

Technological Innovation in Gaming and Its Impact on Cultural Heritage Research

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Abstract. In recent years, due to the advancement of game production techniques, the modeling accuracy of buildings in games has become increasingly realistic. This article aims to explore whether technological updates and development in the game industry can drive the economic growth of the real-world cultural and tourism industry. The article employs the questionnaire survey method as the primary research approach to investigate the relevant factors and specific circumstances that influence the empowerment of cultural heritage clusters by technological innovations in the game industry. By analyzing the data and charts from 153 questionnaires, it examines the relationship between the types of respondents and the development of the game industry and local tourism, verifies the authenticity and validity of the data, and analyzes the prerequisites and transformation process for players to shift from being consumers of games to consumers of cultural and tourism products. The article aims to prove the prerequisites and feasibility of technological innovations in the game industry, empowering cultural heritage clusters, and demonstrates that the architectural modeling design in games has a positive and practical impact on the economic development of tourism in the filming locations.

Keywords: Game Industry, Technological Innovation, Development and Empowerment of Cultural Heritage Clusters.

1. Introduction

The "2023 China Game Industry Report" indicates that in 2023, the actual sales revenue of the domestic game market exceeded the 300 - billion - yuan threshold for the first time, and the user scale reached a new high of 668 million. On August 20, 2024, China's first triple-A game, Black Myth: Wukong, was globally launched, triggering extensive discussions both domestically and internationally. In particular, the game's portrayal of real historical cultural relics and scenic spot scenes has also drawn widespread attention [1].

Towards the end of the summer vacation, Black Myth: Wukong made Shanxi the tourist destination with the highest search popularity, and also pushed cities such as Linfen, Shuozhou, Datong, and Jincheng into the peak tourist season. Data from Tongcheng Travel shows that as of 16:00 on August 20, the search popularity for tourism in Shanxi increased by 17% compared to the same time of the previous day. Among them, the search popularity for tourism in Shuozhou increased by 91%, and that in Jincheng increased by 63% [2].

The progress of game production standards has significantly enhanced players' sense of real experience regarding the locations where real-world materials and scenes are sourced. This has also increased players' willingness to visit these actual locations for on-site tours.

As the ninth form of art, for games with high promotion levels and excellent production quality, the future value-added space of the digital cultural and creative industry will be amplified along with the innovation of production technologies. Modeling scenes, which were originally only used as auxiliary technical means for recording, preservation, and maintenance and repair, have now emerged as a new promotional avenue for generating revenue and realizing value in the cultural and creative as well as cultural tourism industries.

Constrained by the backwardness of domestic 3D modeling technologies and rendering equipment in the past, it was impossible to promote cooperation with relevant cultural and tourism industries through high-quality production and favorable word-of-mouth. Nevertheless, the technological innovations and progress in game production in recent years have gradually translated this vision into reality. The present study endeavors to uncover the industry ecological laws that emerge after integrating the technological innovations within the domestic game industry with related cultural industries. This aims to bridge the theoretical gap resulting from the short-term yet rapid development in this domain.

Driven by the cultural digitization strategy, "digitization integrated with culture and tourism" has emerged as one of the pivotal new trajectories in cultural development. Leveraging digital approaches to narratively convey outstanding traditional culture not only facilitates the digital conversion and innovative recreation of traditional cultural resources, including cultural relics and intangible cultural heritage, but also enables the creation of artistic works that are more engaging and reflective of contemporary characteristics.

Consequently, advancing the digital transformation of traditional culture has become one of the crucial avenues for the profound integration between the online gaming industry and the culture and tourism sectors. In the cases of collaboration with intangible cultural heritage (ICH), the design concepts of online traditional culture experience activities in games can be categorized into the following three types:

- (1) Enabling players to experience the manufacturing process of ICH within the game. This is achieved by simplifying and simulating the manufacturing process or key manufacturing steps of ICH and reconstructing them on the game platform. Such activities may involve players obtaining materials for ICH production through participating in events, taking part in the production steps of ICH, and unlocking albums of ICH works during the manufacturing process.
- (2) Allowing players to view ICH performances during gameplay. Examples of such performances include shadow puppetry shows, theatrical performances, etc.
- (3) Facilitating players' experience of ICH projects (excluding the production process). This is mainly aimed at ICH cultures with high levels of interactivity, such as traditional ICH (e.g., pipa, guqin) or ICH kites [3]. In the cases of collaboration with scenic spots, online games typically integrate traditional cultures, folk customs, etc., associated with these scenic spots into the game design. For example, the game *Peacekeeper Elite* has built a "Digital Temple of Heaven" in the game, replicating the activity of striking bianzhong (bronze chime bells) and the praying ceremony. This enables players to engage in cultural experiences [3].

China's first 3A-level game, *Black Myth: Wukong*, has painstakingly replicated 27 scenic spots in Shanxi Province. This initiative has significantly propelled the robust development of Shanxi's cultural and tourism industries. On the day of the game's release, the search popularity for Shanxi tourism soared, registering a two-fold increase compared to the previous period. Taking Xiaoxitian in Xixian County as an illustrative case, based on the real-time monitoring data from the Shanxi Cultural and Tourism Cloud Public Opinion Monitoring System, within a short span after the game's launch, the overall online public opinion volume related to this scenic spot witnessed an exponential surge.

Specifically, from August 20th to 21st, the Baidu search index climbed by a remarkable 605% year-on-year and 247% month-on-month. This clearly demonstrates the substantial driving effect of *Black Myth: Wukong* on the cultural and tourism industries not only in Shanxi but also across the nation.

This phenomenon not only serves as an affirmation of the meticulous craftsmanship of the production team behind *Black Myth: Wukong*, but also signals a new trend of the profound integration between the game industry, traditional culture, and the cultural and tourism industries in recent years. This trend not only mirrors the diverse and individualized preferences in people's entertainment choices but also underscores the crucial role of the game industry in China's economic and cultural

development landscape [1]. In relevant cases, online games typically construct corresponding traditional-culture interactive experiences on the game platform in accordance with the characteristics of diverse cultural and tourism resources. By doing so, they can effectively showcase the cultural profundity inherent in intangible cultural heritage, tourist attractions, and museums, thus facilitating the digital advancement of traditional culture.

This paper endeavors to investigate the influence of game architectural modeling design on the economic development of tourism in the shooting locations. It also explores how the progress of 3D modeling and rendering technologies in the game industry facilitates the digital storage and online reconstruction of cultural relics. Additionally, it examines how digital games can achieve cultural dissemination, thereby stimulating the local cultural and tourism industries that are centered around cultural heritage clusters.

Specifically, this research aims to determine whether the technological innovation within the game industry exerts a catalytic effect on the cultural industries related to culture, tourism, and cultural and creative products in the real-world shooting locations where inspiration is drawn. Moreover, it aims to summarize the associated laws governing the relationship between the game industry and these cultural industries.

2. Method

In this study, the questionnaire survey method was employed as the primary means of data collection. The questionnaires were disseminated to a randomly selected sample population. No restrictions were imposed on the respondents in terms of age, gender, geographical region, or educational attainment, aiming to ensure the comprehensiveness and representativeness of the collected data. A total of 22 items were designed for the questionnaire. These items were independently developed by the researchers in accordance with the research theme and were closely aligned with the research objectives. The questionnaire was distributed online via the Wenjuanxing platform and promoted through social media channels, including WeChat Moments and WeChat groups.

In this study, 153 valid questionnaires were retrieved, resulting in a response rate of 100%. The data obtained was complete and of high quality, rendering it highly valuable for analysis.

3. Theory Framework

Neo - classical economics, a pivotal sub - discipline within modern economics, emerged in the late 19th and early 20th centuries and has since evolved into the mainstream economic school of thought. This economic paradigm underscores the centrality of market mechanisms in resource allocation. It posits that prices are an inherent outcome of the interplay between market supply and demand. Through the price mechanism, resources are spontaneously directed from sectors with surplus supply to those experiencing supply shortages [4].

The core tenets of neo - classical economics encompass the following aspects.

3.1. The Rational Agent Assumption

Neo - classical economics postulates that economic actors, including consumers and producers, are rational entities, each striving to maximize their self-interest. In the realm of consumption, consumers make choices regarding goods and services in accordance with their budget constraints and personal preferences. On the production side, producers base their decisions on what to produce and in what quantity by weighing costs against potential revenues.

3.2. Market Equilibrium

According to neo-classical economic theory, in a freely competitive market environment, the forces of supply and demand interact and self-adjust, ultimately converging towards an equilibrium state.

At this equilibrium, the market prices and quantities of goods stabilize, signifying a balance where there is neither an overabundance of supply nor an unmet demand.

3.3. Marginal Analysis

Neo - classical economics employs marginal analysis as a fundamental tool for interpreting economic behavior. The concept of "marginal" pertains to the change resulting from a one-unit increment, such as marginal utility, marginal cost, and marginal revenue. By comparing marginal costs with marginal revenues, economic agents are enabled to make optimal decisions.

3.4. Factors of Production

Neo - classical economics classifies factors of production into four categories: labor, capital, land, and entrepreneurial acumen. These factors are integrated and utilized in diverse production processes to generate goods and services [4].

This theoretical framework can effectively elucidate the interrelationship between technological innovation in the game industry and the empowerment of cultural heritage clusters. Moreover, it contributes to elevating the theoretical foundation for substantiating the influence of game architectural modeling design on the economic development of tourism in shooting locations. The rational agent assumption offers a straightforward explanation for the objective demand for game industry technology from both the supply and demand perspectives. Given that the game industry, as an emerging sector, operates within a market environment that emphasizes free competition, it follows that higher - quality works are more likely to manifest the benefits derived from marginal analysis.

4. Result and Discussion

4.1. The Types of Subjects in the Questionnaire Survey

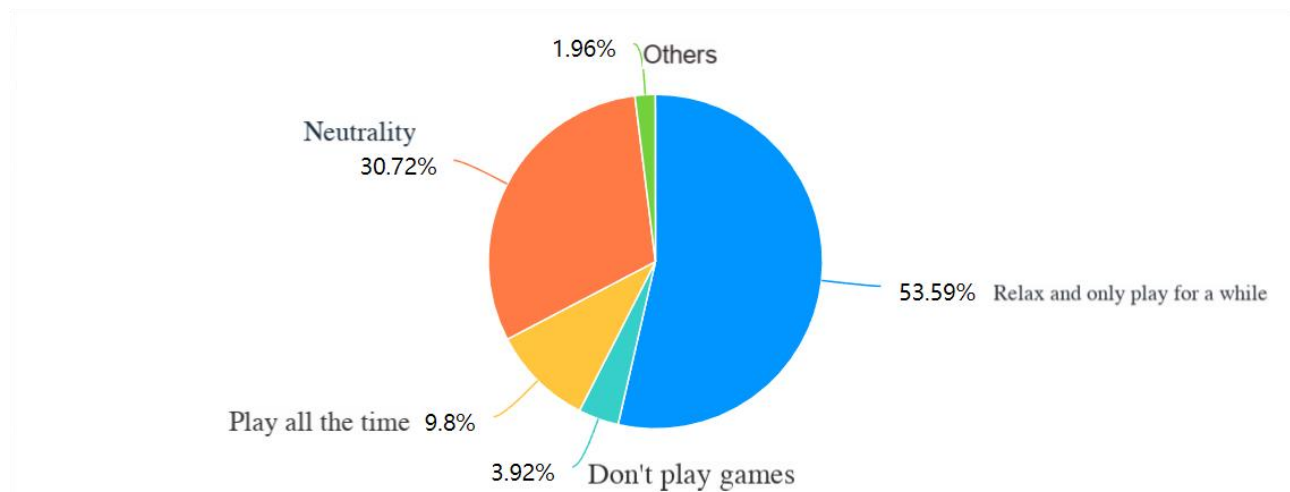


Figure 1. What are your views on the act of playing video games?

As Figure 1 shows, only 3.92% of the surveyed respondents do not play video games. In contrast, 96.08% of the surveyed individuals are either willing to play or actually enjoy playing video games. This situation ensures a relatively high degree of relevance between the surveyed respondents and the content of this research.

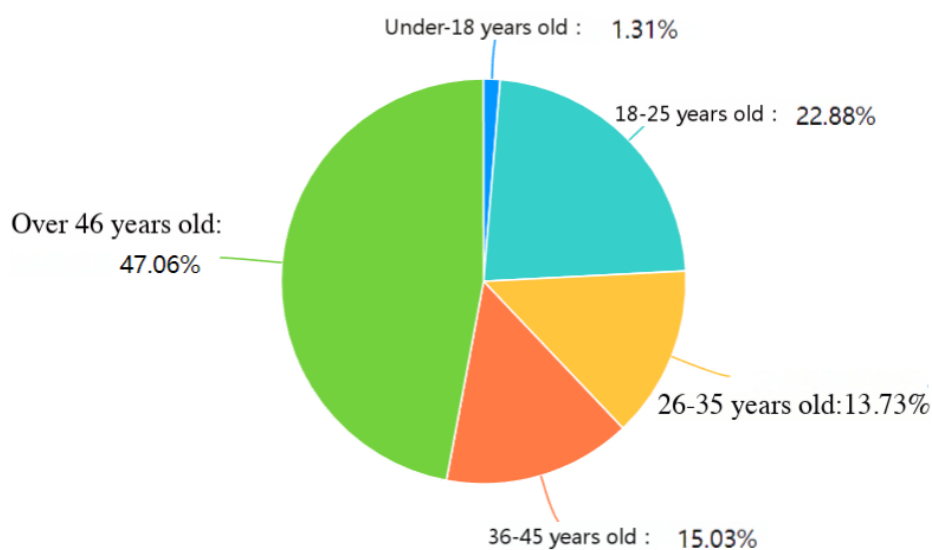


Figure 2. Age

As Figure 2 shows, the proportion of respondents aged over 18 reached 98.69%. This ensures that the vast majority of the interviewees are adults, who possess the capacity to independently decide on traveling and playing video games.

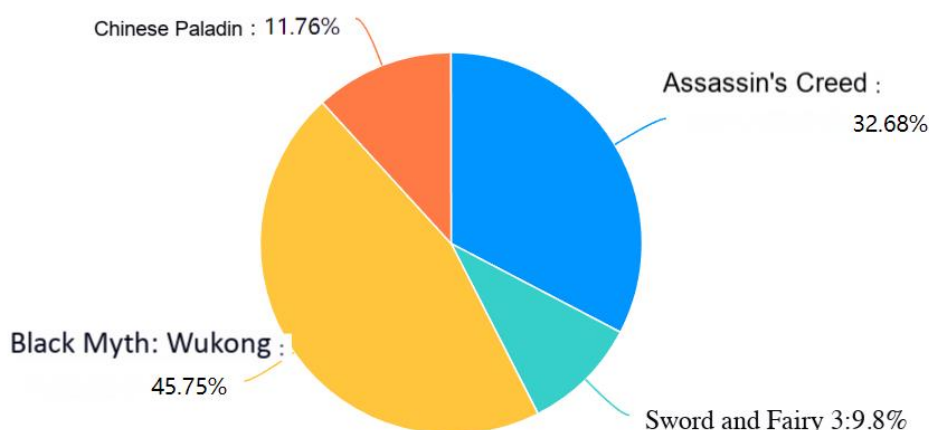


Figure 3. Among the following games, please select the one with the best game modeling technology and highest precision.

As Figure 3 shows, forty-five point seven five percent of the surveyed respondents selected “Black Myth: Wukong,” the game with the most recent release date. Meanwhile, 32.68% of the respondents chose “Assassin's Creed,” a classic and popular game IP under Ubisoft. Both of these games are committed to reconstructing ancient architectural ruins that align with local historical and cultural backgrounds. “Black Myth: Wukong” innovatively implements a “cultural modular output” strategy: 72 in-game scenes correspond to various intangible cultural heritage craftsmanships. Players can unlock instructional videos on crafts such as the Luban Lock and Miao silver forging through AR scanning [5].

An increasing number of games are being developed by integrating next-generation modeling technologies with Unreal Engine 5. “Black Myth: Wukong” utilizes UE5 Unreal Engine technology. The facial capture precision of its characters reaches 0.1 millimeters, and the scene modeling covers a virtual space of over 5 million square meters, showcasing an industrial standard comparable to that

of major Hollywood titles. Examples of such games include “S.T.A.L.K.E.R. 2,” “Redfall,” and “Hellblade 2.” These games have successfully incorporated next-generation modeling technologies into Unreal Engine 5 during production and achieved great success [6].

By comparing two xianxia-themed RPGs that emphasize plot narration, namely “Chinese Paladin” and “Sword and Fairy 3,” it was verified that the surveyed respondents possess the ability to discern improvements in game modeling levels and precision. This ensures the accuracy of the survey questionnaire.

4.2. The Nexus between the Gaming Industry and the Development of Local Tourism

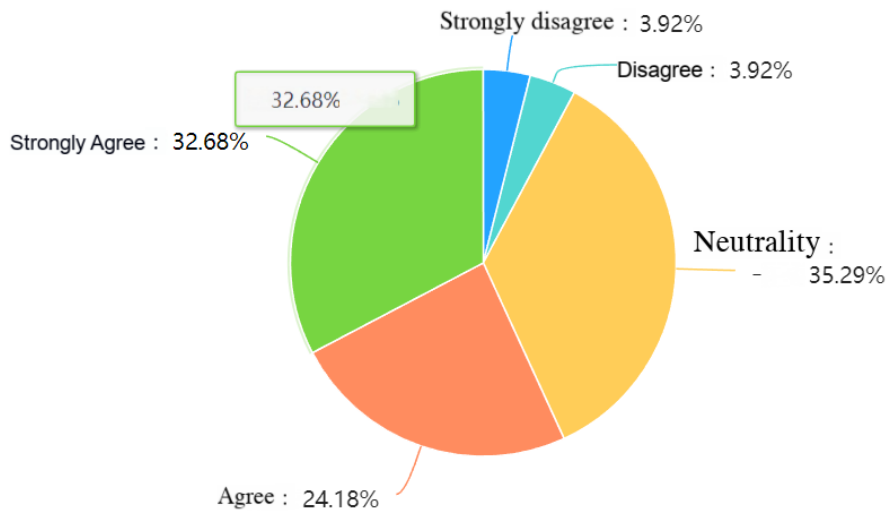


Figure 4. Do the architectural/landscape designs in the game spark your curiosity to explore the traditional cultures and ancient architectural clusters of different countries?

As Figure 4 shows, a total of 7.84% of the surveyed respondents indicated that they were not motivated to explore the traditional cultures and ancient heritage sites of various countries by the in-game architectural and landscape designs. Among them, 3.92% strongly disagreed and another 3.92% disagreed. On the other hand, a combined 56.86% of the respondents, with 32.68% strongly agreeing and 24.18% agreeing, stated that they would be inspired by the in-game architectural and landscape designs to explore the traditional cultures and ancient heritage sites of different countries.

On August 30, the Tongcheng-Travel app released the 2024 Mid-Autumn Festival Travel Trend Report. The report indicates that the debut of the first domestic triple-A game, *Black Myth: Wukong*, has spurred a rapid growth in the attention given to cities like Datong and Shuozhou, which served as filming locations for the game. As of the present, the booking popularity of tourism in Datong and Shuozhou during the Mid-Autumn Festival has more than doubled year-on-year, earning them a place on the list of dark-horse destinations for the Mid-Autumn Festival holiday [2].

The transition from having a curiosity to explore to being willing to make travel location reservations represents an important initial step for the game industry in driving the advancement of local cultural tourism and cultural and creative industries. Take *CrossFire* as an illustrative example. This game has been engaged in cooperation with the Changbai Mountain Management Committee.

On one hand, it integrates the natural landscapes, cultural, and historical elements of Changbai Mountain into the online game. In the seventh-anniversary edition of *CrossFire*, a Chinese-style exploration, shooting-based gameplay map is presented. This map is constructed around the legends of Changbai Mountain and incorporates Changbai Mountain-related elements. Additionally, a new character named "Zhenzhen" is introduced, drawing inspiration from Jurchen culture, thus presenting players with a Changbai Mountain that combines grandeur, beauty, and profound cultural heritage.

On the other hand, *CrossFire* has organized an offline "Changbai Mountain Exploration" event. This event brought together gamers and renowned streamers to Changbai Mountain, enabling them to engage in an in-depth on-site experience of the local culture and traditions [7].

Local authorities, aiming to develop and expand local tourism, strengthen the protection and utilization of cultural relics, inherit intangible cultural heritage, and promote the region's magnificent scenery, have collaborated with online game development companies. Through digital culture, they seek to empower local cultural tourism. When developing games, enterprises incorporate local historical legends, natural landscapes, folk customs, and other cultural resources into the design of game scenes and character images. This approach offers players a more enriched online experience of domestic cultural tourism [7].

By integrating online games with offline tourist attractions, it becomes possible to organize relevant activities such as traditional cultural festivals that align with the themes of online games. This model can attract players to visit offline scenic spots, allowing them to personally experience the allure of culture. On one hand, it enriches players' cultural tourism experiences; on the other hand, it effectively enhances the commercial value of the scenic spots.

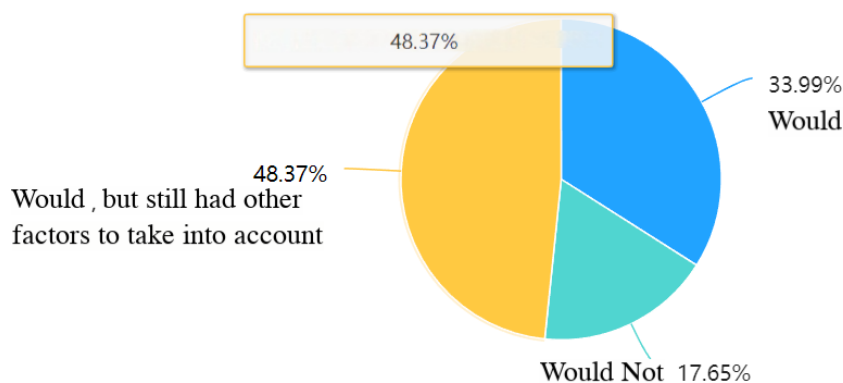


Figure 5. Can a game with outstanding production quality prompt you to consider the shooting locations of its in-game content as future travel destinations?

As Figure 5 shows, a total of 82.36% of the surveyed respondents, including 48.37% who indicated that they would consider visiting the shooting locations of game materials but still had other factors to take into account, and 33.99% who simply thought they would, were inclined to visit the shooting locations due to the excellent production quality of the game.

Since the start of this year, the soaring popularity of *Black Myth: Wukong* has led to a continuous surge in the topicality and popularity of the province's cultural tourism. In August, the number of tourists received by key monitored scenic spots in Linfen City increased by 15.5% year-on-year, ticket revenue increased by 30.2%, and operating income increased by 22.0% year-on-year. The number of tourists received by Xiaoxitian in Xi County and Guangsheng Temple in Hongdong County, the shooting locations of the game, increased by 516.4% and 208.8% respectively [8].

Therefore, the cultural tourism and cultural-creative industries must be integrated with the gaming industry and undergo industrial marketing upgrades to win over the 48.37% of surveyed respondents who still have other considerations. Data collection from the case of the game *Black Myth: Wukong* and the economic development of Shanxi's tourism industry can more intuitively corroborate this.

Since the beginning of this year, Linfen City has been continuously promoting the in-depth integration of culture and tourism, creating the cultural-tourism brand of "Root-Seeking, Soul - Shaping, and Enjoyable Life". Through activities such as the Linfen stop of the "Journey with Brilliance" Shanxi

tour and the filming locations of the game Black Myth: Wukong, it has promoted ancient architecture and traditional culture. Additionally, events such as the 2024 Linfen Half Marathon and the "Lucky 520" Yellow River Hero Auto Cross-Country Rally have been held to enhance the city's image and popularity. As a result, the ticket revenue of scenic spots has increased significantly.

From January to September, the key monitored scenic spots in the whole city received 5.25 million tourist visits, a year - on - year increase of 3.2%. The ticket revenue reached 190 million yuan, a year -on-year increase of 20.6% [9].

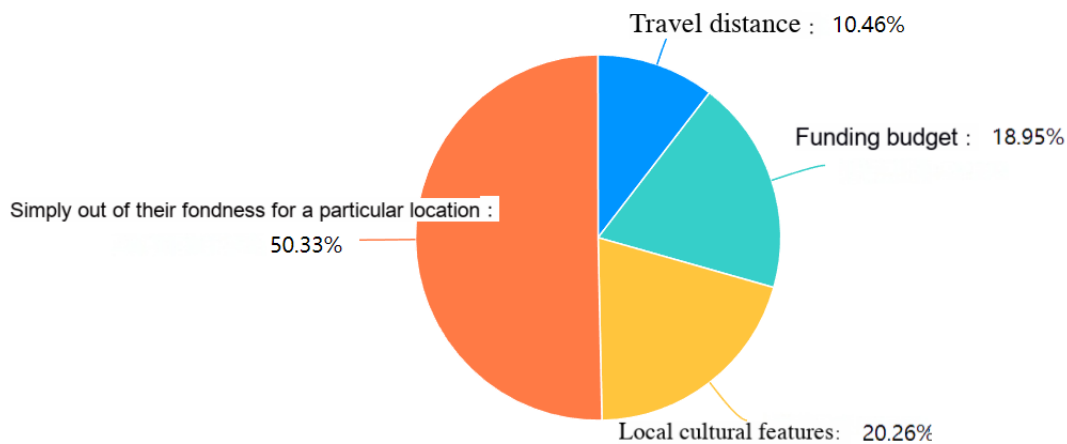


Figure 6. The Highest Priority When You Plan a Trip

As Figure 6 shows, as many as 50.33% of people plan a trip simply out of their fondness for a particular location. The opening line in the game, "The land of Xiaoxitian pays respectful homage to the chosen one," has led to long queues at the entrance of the Xiaoxitian Scenic Area in Xi County, Linfen. Ctrip data indicates that during this year's summer vacation, the order volume of some temple-themed scenic areas has witnessed a notable increase. Specifically, the ticket order volume of the Xiaoxitian Scenic Area in Xi County, one of the game's filming locations, has increased by 261% year-on-year [2].

This case study provides evidence that most people with a travel inclination are willing to pay for elements they hold dear. It also demonstrates the feasibility of converting the surveyed respondents' enthusiasm for a beloved game into an affection for the cultural tourism and cultural-creative industrial clusters associated with the shooting locations of the in - game architectural models.

5. Conclusion

This study has demonstrated the prerequisite conditions and feasibility of the technological innovation of the game industry in empowering cultural heritage clusters. It has also shown that the game architectural modeling design has a tangible positive impact on driving the economic development of tourism in shooting locations.

The limitations of this questionnaire survey are as follows: the sample size is relatively small, and the ages of the research subjects are generally concentrated among the young and middle - aged groups, resulting in insufficient coverage of the research subject samples.

This paper mainly focuses on researching the competition within the free - market economic system. Regarding future research directions, efforts will be made to address the issue of the positive contributions of the government and society in the macro - regulation of the technological innovation of the game industry in empowering cultural heritage clusters. Additionally, plans include expanding the information scope and sample size of the questionnaire survey.

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