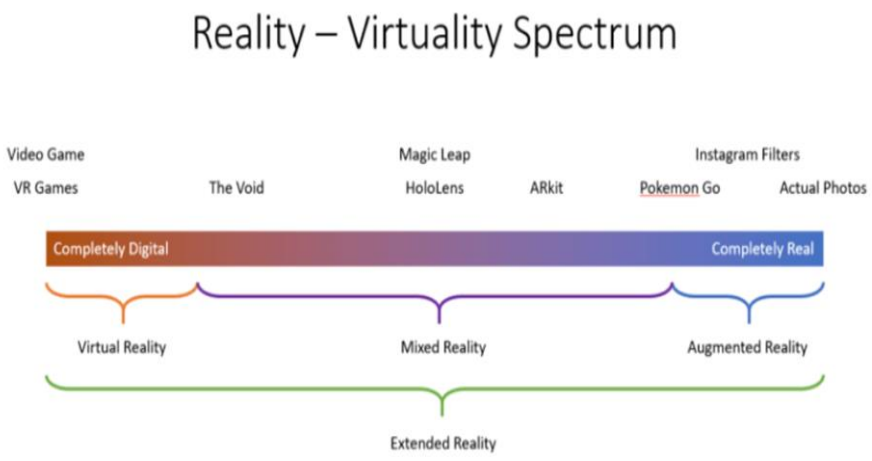

Figure. 1. Reality-Virtuality Spectrum (Steele, 2019).

As seen in Figure 1. immersive reality technologies consist of different technologies, such as virtual reality, augmented reality, mixed reality, and extended reality. The reality- virtuality spectrum refers to the

real-time experience that is usually created with the help of wearable glasses and equipment. In addition to the virtual elements added as a part of the real space, it includes more advanced experiences, from changing the images and sounds of the environment to the re-presentation to the user. Hardware such as Microsoft HoloLens allows users to interact within applications entirely with hand gestures, without any screen or hand control.

Virtual Reality (VR)

Virtual reality (VR) technology is defined as a computer-derived three-dimensional environment where individuals experience the feeling of being there through a computer simulation system. The virtual environment, in which users participate through wearable devices, completely disconnects people from reality and gives them a sense of belonging to that environment (Azuma, 1997). Virtual reality technology is a comprehensive technology that includes sensor technology, computer simulation technology and multimedia technology (Juhou et al., 2019). One of the first wearables to facilitate VR was Google Glass, which combined computers into a head-mounted display (Rhodes & Allen, 2014). The launch of wearables like MagicLeap Lightwear and Microsoft HoloLens, or VR headsets like Google Cardboard and Oculus Rift, has improved user interaction in virtual environments and created opportunities to tackle challenges like instant overlay (Bonetti et al., 2018).

Augmented Reality (AR)

AR technology allows users to benefit such as gaining knowledge, navigating media, and experiencing stories that are naturally included in their environment, so this technology is valued as a technological approach that provides a perfect view of an enhanced version of the real world. So, they can access information about the current location and interact more fun and directly with the app's content. AR has led to the widespread use of technology in many industries because a modern mobile device allows this technology to be used without any additional cost or equipment (Serino et al., 2016).

With AR which enhances the real-world environment with virtual information and combines the real world with virtual characters, the user can

enrich the real world with 3D graphics placed in the field of view (Azuma, 1997). AR applications, which are different versions of VR are more preferred for reasons such as the fact that today's smartphones can access the augmented reality data at any time and can process with a large amount of computing power. Again, the fact that VR applications suppose external resources and a powerful computer to run virtual programs or hardware such as a head-mounted device (HMD) makes augmented reality applications available anytime, anywhere by mobile phone rather than VR (Zheng & Ni, 2006).

Mixed Reality (MR)

The term Mixed Reality was first used in the article which was dealt with the concepts of AR and VR included in the Mixed Reality spectrum, as well as their classification over the human-machine relationship and reality experiences in 1994 by Milgram and Kishino. The machine-to-human relationship and reality experience types mentioned in the article have become one of the most important issues of today, with the increase in the processor capacities of the devices and the decrease in their size simultaneously over the years. HTC Vive Pro Eye which has been developed considerably since the first virtual reality device named "Sensorama Simulator" invented by Morton Heilig in 1962, is the most equipped example of this technology. Being the most well-known member of mixed reality technologies, which include both virtual reality and augmented reality technology, this headset can track the user's pupil movements with the inclusion of external eye-tracking technology (Bayrak and Yengin, 2020).

In recent years, the concept of Mixed Reality has started to be talked about intensely again, with the launching of HoloLens as Microsoft's first commercial HMD (Head-Mounted-Display) product, and Windows introducing the Mixed Reality universe. It is predicted that this technology will be more integrated into daily life with devices like the Magic Leap which allows the physical and digital worlds to be intertwined with the surrounding 3D hologram images and realistic sounds. Not only the visualization of virtual objects and images in the real world but also the inclusion of real-world visuals and data in virtual worlds will come true within the limits of Mixed Reality. Virtual avatars will be created with 3D Holograms that scan the body in real-time and transfer these images to

virtually created environments via computers. Thereby people will be able to attend meetings as if they were really there (HoloNext, 2019).

In addition to the advantages of simple interface, providing a continuous but controlled connection, comfortable and erasing the distance between people and information, MR will be used much more by many industries in the coming years due to increasing processor capacities and decreasing costs (Starchi, 2018).

Extended Reality (XR)

Extended reality (XR) is a type of reality that combines the features of virtual reality, augmented reality, and mixed reality. XR enables the study of technological interactions between humans and machines by combining virtual and real environments. Encompassing all the reality technologies, Extended Reality is a new umbrella term given to all computer-generated environments that combine physical and virtual worlds, creating a completely 3D experience for the user (Qualcomm, 2017).

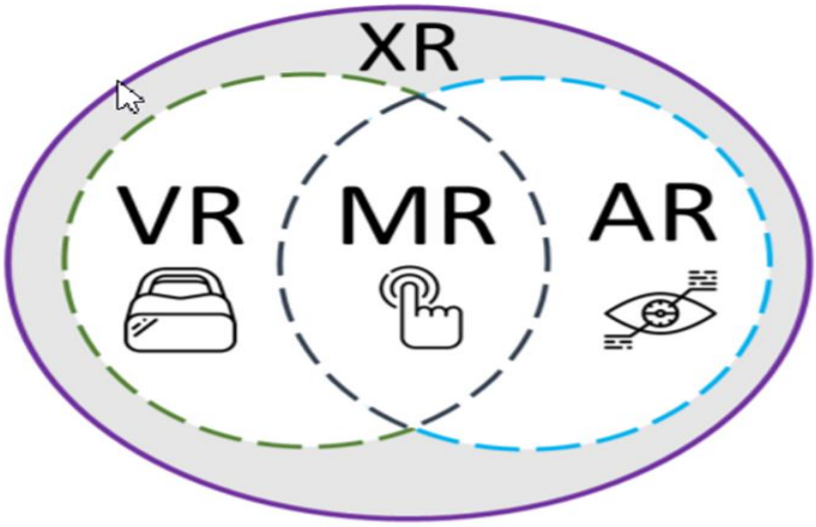

Figure 2. Relationships between XR, VR, AR, and MR (Andrade and Bastos, 2019).

As seen in Figure 2. XR technology is preferred because it removes distance barriers, creates environments that enable learning information that

cannot be obtained by using eyes, imagination, and intelligence. As with any technology, there are advantages and disadvantages in extended reality. The advantages of XR are to be able to experience a different reality, to see the environments that attract users' attention, and to obtain accurate information whenever they want without leaving the working environment, to enable users to receive more effective training and to train them safely with faster and dangerous jobs, to receive distant data without difficulty and uninterruptedly because distance barriers are removed. The disadvantages of XR are the possibility of being exposed to cyber-attacks as in all other technologies, the possibility of creating a business environment where people can prevent their one-on-one and physical communications and communicate only from virtual environments, physical damage caused by XR, VR, AR, MR equipment as a result of long-term use, arising financial loss as the implementation of XR solutions and equipment in the business environment will be a very costly process (Accenture, 2018).

The Potential Usage of MR and XR as Immersive Reality Technologies for Tourism Industry

Immersive reality technologies provide significant contributions for tourism in areas such as accommodation, food and beverage, transportation, marketing, entertainment, and museum (Demirezen, 2019). Combining these technologies with the physical world and the virtual environment to increase interaction and reality is a different experience (Gaberli, 2019). Just as VR and AR, MR and XR can create a customer experience. With these technologies, users are able to interact with both real and virtual objects in real-time, while these objects can interact with each other at the same time (Flaviánet al., 2019). Therefore, companies need to manage these technologies effectively to create memorable experiences (Brakus et al., 2009) that generate affective, positive cognitive, social, emotional, and physical responses (Carlson, et al., 2016). Many services and entertainment industries utilize immersive reality technologies devices to develop highly interactive applications that can guide, educate, and entertain visitors by spatially presenting visuals to increase the imagination, motivation, and enrichment of users (Hammady et al., 2020).

Due to the nature of tourism, it requires constant creativity. Tourism and creativity are inseparable concepts. With technological developments,

the creativity in tourism has also improved and new technologies have allowed innovations in service delivery in the travel and tourism industry (Putro, 2015). Immersive reality technologies can supply a beneficial channel to communicate between product and stakeholders, not only to showcase infrastructures but also to allow ideas to be more easily visualized and understood. Therefore, these technologies have the potential to reshape all industries and the future of society (Andrade and Bastos, 2019).

As well as websites and social media applications, immersive reality technologies play a major role in the development of commerce as they are resilient technologies that can be used to see the products and services offered by tourism businesses in a virtual environment, and to have a sense of reality and a preliminary experience (Fast-Berqlund, et al., 2018), have become very important. These technologies enable people to create unique and the best experiences to improve their travel and tourism interests. For example, it is possible to visit a destination or a touristic area with 360 degrees 3D MR glasses. Advances in holographic IR systems reveal virtual guides that can create narratives and display high-resolution virtual images of places (Dyne, 2018).

Immersive reality technologies giving consumers a chance to explore their destination before booking are the perfect sales tools for travel companies that take the travel shopping experience to a whole new level. Another way that travel businesses can use immersive reality technologies is that these technologies highlight specific points of the destination, like a virtual guide. These technologies can point to different historical events or recreational activities about the destination by reality glasses. Even travel brands can help those who are afraid of boarding an airplane or a boat by using immersive reality technologies that would calm them down or allow them to think of something else (Covarrubias, 2020).

Museums, as one of the major attraction centers of cultural tourism, have great potential where immersive technologies can be used. The utilization of immersive technologies in museums not only enhances experiences but also enriches museums and heritage sites with digital content adapted by using various interaction methods such as sensor-based, concrete, device-based, multimodal, collaborative, and hybrid interaction methods (Bekele & Champion, 2019). Immersive reality technologies can be used in ancient cities as well as in museums. With these technologies, when visitors enter an ancient city, they can see people walking around and

chatting on the streets, get the smell of food cooked in a house, open and close the door of the house, discover all details of the original life of a city (vizyonergenc, 2019).

Health tourism, a developing and increasingly important sector of tourism will also benefit from these technologies. In the healthcare industry, XR can represent the future in different ways for every actor such as insurers, patients, therapists, physicians, and tourism professionals (Storchi, 2018).

Education is becoming more and more important in society, so it is envisaged that more XR applications will be created in tourism education as in many areas. Because these technologies provide a way to simulate or show operating systems without the need for real devices. While XR devices do not affect an already existing solution in any way, they can provide a simulated scenario where users can learn and have hands-on experience. This solution eliminates the need for a person to help and explain how something works. If gamification is applied, by taking action the experience can track the student's actions and provide incentives, such as narration and tips or more detailed information for the student to succeed if the student gets difficulties or does something wrong (Andrade and Bastos, 2019). Converting the way of educational content with visual learning, emotional response, and creativity, XR can be used to increase students' learning and participation in classrooms (Babich, 2018). With these aspects, immersive reality technologies can radically change the way of approach to education (Storchi, 2018), and will be the second sector in terms of XR investments, as highlighted in the Perkins Coie (2018) survey. Another advantage of immersive reality technologies for tourism education is training. It provides safe virtual contexts for trainees to experiment with dangerous equipment and scenarios while allowing supervisors to review training video recordings to monitor trainees' progress and adapt lessons accordingly (Kunkel & Soechting, 2018).

Conclusion

In order to adapt to the changing competitive conditions in parallel with the developing technology, tourism companies must transform into learning organizations. Creating an efficient learning environment for the organization by keeping the available information in the company is the most fundamental goal of a learning organization. Therefore, learning

processes should be supported using current technology and learning methodologies (Bohlin & Brenner, 1997). Although research shows that regions such as North America, Europe, and the Far East are leading the development of these technologies, recent reports show interesting data from emerging markets and developing countries. It is estimated that immersive reality technologies will be the next generation's technology within 15 years (Storchi, 2018).

Real-time interaction and visualization with large volumes of data, and cooperation/information sharing are today's biggest technological challenges. Immersive reality technologies break the barrier of distance that increases access to information and new experiences and enable complex data-rich scenarios to be transformed into accessible applications that blend the real and virtual worlds to enable enhanced and more natural interactions between people and data (Andrade & Bastos, 2019).

Immersive reality technologies will become increasingly common in the future of the tourism industry (Storchi, 2018) because they provide so many benefits such as (Ercan, 2020);

- Provides easy access to information,
- Increases accessibility,
- Provides innovation,
- Supports sustainability,
- Increases attractiveness,
- Creates the image,
- Provides brand loyalty,
- Improves service quality,
- Provides satisfaction,
- Contributes to marketing and promotional activities,
- Contributes to planning and management activities,
- Provides an increase in income,
- Provides efficiency in education
- Provides convenience and professionalism in work and tasks,
- Increases safety.

On the other hand, some difficulties of these technologies should not be ignored. These technologies collect and process large amounts of detailed personal data and data spreading offers a new layer of vulnerability for cyberattacks. Although the application cost is expected to decrease as the

investments of these technologies increase, these technologies are high cost. It is essential that wearables that allow for fully immersive experiences are comfortable and fashionable, as well as always smart and connected. There are significant hardware and technical issues that need to be resolved, such as limited display, power and thermal, connectivity, motion tracking, and co-lighting. Despite all challenges, many new technology services will emerge in the future and many new business values will also emerge with these technologies.

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