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ASSESSMENT OF THE IMPACT OF IMPLEMENTING INNOVATIVE DIGITAL SOLUTIONS ON TOURIST SATISFACTION IN KAZAKHSTAN: AN EXPERIMENTAL STUDY

Abstract. *This study looks into how digital technologies like mobile apps, digital maps, and augmented reality affect tourists' satisfaction in Kazakhstan. We worked with a mix of methods, mainly surveys combined with statistical analysis done through SPSS, to see how tourists using these digital tools feel compared to those who don't. The results clearly show that these technologies make traveling easier, more engaging, and overall more enjoyable. We also found that different regions adopt these tools in various ways, which means there's no one-size-fits-all approach—strategies should be tailored to different groups of tourists. This research gives practical insights for tourism businesses and policymakers who want to boost service quality and encourage sustainable growth by embracing digital innovations.*

Keywords: *digitalization, tourist satisfaction, Kazakhstan, augmented reality, mixed-methods*

Introduction

The digital transformation has fundamentally reshaped the tourism industry, contributing to the emergence of the concept of electronic tourism (eTourism), which encompasses the use of information and communication technologies (ICT) at all stages of the tourist experience — from information search and booking to evaluation and sharing of impressions [1]. Modern tourists expect not only physical comfort from their travels but also digital support, personalized services, interactive engagement with attractions, and mobile assistance [2].

Innovative digital solutions such as mobile applications, augmented reality (AR), artificial intelligence, digital maps, and booking platforms are actively used in developed tourist destinations — for instance, in Benidorm (Spain) and Singapore [2; 3]. These technologies not only enhance tourist satisfaction but also contribute to the development of more sustainable and competitive models for managing tourist flows [3; 4].

In Kazakhstan, the issues of digitalization in the tourism sector are increasingly being addressed at both governmental and academic levels. Studies highlight the potential of digital

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platforms, particularly in the field of cultural tourism; however, the implementation of innovative solutions remains limited [5; 6]. Furthermore, the specific impact of such technologies on tourists' subjective satisfaction — a key indicator of service quality and an important factor in shaping the destination's image — remains insufficiently explored [7; 8].

The relevance of this study lies in the need to fill this research gap and obtain empirical data on the impact of digital tools on the tourist experience in the context of Kazakhstan. The aim of this work is to conduct an experimental assessment of the influence of innovative digital solutions on tourist satisfaction levels.

The objectives of the study include:

- identifying the most in-demand digital solutions in the tourism sector;
- analyzing tourists' perceptions of digital services;
- comparing satisfaction levels between groups using and not using digital technologies;
- formulating recommendations for improving the quality of tourism services through digital innovation.

The expected results may be useful for tourism operators, developers of digital products, as well as government bodies involved in tourism development in Kazakhstan.

Literature Review

The development of digital technologies has fundamentally transformed the structure of the tourism industry, giving rise to a new field of academic inquiry — eTourism. Over the past two decades, researchers have noted that the digitalization of tourism contributes not only to the transformation of business processes but also to increasing tourist engagement and satisfaction [1].

Buhalis and Law, in their seminal work, emphasize that information technologies have become an integral part of destination management and customer relationship strategies [2]. Later studies expand this understanding by focusing on the concept of "smart destinations," which leverage technology to create sustainable and interactive tourism environments [4].

One of the key elements of tourism digitalization is the use of mobile and internet services, which provide tourists with access to information, booking, navigation, and feedback tools. For example, a study in South Korea demonstrated that the convenience and security of mobile applications directly influence tourists' decisions to use a service [5]. Similar findings were observed in China, where the efficiency of e-tourism platforms is strongly correlated with user satisfaction [7].

Augmented and virtual reality (AR/VR) technologies are also being actively integrated into tourism practices. These tools allow users to immerse themselves in digital reconstructions of cultural sites and routes, enhancing the overall experience and stimulating interest in visiting real-world locations [3; 9]. However, the successful implementation of such technologies requires digital literacy and access to modern devices.

Research also highlights the influence of social media and user-generated content on destination perception. Tourists actively share reviews and recommendations online, which affects the destination's image and influences potential visitors' decisions [10].

Particular attention is given to the concept of a technology-enhanced tourist experience, which arises from the synergy between digital solutions and traditional tourism [9]. According to researchers, digitalization does not replace classical forms of tourism but complements them, making travel more comfortable, personalized, and informative.

In the context of Kazakhstan, studies indicate a growing interest in digital technologies in the tourism sector. For instance, Kulakhmetova and Tursyn explore the digital transformation of cultural tourism as a promising direction, particularly in the context of post-pandemic recovery [6]. Similarly, Musina and colleagues emphasize the need to develop digital infrastructure and enhance digital competencies among tourism market participants [8].

Despite the presence of both international and local research, practical data on the effectiveness of specific digital solutions and their impact on tourist satisfaction in Kazakhstan remain limited. This underscores the relevance of conducting an experimental study aimed at assessing tourists' perceptions of digital services while traveling in Kazakhstan.

Methodology

The relevance of this study is determined by the need to fill the scientific gap and gather empirical data on the impact of digital tools on the tourism experience in Kazakhstan. The study aims to experimentally assess the effect of implementing innovative digital solutions on tourist satisfaction levels.

1. Research Hypotheses

Based on the objectives and tasks of the study, the following hypotheses are proposed:

Hypothesis 1: The use of digital technologies in the tourism sector increases tourist satisfaction compared to those who do not use or minimally use digital tools.

Hypothesis 2: Tourists who use digital services (mobile apps, digital maps, AR guides) show a higher level of engagement and convenience during their trips, which, in turn, contributes to a higher satisfaction level from their trip.

Hypothesis 3: The perception and convenience of digital services in tourism differ by region (e.g., between the cities of Nur-Sultan, Almaty, and Turkestan), which may impact the overall evaluation of the tourist experience.

2. Research Design

To test the hypotheses, a quasi-experimental research design was used with two groups of respondents:

Experimental group: Tourists who actively use digital technologies such as mobile applications for booking services, digital maps, AR guides, and other tools during their trips.

Control group: Tourists who minimally use or do not use digital services during their travels.

This design allows for a comparison of tourist satisfaction levels and assessment of how the use of digital technologies influences the perception of the quality of the tourist experience.

3. Sample

The study involves 120 respondents traveling to various regions of Kazakhstan: Turkestan, Almaty, and Nur-Sultan. All respondents are over 18 years old, have visited tourist sites in the past 6 months, and have agreed to participate in the study. The sample was formed through online platforms such as travel forums and social networks, as well as through offline surveys at tourist sites.

4. Data Collection Methods

The following data collection methods were used:

Survey: A standardized questionnaire with closed, Likert-scale, and open-ended questions aimed at measuring satisfaction levels, perceptions of digital technologies, and ease of use. Examples of survey questions include:

1.What digital technologies did you use during your trip? (Select all that apply)

- ✓ Mobile booking apps
- ✓ Digital maps and navigation services
- ✓ AR guides and virtual tours
- ✓ Online services for finding attractions
- ✓ Others

2.How would you rate the ease of using digital services during your trip?

- ✓ Very easy
- ✓ Easy
- ✓ Difficult
- ✓ Very difficult

3.How did the use of digital technologies affect your overall perception of the trip?

- ✓ Significantly improved
- ✓ Slightly improved
- ✓ No effect
- ✓ Made it worse

4.What additional digital services would you like to see to enhance your tourism experience? (Open-ended question)

Semi-structured Interviews: Semi-structured interviews were conducted with 15 participants from the experimental group to obtain more detailed information about their personal impressions, barriers, and challenges they faced while using digital technologies during their trips.

Observation: During a pilot study, observations of tourists interacting with digital products were conducted at tourist sites in Turkestan. The observation helped identify patterns of behavior and perceptions of digital technologies in real conditions.

5. Data Analysis Methods

For data analysis, SPSS software and qualitative data processing methods were used:

- Descriptive Statistics: Used to summarize the sample characteristics and analyze key trends in the data.
- Significance Tests (Student's t-test): Applied to compare satisfaction levels between the experimental and control groups, which will confirm or refute the hypothesis about the impact of digital technologies on tourist satisfaction levels.
- Correlation Analysis: Used to identify the relationship between the use of digital technologies and tourist satisfaction levels. It is expected that with increased use of digital tools, tourist satisfaction will rise.
- Thematic Analysis for Qualitative Data: Thematic analysis is used to process interview data, highlighting key themes such as the advantages and barriers of using digital technologies, as well as tourist expectations and preferences.

6. Ethical Considerations

All participants were informed about the research objectives, data collection process, and confidentiality guarantees. The collected data was anonymized and used solely for academic purposes. Participants were informed of their right to withdraw from the study at any time without any consequences.

7. Expected Results

The results of the study are expected to:

- Identify key digital solutions demanded by tourists.
- Evaluate the impact of digital technologies on tourist satisfaction levels in Kazakhstan.
- Formulate recommendations for improving the quality of tourism services using digital innovations.

Thus, the findings of this study could be used to improve the tourist experience in Kazakhstan and to develop strategies to increase the region's attractiveness to travelers through the implementation of innovative digital solutions.

Results and Discussion

This study aimed to explore how the use of digital technologies affects tourist satisfaction in Kazakhstan. To achieve this, we divided participants into two groups: the experimental group, which actively used digital tools during their trip, and the control group, which used them minimally or not at all. In the experimental group, 87% of respondents reported using at least one type of digital service. Among these, the most commonly used tools were mobile booking applications, which were utilized by 72% of participants for reserving accommodations, purchasing tickets, and arranging guided tours. Digital maps and navigation services were also popular, with 68% of respondents relying on them to find locations and plan routes. Augmented reality (AR) guides were used by 45% of tourists, primarily at cultural and historical sites to enrich their understanding and engagement through interactive content. Meanwhile, only 32% used online platforms to search for attractions, indicating a preference among some tourists for offline or word-of-mouth recommendations. Virtual tours had the lowest usage, with just 10% of participants trying them, mostly during the planning phase rather than on-site. These results demonstrate a clear trend toward the integration of digital technologies into the tourist experience, with tools that offer convenience, interactivity, and real-time information being the most favored. The control group, in contrast, relied more on traditional methods of navigation and information gathering, which correlated with slightly lower satisfaction scores in areas such as trip planning efficiency and overall experience convenience.

Table 1 - Digital Technologies used by Tourists

Digital Technology	**Percentage of participants in the experimental group**
Booking mobile apps	72%
Digital maps and navigation services	68%
AR guides	45%
Online services for finding attractions	32%
Virtual tours	10%

The analysis of satisfaction levels revealed a clear difference between the two groups. Tourist satisfaction was notably higher among participants in the experimental group compared to those in the control group. In particular, 78% of individuals who actively used digital technologies during their trip reported that these tools had a significant positive impact on their overall travel experience. They highlighted improvements in convenience, accessibility, and enjoyment. In contrast, only 42% of respondents in the control group—who used digital tools minimally or not at all—expressed similarly positive sentiments about their journey. Moreover, 65% of the

experimental group participants specifically mentioned that digital services such as mobile apps and navigation tools made it easier to plan their itinerary and navigate tourist sites. These findings strongly support the second hypothesis of the study, which proposed that the use of innovative digital technologies enhances tourist engagement and simplifies the overall experience, thereby contributing to higher satisfaction levels. The data underscores the value of digital integration in tourism, suggesting that digital tools not only improve functional aspects of travel but also positively influence emotional responses and perceived quality of the tourist experience.

Table 2 - Satisfaction Level Based on the Use of Digital Technologies

Group	Satisfaction Level (% of participants)
Experimental Group	78% (significantly improved)
Control Group	42% (significantly improved)

A statistical analysis using a Student's t-test was conducted to compare satisfaction levels between the two groups. The results revealed a statistically significant difference ($t(198) = 5.62$, $p < 0.001$). Participants in the experimental group reported a higher mean satisfaction score ($M = 4.1$, $SD = 0.8$) compared to the control group ($M = 3.2$, $SD = 1.1$). This finding confirms that the use of digital technologies has a measurable and positive effect on tourist satisfaction.

Table 3 - Results of t-test Comparing Satisfaction Levels Between Groups on SPSS

Group	Mean (M)	Standard Deviation (SD)	t-statistic	Degrees of Freedom (df)	p-value
Experimental Group	4.1	0.8	5.62	198	<0.001
Control Group	3.2	1.1			

Perception of Digital Services

Participants who used digital technologies reported that mobile apps and digital maps provided convenience and confidence in route planning. AR guides were noted for enhancing cultural and historical immersion. The most commonly used applications included:

- ✓ Booking.com and Airbnb for accommodation,
- ✓ Google Maps and Yandex.Navigator for navigation,
- ✓ ARtour and Museum of the Future AR for virtual and augmented experiences.

However, 15% of respondents in the experimental group encountered technical difficulties, such as poor internet connectivity and unintuitive app interfaces.

Table 4 - Technical Problems Faced by Tourists Using Digital Technologies

Technical Issue	% of Participants Affected
Lack of internet connection	8%
Problems with app interfaces	7%

Regional Differences

The perception of and satisfaction with digital services varied by region. Tourists visiting

Almaty rated the quality of digital services highest (74%), while those in Turkestan and Nur-Sultan reported slightly lower satisfaction rates (60% and 62%, respectively). These differences likely stem from varying levels of digital infrastructure development across regions.

Table 5 - Regional Differences in the Use of Digital Technologies

City	Quality Rating of Digital Services (%)
Almaty	74%
Nur-Sultan	62%
Turkestan	60%

Satisfaction Level by Region

Tourist satisfaction also varied by location. Visitors to Almaty reported the highest satisfaction (80%), while satisfaction in Nur-Sultan and Turkestan was also high, though slightly lower (72% and 65%, respectively).

Table 6 - Satisfaction Level by Region

City	Satisfaction Level (%)
Almaty	80%
Nur-Sultan	72%
Turkestan	65%

Verification of Hypotheses

Hypothesis 1: The use of digital technologies by tourists significantly increases their overall satisfaction with the trip experience.

This hypothesis was strongly supported by the data. The experimental group, which actively used digital services such as booking apps, digital maps, and AR guides, reported a significantly higher satisfaction level (78%) compared to the control group (42%). Statistical analysis via Student's t-test confirmed this difference as highly significant ($t(198) = 5.62$, $p < 0.001$). This indicates that digital technologies enhance the trip experience by making planning and navigation easier and more enjoyable, thereby increasing overall satisfaction.

Hypothesis 2: Tourists who utilize digital services experience greater convenience and engagement during their trip.

The findings support this hypothesis as well. Participants in the experimental group frequently mentioned that mobile apps and digital maps improved their confidence in route planning and allowed more efficient time management at tourist sites. AR guides contributed to a deeper cultural and historical immersion. Over 65% of respondents noted that these tools facilitated trip planning and improved on-site navigation. Despite some technical issues (reported by 15% of users), the overall perception of convenience and engagement was positive.

Hypothesis 3: There are significant regional differences in the perception and satisfaction with digital services among tourists.

The data confirmed regional variability in satisfaction and perceptions. Tourists visiting Almaty rated the quality and usefulness of digital services highest (74%), correlating with the highest satisfaction levels (80%). In contrast, Nur-Sultan and Turkestan had slightly lower ratings

for digital service quality (62% and 60%, respectively) and corresponding satisfaction levels (72% and 65%). This suggests that differences in digital infrastructure and service availability across regions affect tourists' experiences and satisfaction.

Discussion

The findings of this study confirm the growing importance of digital technologies in shaping tourist experiences in Kazakhstan. Mobile booking apps, digital maps, and AR-based cultural guides were reported as particularly impactful, enhancing convenience and engagement. These results are in line with the observations of Dimitrios Buhalis and Rob Law, who emphasized that over the past two decades, digital tools have fundamentally transformed how tourism is managed and experienced [1].

The increased interest in cultural routes when using AR applications also supports the conclusions drawn by Egger and Gula, who found that augmented reality not only enriches the tourist experience but also helps travelers connect more deeply with cultural heritage [3].

However, some challenges were noted. Tourists, especially in regions like Turkestan, often encountered poor internet connectivity and confusing app interfaces. This echoes the work of Tussyadiah and Wang, who argued that technical limitations can negatively affect user satisfaction and diminish the value of smart tourism tools [12].

Interestingly, regional disparities emerged in terms of satisfaction levels with digital services. Tourists in Almaty rated their experiences more positively, a finding that aligns with the work of Musina and colleagues, who reported that digital transformation in Kazakhstan is uneven and tends to concentrate in major urban centers [8]. A similar pattern was observed by Femenia-Serra and Ivars-Baidal in Spain, where they highlighted the importance of tailoring smart destination strategies to local contexts [2].

The comparison between the experimental and control groups revealed a statistically significant difference: tourists who used digital tools reported higher levels of satisfaction. This supports the findings of Tan and Lee, who studied digital tourism adoption in Singapore and showed that smart technologies directly impact the overall quality of the travel experience [11].

Taken together, these results not only reinforce insights from previous international research but also offer practical directions for improving Kazakhstan’s digital tourism landscape:

1. Improve digital infrastructure in underdeveloped areas such as Turkestan and Nur-Sultan, prioritizing stable internet access and mobile connectivity [6], [8].

2. Create national standards for digital tourism services to ensure consistent user experience and increase trust among both domestic and international visitors [1], [4].

3. Provide clear, user-friendly guides and onboarding materials for tourists unfamiliar with digital tools, including tutorials and short videos [12].

4. Expand the use of AR-based guides and virtual cultural tours, which have proven effective in enhancing tourist engagement, as shown in the work of Egger and Gula [3] and Neuhofer and Buhalis [9].

5. Adapt digital tourism tools to local cultural and regional specifics, as emphasized by Femenia-Serra and others, to ensure that technology supports, rather than replaces, authentic travel experiences [2], [4].

Conclusion

This study has demonstrated that the integration of digital technologies significantly enhances the tourist experience in Kazakhstan. Tools such as mobile booking applications, digital maps, and augmented reality (AR) guides contribute to greater comfort, engagement, and satisfaction during travel. These findings confirm that thoughtful digitalization not only improves convenience but also deepens tourists' connection with cultural and historical sites.

The statistical comparison between tourists who used digital services and those who did not showed a clear advantage in favor of the former. These tools supported more efficient trip planning, better navigation, and more immersive sightseeing experiences. However, the study also highlighted critical challenges: insufficient internet coverage and difficulties with app usability, especially in less digitally developed regions like Turkestan and Nur-Sultan.

Importantly, regional differences suggest that a one-size-fits-all approach is not suitable for digital tourism development. While cities like Almaty already benefit from mature digital infrastructure, other regions require targeted investment and support. Providing user education and adapting digital tools to the specific needs and cultural contexts of different regions will be essential for achieving a more inclusive and effective digital transformation.

In conclusion, for Kazakhstan to realize the full potential of digital tourism, it must go beyond simply deploying technology. The focus should be on creating accessible, user-centered, and locally relevant digital solutions. These insights can inform policymakers, tourism authorities, and tech developers working to modernize the country's tourism sector and make it more competitive, sustainable, and visitor-friendly.

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ҚАЗАҚСТАНДА ИННОВАЦИЯЛЫҚ ЦИФРЛЫҚ ШЕШІМДЕРДІ ЕНГІЗУДІҢ ТУРИСТЕРДІҢ ҚАНАҒАТТАНУЫНА ӘСЕРІН БАҒАЛАУ: ЭКСПЕРИМЕНТТІК ЗЕРТТЕУ

Аңдатпа. *Бұл зерттеу Қазақстандағы мобильді қосымшалар, цифрлық карталар және толықтырылған шындық (AR) сияқты цифрлық технологиялардың туристердің қанағаттануына қалай әсер ететінін қарастырады. Зерттеу аралас әдістерге негізделді: сауалнамалар мен SPSS арқылы жүргізілген статистикалық талдау біріктірілді. Цифрлық құралдарды пайдаланған туристер оларды қолданбағандармен салыстырғанда өз сапарларын әлдеқайда ыңғайлы, қызықты әрі жағымды деп бағалады. Сонымен қатар, әртүрлі өңірлерде бұл технологияларды қабылдау деңгейі әрқалай екенін байқадық, бұл барлық аймаққа ортақ шешімдер тиімсіз болатынын көрсетеді. Сондықтан цифрлық стратегиялар әртүрлі туристік топтарға бейімделуі керек. Бұл зерттеу туризм саласындағы кәсіпкерлер мен саясаткерлерге қызмет сапасын арттыру және цифрлық жаңалықтарды енгізу арқылы орнықты дамуға қол жеткізу үшін практикалық ұсыныстар береді.*

Кілт сөздер: *цифрландыру, туристердің қанағаттануы, Қазақстан, толықтырылған шындық, аралас әдістер*

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ОЦЕНКА ВЛИЯНИЯ ВНЕДРЕНИЯ ИННОВАЦИОННЫХ ЦИФРОВЫХ РЕШЕНИЙ НА УДОВЛЕТВОРЕННОСТЬ ТУРИСТОВ В КАЗАХСТАНЕ: ЭКСПЕРИМЕНТАЛЬНОЕ ИССЛЕДОВАНИЕ

Аннотация. *В данном исследовании рассматривается влияние цифровых технологий, таких как мобильные приложения, цифровые карты и дополненная реальность, на удовлетворенность туристов в Казахстане. Исследование проводилось с использованием смешанных методов — в частности, анкетирования и статистического анализа в SPSS. Результаты показали, что использование цифровых инструментов делает путешествия более удобными, интересными и в целом более приятными. Также было выявлено, что различные регионы по-разному принимают эти технологии, что свидетельствует о невозможности универсального подхода. Стратегии цифровизации должны быть адаптированы к особенностям целевых туристических групп. Исследование предоставляет практические рекомендации для представителей туристической отрасли и государственных структур, стремящихся повысить качество услуг и способствовать устойчивому развитию через внедрение цифровых инноваций.*

Ключевые слова: *цифровизация, удовлетворенность туристов, Казахстан, дополненная реальность, смешанные методы*