

# Immersive technologies as a promising mechanism to reduce the negative impact on natural and cultural tourist sites

*Eugenia Vasyuta*<sup>1\*</sup>, *Galiya Faizullina*<sup>2</sup>, *Tatiana Podolskaya*<sup>1</sup>, *Natalia Bryukhanova*<sup>1</sup>, and *Denis Ushakov*<sup>1</sup>

<sup>1</sup>South-Russian Institute of Management, Russia Academy of National Economy and Public Administration, International Economic Relations Department, Pushkinskaya str., 70, Rostov-on-Don, Russia

<sup>2</sup>Turan University, K. Satpaev str., 16 B, Almaty, Kazakhstan

**Abstract.** Deterioration of architectural monuments, negative impact on natural monuments and closure of tourist sites, manifestations of over tourism negative consequences, transformation of consumer behaviour associated with the spread of the COVID-19 pandemic and other infectious diseases are only a small part of the global problems faced by the world tourism industry. The study aims to form a conceptual idea of the immersive technologies role in reducing the negative impact on natural and cultural tourist facilities, revealing their potential as a positive factor that affects consumer preferences and environmental awareness of potential tourists. The study analyzed statistical data allowing estimating the current state of the immersive tourism technologies market. Besides, the article analyses the degree of demand for these digital tools in various types of tourism in the context of the importance of preservation of cultural monuments and natural heritage on the basis of the survey of potential target audience. The authors provided a classification of immersive technologies in tourism, and evaluated the possibility of their integration into specific tourism products on the basis of existing successful implementation practices. As a result of the answers to the proposed research questions the authors conclude that immersive technologies have become an important factor that influence the decision to purchase a certain tourist product or service, as well as accelerates the probability of visiting a specific tourist attraction. This proves that in modern reality tourism is one of the key sectors of the economy, which focuses is not only on the experience economy, but also on ecological awareness of potential categories of tourists

## 1 Introduction

The rapid development of digital technologies has led to the emergence of innovative solutions, which give new life not only to existing tourism products and services, but also

---

\* Corresponding author: vasyuta-ea@ranepa.ru

to whole destinations of environmental condition that is causing serious concern and to ones that are under the threat of extinction [1-20]. One type of such innovative mechanism is the immersive technologies, which development began in the 1950s. In 1961 Philco Corporation developed the first VR-helmet for military purposes, and a year later M. Heilig patented the world's first virtual simulator called «Sensorama». And in the 1990s immersive technologies began to be actively used in the tourism sector. In this regard, at the current stage of development, immersive technologies are one of the key tools used to form and stimulate consumer demand for tourism services [3]. However, to date, the scientific community is still debating the role of immersive technologies in modern tourism.

Mayuree & Khan (2024) believe that the application of immersive technologies in tourism could become a popular digital tool, providing a new experience of tourist acquaintance with cultural and natural heritage, and also, among other things, and an innovative way to preserve it. Mengyuan & Yixuan (2023) also stick to this position, they note that the expansion of interaction between historical monuments and tourists through digital technology (for example, metauniverses, which also stand out as a kind of immersive technology) are a prerequisite for structural reforms in the field of cultural tourism. However, the authors do not specify how to find a balance between technological progress and the preservation of the authenticity of cultural heritage.

In opposition to this, a team of authors led by Fransis et al. (2022) notice that when making cultural trips, the AR-app indirectly forces users to focus more on the smartphone screen, than on physical interaction with a real tourist attraction.

The fact that immersive aspects of the tourist experience positively influence the perception of the value of visiting cultural heritage sites is noted the team of authors led by Prabuddha & Ranasinghe (2023). At the same time, the authors even recommend the use of AR-technology to improve the destinations of cultural tourism, which will ensure repeated visits to cultural heritage sites. However, the authors do not specify what attractive cultural and historical locations can be included in a potential tourist route [1,4,17]. Moreover, the authors do not note their direction, which makes it difficult to assess the prospects of integrating immersive technologies.

However, a team of authors led by Ricardo et al. (2024) noted that premium tourism suppliers who use augmented reality technologies can also contribute to the preservation of the environment, while improving the quality of guest service. They also note that in the future, successful integration of gamification strategies into tourism products will depend on understanding the peculiarities of the immersive technologies introduced, the expectations of guests and the environmental context.

Analysis of publication activity on the selected topic leads to the conclusion that the problems of tourism activities digital transformation in the context of integration of immersive technologies are the subject of close attention not only of the scientific community, representatives of business and government, but also environmental organizations.

## **2 Materials and Methods**

Despite a sufficient number of diverse works on the topic, the degree of knowledge of immersive technologies in the context of their impact on natural and cultural tourist attractions is insufficient and requires additional research. This article defines immersive technologies as the technologies that provide emotionally rich impressions during the process of receiving a tourist service due to the multisensory impact (tools of extended reality (XR), virtual (VR), mixed (MR) and augmented (AR) reality) and interactive formats personalizing the travel product (digital QR-codes, audio guides and storefronts) [6, 16, 19].

As part of human activities digitalization, the development of VR and AR technologies became increasingly widespread. VR –is a virtual reality in which only the digital world is visible [8]. The use of this technology requires digital reality glasses (VR-glasses), which makes it possible to personalize the experience from the consumption of a tourist product with this type of reality.

AR –isan augmented reality. It requires to use a device (tablet or smartphone) through which one can look at the real world. The digital object appears on the device screen. Considering that, according to the GSM Association, the number of people who have smartphones is 4.3 billion people or 54% of the world population, this technology is practically available to the overwhelming majority of tourists without additional costs for the purchase and maintenance of equipment for tourist facilities.

The main difference between virtual and augmented reality lies in the degree of immersion and the nature of the reality of what is happening. So, if virtual reality (VR) is a computer technology that allows users to plunge into a fully created digital world that looks and feels real but is not, then augmented reality (AR) is a technology that allows the user to combine virtual elements with the real world. It turns out that unlike virtual reality, where the user is completely immersed in a virtual environment, AR adds virtual objects and information to the real environment with which the user interacts. Another main difference between VR and AR is the technology: technical means for virtual reality include VR-helmets, VR-glasses, sensors, gloves, etc. – additional equipment that must be purchased. And in order to use the augmented reality, it is enough to have a smartphone or tablet and download a special application (Tang, 2024, Zhang & Yan, 2023, Ushakov et al., 2022).

However, it should be noted that augmented reality also uses AR-glasses, fixed screens or projection devices for enhancing visual and emotional impact. Thus, in most cases, in contrast to virtual reality technology, augmented reality does not critically require the use of specialized hardware, which makes it more widely applicable and cheaper in mass deployment.

However, digital immersive technology includes two other kinds of reality: MR and XR. MR is a mixed reality in which the digital world interacts with the real world.

XR is an extended reality –a technology that allows the user to immerse in a virtual environment and interact with it through a smartphone, tablet or computer. The environment is based on the data from the video cameras that transmit the image to the screen. Unlike AR-, VR-, and MR-technologies, the use of virtual reality helmets and glasses is not required to view content created in extended reality. Special LED-screens and audio equipment are sufficient. XR-technology combines digital background and real objects as they appear at the time of filming. Extended reality technology also builds an environment beyond these screens, complementing the image as much as the camera can capture it.

A number of experts define extended reality as a technology that includes AR-, VR- and MR-technologies. However, the fundamental distinction of XR technology is that in order to perceive content, it does not require a personalized digital device (smartphone, tablet, helmet or virtual reality glasses), which allows to simultaneously broadcast XR-product to a large number of people and do not spend money on the purchase of individual gadgets for everyone.

Augmented reality technology introduces objects that overlap a person within a virtual environment. By using augmented reality in XR, a person can interact with an object created through AR-technology.

Thus, the user can enter or bypass the premises created by augmented reality technology. The cameras' sensors allow the user to film AR-objects from the right perspective, so that the scenes seem as believable as possible. Wherever the camera turns, sensors adjust the graphic elements in the frame to the desired angle.

XR is most often used in live broadcasts, online concerts, virtual studios and product presentations.

During the preparation of this scientific study the following general scientific methods were used: monographic, economic-statistical, analytical and comparative. The application of these methods will provide answers to the following research questions (RQ), which in turn will help to identify the specifics of the digital transformation of the hospitality and tourism industry as part of the accelerated immersive technologies introduction:

- how immersion technologies influence the travel experience of modern tourists, including those interested in preserving cultural and historical heritage;
- how to classify immersive technologies that can be used in tourism to reduce anthropogenic pressures on natural and cultural heritage;
- what are the potential directions for the immersive technologies development for the preservation of natural tourist sites and cultural monuments.

### 3 Results

In modern realities, including the post-pandemic recovery of the industry, the successful promotion of tourism products and the growth of tourism services sales largely depend on consumer behavior and preferences. It relates to both the personalization of tourism offers and the digital transformation of the industry.

The global immersive reality market is projected to reach \$136 billion in 2025 and \$780.4 billion in 2033 at an average annual growth rate of 24% (Global immersive reality market – trends and forecast for 2024-2033).

At the same time, the introduction of immersive technologies in the tourist product will not only become a necessary attribute of any trip, but will also help to preserve the state of natural and cultural monuments. To confirm this thesis, in February 2024, the authors of this study conducted a survey among young people aged 20-25 living in Russia. The results are presented in Figure 1.

The purpose of the survey is to identify types of immersive technologies used by them during travel.

The sample size was 100 respondents.

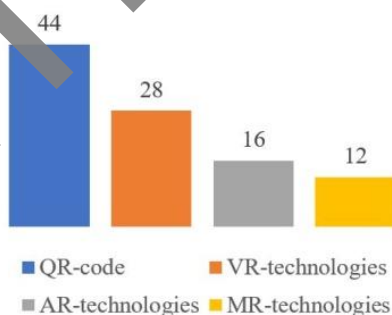


Fig.1. Immersive technologies used by tourist during travel, %

In addition, the survey noted that this digital technology is most commonly used by respondents in educational and cultural tourism, as well as during leisure trips.

Besides, given the trend of increasing the environmental culture of young people, it was noted that immersive technologies are considered quite popular digital tools within the framework of eco-tourism too.

Thus, as a result of the survey data analysis, it is advisable to propose a following classification of immersive technologies, which are the key components underlying the modern tourist product:

- informative immersive technologies (I-IT);
- illusionary installation immersive technologies (2I-IT);
- augmented reality technologies (AR-technologies);
- virtual reality technologies (VR-technologies);
- mixed reality technologies (MR-technologies).

Thus, the presented classification allows to assess the possibility of implementation of specific types of immersive technologies in the structure of tourism products of different orientation, as illustrated in Table 1.

**Table 1.** Assessment of immersive technologies use in the structure of tourism product adapted to the preservation of cultural and natural tourist heritage

Kind of tourism	Type of immersive technology	Type and example of museum complex that needs to implement immersive technologies into its activities	Advantages of immersive technologies in the structure of the tourist product in terms of preservation of natural heritage and cultural monuments
Cultural and educational, cognitive	I-IT,2I-IT	Architectural Museum/ Acropolis Museum (Athens)	Possibility to reconstruct ancient structures and significant architectural monuments, which allows a tourist to see everything in the smallest detail and at the same time reduce the influence of external negative factors
Entertaining	AR-technologies VR-technologies	History Museum/ Prado Museum (Madrid), Art Museum/ Uffizi Gallery (Florence)	Virtual reconstruction of historical cultural monuments, allowing to offer visitors a digital tour in different eras, while preserving everyday objects in the pristine state
Ecological	MR-technologies	Natural Science Museum/ Smithsonian Institution (Washington)	Immersion of visitors in the world of wildlife, which gives the opportunity to get acquainted with the unique species of plants and animals, as well as to understand the importance of environmental problems in the future

## 4 Discussion

Analysis of some successful practices of immersive technologies implementation in the tourism sector leads to the conclusion that the presence of the latter in the structure of the tourism product can not only change the attitude of consumers to a specific tourism product or service, but also to a whole natural and cultural destination, radically transforming these preferences in a positive way and instilling a careful attitude to a particular territory. This approach is used, for example, in the Russian gastronomic tourism.

For instance, within the project «Immersive Theatre – Food with the sound of the sea» tourists [2] can not only meet their gastronomic needs, but also gain a new experience during acquaintance with the culinary traditions of different regions of Russia. In addition, the framework of such tours quite successfully implements the principles of nature-friendly nutrition, in which the process of cooking does not damage the environment, plant and animal life. It is also worth noting that the introduction of new digital wearable devices adapted to the perception of immersive reality will not only increase the level of attractiveness of domestic tourism in the regions of Russia, but also the level of awareness about iconic tourist locations for new categories of consumers.

For example, immersive component is important aspect of children's tourism [7], reflected in such programs as "Tour to the fairy tale park-hotel "Mazay" (Yaroslavl region), "Old Tula fun" (Tula region), "Moscow Speaks and Shows" (Moscow region) etc. It should also be mentioned that immersive technologies are actively used by key players of the tourism services market and as a marketing tool, allowing to create more emotional advertising materials. These materials are used to sell potential tourist experience, that, among other things, focuses on environment. For example, this is how the national tour operator «Alean» [14], one of the flagships in the development of domestic tourism, offers 8 author tours in Russia, which can be classified as trips, carried out in the context of immersive tourism and aimed at the preservation of natural and cultural monuments.

The concept of these trips implies prior aesthetic pleasure, parallel participation in educational and cognitive programs, virtual gastronomic travel, MR master classes, as well as an active communication between tourists, who become the part of the tour group and the active participants of the gaming tours.

Thus, tourism based on immersive technologies is a potential tool for post-COVID recovery of the tourism industry ecosystems, as well as a prerequisite for the sustainable development of the industry, existing in the conditions of adverse anthropogenic factors impact.

## 5 Conclusion

The results of the study show that immersive technologies can become a promising instrument influencing consumer behavior and environmental awareness. However, it should be noted that in the post-pandemic recovery of the industry, immersive technologies will not be able to fully replace tourism. At the same time, the use of these technologies in the structure of tourism products will remain relevant for the categories of consumers whose income level cannot allow them to travel or who have any health restrictions, which also limits their ability to travel fully. Additionally, immersive technologies can be used by the tourist services consumer during the main phases of the journey, namely: in the framework of the so-called test or study visit, during the trip, and after that, which in turn will preserve the natural ecosystems of the regions.

It is also worth mentioning that immersive technologies can not only change the behavior of tourism consumers, but also transform the behavior of digital tourism providers at a time of increasing global environmental problems. Thus, changes in the perception of risks, which may also arise in the context of environmental degradation, as well as increased requirements for the quality and safety of tourism services, have also led to the conclusion, immersive technologies can be a key factor in the growth of domestic tourism and the recovery of tourist flows. Thus, in the context of the digital transformation of tourism, immersive technology is a key component of the modern tourism product, which is transforming the behavior of key market players, allowing the latter to implement an alternative type of travel, which is beneficial to the industry's resilience to external threats.

## Acknowledgements

Article was written on the basis of the RANEPА state assignment research program.  
Research topic - 6.14-2024-1



## References

1. Akopova, E.S., Przhedetskaya, N.V., Taranov, P.V., Israilova, E.A. (2017). *European Research Studies Journal*, **20(1)**: 267–275.
2. Belova, S. K. (2023). Creative approaches to popularizing new Russian cuisine. Retrieved from: [https://www.elibrary.ru/download/elibrary\\_54343577\\_56909921.pdf](https://www.elibrary.ru/download/elibrary_54343577_56909921.pdf)
3. Cheong, R. (1995). The virtual threat to travel and tourism. Retrieved from: <https://www.sciencedirect.com/science/article/abs/pii/026151779500049T?via%3Dihub>
4. Ermilova, M.I., Ushakov, D., Laptev, S.V. (2018). *Opcion*, **34**(Special Issue 17): 1074–1087.
5. Global immersive reality market – trends and forecast for 2024-2033. Retrieved from: <https://globalcio.ru/discussion/37797/>
6. Jiao, J., Hu, D. (2024). *The EUrASEANs: Journal on Global Socio-Economic Dynamics*, **1(44)**: 147-159.
7. Kushnir, K.V. (2023). Children's tourism as a direction of creative activity: regional cases. Retrieved from: <https://cyberleninka.ru/article/n/detskiy-turizm-kak-napravlenie-kreativnoy-deyatelnosti-regionalnye-keysy/viewer>
8. Li, T., Chen, Y. (2019). Will virtual reality be a double-edged sword? Exploring the moderation effects of the expected enjoyment of a destination on travel intention. Retrieved from <https://www.sci-hub.ru/10.1016/j.dmm.2019.02.003>
9. Mayuree, N. & Khan, M. (2023). Application of Immersive Technologies for Managing Intangible Cultural Heritage in Tourism Destinations. Retrieved from: <https://www.sciencedirect.com/science/article/abs/pii/026151779500049T?via%3Dihub>
10. Mengyuan, Z. & Yixuan, Y. (2023). The Research on the Application of Metaverse in the Cultural and Tourism Industry. Retrieved from: [https://www.researchgate.net/publication/376132133\\_The\\_Research\\_on\\_the\\_](https://www.researchgate.net/publication/376132133_The_Research_on_the_)
11. Prabuddha C. & Ranasinghe P. (2023) Investigation of Augmented Reality's Influence on Heritage Tourism Satisfaction. Retrieved from: [https://www.researchgate.net/publication/378300218\\_Investigation\\_of\\_Augmented\\_Reality's\\_Influence\\_on\\_Heritage\\_Tourism\\_Satisfaction](https://www.researchgate.net/publication/378300218_Investigation_of_Augmented_Reality's_Influence_on_Heritage_Tourism_Satisfaction)
12. Pratisto, F. H., Thompson, N. & Potdar, V. (2022) Immersive technologies for tourism: a systematic review. Retrieved from: [https://www.researchgate.net/publication/361478697\\_Immersive\\_technologies\\_](https://www.researchgate.net/publication/361478697_Immersive_technologies_)
13. Ricardo, M., Vasco, S. & Sampaio, M. (2024) Exploring Gamification in Luxury Tourism. Retrieved from: [https://www.researchgate.net/publication/379626136\\_Exploring\\_Gamification\\_in\\_Luxury\\_Tourism](https://www.researchgate.net/publication/379626136_Exploring_Gamification_in_Luxury_Tourism)
14. Sukhov, S. R. (2023) Opportunities for involving creative industries in the formation of a tourism product. Retrieved from <https://cyberleninka.ru/article/n/vozmozhnosti-vovlecheniya-kreativnyh-industriy-v-formirovanie-turistskogo-produkta/viewer>
15. Tang, G. (2024). *The EUrASEANs: Journal on Global Socio-Economic Dynamics* **2(45)**: 494-507.
16. Ushakov, D., Bandurin, V., Bandurin, A.(2017). *Montenegrin Journal of Economics*, **13(1)**: 171–179.

17. Ushakov, D., Chich-Jen, S. (2018). E-Planning and Collaboration: Concepts, Methodologies, Tools, and Applications, **2-3**: 1096–1119.
18. Ushakov, D., Dudukalov, E., Kozlova, E., Shatila, K. (2022). Transportation Research Procedia, **63**: 2392–2400
19. Wazni, I. (2023). The EUrASEANs: Journal on Global Socio-Economic Dynamics, **1(38)**: 7-17.
20. Zhang, X. & Yan, H. (2023). The EUrASEANs: Journal on Global Socio-Economic Dynamics, **1(38)**: 61-72.

RETRACTED