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Scientific and Social Research

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Smart Tourism Technology Attributes and Behavioral Intentions of Tourists Among the Resorts in Batangas Province: Basis of an Action Plan

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Abstract: This study examined the relationship between smart tourism technology (STT) attributes and tourist behavioral intentions in resorts across Batangas Province. Employing a descriptive correlational design, the study aimed to explore how informativeness, accessibility, interactivity, and personalization of STT influence tourists' decisions to revisit, recommend, and show loyalty toward resorts. A structured questionnaire adapted from validated instruments was administered to 384 tourists who recently experienced smart technologies in Batangas resorts. The sample was carefully selected using random sampling to ensure representativeness. Data collection prioritized ethical considerations, including securing approvals and informed consent, and involved pilot testing to enhance instrument validity and reliability. Findings revealed that respondents were predominantly female, mostly adults, and married, indicating a diverse demographic profile. Tourists strongly agreed that the accessibility and informativeness of STT significantly enhanced their travel experience. Positive behavioral intentions were evident, particularly in revisit intentions and word-of-mouth recommendations, although willingness to pay more was less pronounced. Statistical analysis confirmed a significant positive relationship between STT attributes and behavioral intentions, suggesting that enhanced digital features foster greater tourist engagement and loyalty. Based on these results, the study proposes an action plan to improve STT implementation in Batangas resorts, emphasizing tailored strategies that reflect the needs of the main demographic groups. The findings contribute valuable insights to the growing field of smart tourism, highlighting the potential of digital innovations to enhance destination competitiveness and tourist satisfaction in emerging resort markets. Future research may explore additional factors, such as security, digital literacy, and social media influence, to deepen understanding of tourist behavior in smart tourism contexts.

Keywords: Smart tourism technology; Behavioral intention; Resorts; Batangas Province; Tourist engagement

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1. Introduction

Smart tourism technology has profoundly transformed how tourists experience and engage with destinations by incorporating digital innovations that offer seamless, personalized, and efficient travel experiences. Smart technology refers to advanced tools and systems—often powered by artificial intelligence (AI), the Internet of Things (IoT), big data, and real-time analytics—that collect and analyze data to automate responses, improve services, and enhance user experiences with minimal human intervention. In the tourism sector, these technologies include mobile applications, digital payment systems, AI-driven chatbots, and social media platforms, all of which contribute to improving convenience, satisfaction, and engagement throughout the tourist journey.

As the digital age progresses, mobile connectivity and social media have become integral components of the modern travel experience. Recent studies highlight that smart tourism technologies significantly enhance tourist engagement by providing real-time information, personalized recommendations, and interactive services^[1]. The increasing reliance on these technologies has reshaped tourist expectations, placing a premium on attributes such as interactivity, security, accessibility, and personalization. These features strongly influence key behavioral intentions—such as the likelihood of revisiting a destination, recommending it to others, and demonstrating brand loyalty^[2].

Resorts and tourism stakeholders that effectively integrate smart tourism technologies can greatly improve visitor satisfaction, strengthen emotional connections with their guests, and gain a competitive edge in an increasingly digital tourism landscape. As such, understanding and strategically applying smart technologies is vital for sustainable tourism growth and innovation.

Studies suggest that key attributes of smart tourism technology—including informativeness, accessibility, interactivity, and personalization—play a significant role in shaping tourists' behavioral intentions. These attributes not only improve convenience but also enhance engagement, increasing the probability that tourists will develop a strong connection to the destination and return in the future^[3–4]. Recent findings emphasize that seamless integration of smart tourism features fosters a more immersive and satisfying experience, ultimately influencing tourists' revisit intentions and word-of-mouth recommendations^[5].

Despite the widespread integration of smart technologies in tourism, research remains limited, particularly in the context of resorts as primary travel destinations. While many global cities and established tourist hubs have successfully adopted advanced digital tools to influence tourist behavior, destinations such as resorts in Batangas Province are still navigating the early stages of digital transformation. Batangas, renowned for its pristine beaches, diving spots, and rich cultural heritage, continues to attract both local and international tourists. However, the adoption of cutting-edge smart tourism technologies remains minimal, especially in resort-based and developing tourism destinations. While global tourism hubs have advanced in integrating innovations such as AI-powered services, virtual reality, and the Internet of Things (IoT), many local resorts still depend on basic digital tools like websites and social media for marketing and bookings. This limited adoption is often due to infrastructural constraints, financial limitations, and a lack of digital literacy among tourism stakeholders. Recent studies affirm this gap as Gajdošík and Marciš noted that small-scale tourism operations often lack the strategic capacity to implement smart technologies effectively, while Zare et al. highlighted the challenges in bridging the digital divide in rural and coastal areas^[6–7]. Similarly, Boes, Buhalis, and Inversini found that many destinations remain in early stages of smart tourism adoption due to insufficient governance and stakeholder engagement^[8]. The full potential of smart tourism remains underutilized, underscoring the need for targeted

investments and policy support to foster digital transformation.

One of the most widely used digital tools in the area is social media, which plays a critical role in shaping tourist perceptions, decisions, and experiences. Tourists often rely on platforms like Facebook, Instagram, and TikTok to discover destinations, compare resort experiences, read reviews, and share real-time travel content. However, most resorts in Batangas still underutilize these platforms, often limiting their digital presence to basic promotional posts or static information. There is a significant opportunity to enhance digital engagement through dynamic content strategies, influencer partnerships, and user-generated content campaigns that foster interactive relationships with potential visitors.

By strategically leveraging social media as a component of smart tourism technology, resorts in Batangas can boost visibility, strengthen brand identity, and build emotional connections with tourists. This shift can transform passive viewers into active promoters, increase repeat visitation, and elevate the province's competitiveness in the increasingly digital global tourism landscape ^[8-9].

Understanding how smart tourism technology attributes influence tourists' behavioral intentions is crucial for improving the overall tourism experience in Batangas Province. With the rapid digitalization of the tourism industry, resorts must adapt to evolving consumer expectations by leveraging smart technologies to enhance service delivery, engagement, and long-term tourist retention ^[10]. Smart tourism technologies, which encompass digital platforms, play a pivotal role in shaping how tourists interact with destinations, make travel decisions, and share their experiences ^[11]. These advancements have transformed tourism into a more personalized, interactive, and accessible experience, significantly influencing tourists' behavioral intentions, including their willingness to revisit, recommend, and even pay a premium for enhanced digital experiences ^[12].

Given the increasing competition among tourist destinations, Batangas Province must enhance its smart tourism initiatives to remain competitive. Recent studies highlight the crucial role of digital engagement in attracting modern travelers, who rely heavily on technology for trip planning, navigation, and experience-sharing ^[13]. Smart tourism technologies have been shown to improve destination competitiveness by optimizing resource management, enhancing visitor experiences, and promoting sustainable tourism development ^[14]. Moreover, the integration of smart technologies positively influences tourist satisfaction and well-being, particularly in marine and coastal tourism settings ^[15]. To cater to the evolving expectations of tech-savvy travelers, resorts and tourism stakeholders in Batangas should invest in digital transformation, ensuring seamless, innovative, and engaging tourism experiences.

The locale of the study is in Batangas Province, concentrating especially on DOT-accredited resorts and eliminating those categorized as Mabuhay Accommodation. The respondents were local tourists booking via social media, particularly Facebook. This study sought to examine the connection between the attributes of smart tourism technology (STT) and the behavioral intentions of tourists who visited resorts in Batangas Province. In particular, the study aimed to explore how key features influence tourists' decision-making when selecting a resort as their vacation destination. Recent research has shown that these STT elements play a crucial role in enhancing tourists' overall experiences, increasing satisfaction levels, and encouraging positive behavioral outcomes such as return visits and word-of-mouth referrals ^[1-2, 8].

This study holds significant practical value for the tourism industry in Batangas Province. By identifying the relationship between key attributes of smart tourism technology and tourist behavioral intentions, it offers actionable insights for enhancing digital tourism services. The findings can help tourism operators and resort owners optimize their online platforms, improve user experience, and develop data-driven marketing strategies

that encourage repeat visits. Additionally, the conclusions and recommendations from this research will be shared with resort management to support decision-making and strategic planning.

Focusing specifically on Batangas Province, the study provides a contextualized understanding of how smart tourism technologies influence tourist behavior in a region that is both developing and experiencing rapid tourism growth. Given Batangas' strategic location near the capital and its rich blend of natural and cultural attractions, embracing technological innovation in tourism is both timely and necessary. The integration of digital tools such as mobile-friendly websites, AI-powered services, and interactive social media campaigns reflects the province's move toward modernizing its tourism offerings while maintaining its local identity.

Moreover, the research examined how core attributes of smart tourism technology—accessibility, informativeness, personalization, interactivity, and responsiveness—shape tourists' behavioral intentions. These include their likelihood to revisit, recommend the resort to others, remain loyal to the brand, and pay more for enhanced services. The findings offer valuable guidance for tourism stakeholders, showing how digital transformation can elevate the tourist experience, build emotional connections with visitors, and foster sustainable development within the local tourism sector.

Ultimately, this study lays the groundwork for developing a comprehensive action plan to strengthen the smart tourism landscape in Batangas Province. By using data-informed strategies, stakeholders can implement targeted interventions to improve the quality and reach of digital tourism services. The action plan will support the seamless integration of smart technologies, helping Batangas maintain its competitive edge and appeal in the digital era. These efforts are expected to attract more tourists, encourage repeat visits, boost customer loyalty, and drive sustainable economic growth across the region.

2. Objectives of the study

The study assessed the relationship between smart tourism technology attributes and the behavioral intentions of tourists among the resorts in Batangas Province.

Specifically, the research described the demographic profile of tourists in terms of age, sex, and civil status.

The study determined smart tourism technology attributes in terms of: informativeness, accessibility, and interactivity; determined tourist behavioral intentions, particularly their revisit intention, word-of-mouth recommendations, and willingness to pay more. Lastly, it proposed an action plan to enhance the implementation of smart tourism technology among resorts in Batangas Province.

3. Research design

This study employed a descriptive-correlational research design, which is effective for identifying relationships between variables and understanding trends in a given population ^[16]. It explored how key attributes of smart tourism technology—such as informativeness, accessibility, interactivity, and personalization—relate to tourists' behavioral intentions in Batangas Province resorts.

A quantitative approach was used, with survey questionnaires as the main data collection tool. This method enabled the structured gathering of data from local tourists, supporting accurate and consistent analysis ^[17]. The use of standardized instruments contributed to the reliability and validity of findings, facilitating a clear understanding of the patterns and connections among the variables studied ^[18].

4. Respondent of the study

The participants of this study comprised 384 tourists who had availed themselves of services at various selected resorts across Batangas Province. These individuals were carefully selected based on their direct and recent exposure to smart tourism technologies integrated into the resort experience. The sample included domestic travelers, representing diverse demographic backgrounds in terms of age, gender, occupation, and travel purposes, ranging from leisure vacations to family holidays and business retreats. Their inclusion was intentional, as they were able to provide authentic, experience-based feedback on the functionality, usability, and overall influence of smart tourism technologies on their travel experience. These tourists interacted with features such as mobile-responsive websites, AI-powered concierge services, online booking platforms, interactive digital guides, real-time service updates, and social media engagement tools. Their perspectives offered rich and nuanced insights into the effectiveness of these technologies, particularly in relation to core attributes like informativeness, accessibility, interactivity, and personalization—attributes central to shaping satisfaction and behavioral intentions in modern tourism settings.

The sample size of 384 participants was determined using Cochran's formula, a widely accepted method for calculating sample size in studies where the total population is unknown. This approach ensured statistical reliability and representativeness. The calculation incorporated several essential parameters: a 95% confidence level ($z = 1.96$), a margin of error of 5% ($E = 0.05$), and a population proportion of 50% ($P = 0.5$), the most conservative estimate to account for maximum variability. To further ensure the generalizability of the results, the study employed random sampling techniques in selecting tourists who had availed themselves of resort services and experienced smart tourism technologies in Batangas Province. This method minimized selection bias and allowed for equal opportunity among participants to be included in the study, thus enhancing the validity of the findings. This approach ensured adequate representation of the broader tourist population visiting Batangas resorts, allowing the study to capture a diverse range of experiences and perspectives. The tourists' feedback contributed to a comprehensive understanding of how smart tourism technologies influence behavioral intentions, such as their likelihood to revisit or recommend the destination. Ultimately, their insights are vital for informing digital transformation strategies in the resort tourism sector of Batangas Province.

5. Data gathering instrument

The study employed an adapted structured questionnaire as the primary data-gathering tool to comprehensively examine how smart tourism technology attributes influence tourist behavioral intentions in selected resorts across Batangas Province. The instrument was modified from previously validated tools to suit the unique cultural and operational context of local tourism settings, ensuring both relevance and academic rigor.

The questionnaire was organized into three main parts. Part I collected demographic information such as age, sex, and civil status. This section was vital for developing respondent profiles and identifying patterns in technology use and perceptions across different demographic groups. Part II measured key smart tourism technology attributes, including informativeness, accessibility, interactivity, and personalization. Each attribute was assessed using 5 to 7 items that captured tourists' evaluations of how these technologies enhanced their travel experiences. Part III focused on tourists' behavioral intentions, specifically their willingness to revisit, spread word-of-mouth, show loyalty, and pay more for services. Each dimension included 4 items designed to capture forward-looking attitudes linked to smart tourism experiences.

To ensure content validity and reliability, the draft questionnaire was reviewed by a panel comprising a research adviser, a tourism academic, a resort manager, and a resort owner. Their insights led to refinements in language, structure, and item relevance. A pilot test involving 30 participants with similar profiles to the target population was also conducted to assess clarity, consistency, and internal reliability. Minor revisions were made to enhance the instrument's effectiveness.

The final questionnaire was administered to 384 randomly selected tourists who had direct experience with smart tourism technologies in Batangas resorts. Respondents were approached either in person or through online resort-affiliated platforms. Before participation, individuals were informed of the study's purpose, assured of confidentiality, and asked for their voluntary consent.

Parts II and III of the questionnaire used a 4-point Likert scale: 4 = Strongly Agree, 3 = Agree, 2 = Disagree, and 1 = Strongly Disagree. This scale was intentionally chosen to discourage neutral responses and prompt definitive answers. The data gathered were analyzed using mean scores and standard deviations to identify prevailing trends and patterns. These findings ultimately informed the development of an action plan to enhance the implementation of the ordinance.

6. Data gathering procedure

The data-gathering process began with coordination and approval from resort management and relevant authorities in selected areas of Batangas Province. After securing permissions, ethical standards were upheld through informed consent, ensuring voluntary participation and confidentiality. A total of 384 tourists, selected for their direct experience with smart tourism technologies, participated in the study.

A structured, pilot-tested, and validated questionnaire served as the primary data collection tool. It was administered during scheduled on-site visits, with assistance provided to clarify any questions. Data accuracy was ensured through validation and cleaning procedures, checking for completeness and consistency. The collected data were then analyzed using statistical methods to identify trends and behavioral patterns, providing insights to enhance tourism practices in the province.

7. Data analysis

The data were collected from respondents using the standardized questionnaires. In calculating and evaluating the data, weighted means were computed to assess the respondents' organizational commitment, morale, and leadership practices. Analysis of variance (ANOVA) was applied to determine the significant differences between the firmographic profile and all other variables. Additionally, Pearson's r-correlation was used to determine the relationships among the three variables. After statistical treatment, all the data were presented in tabulated form or through visual representations. The data were then critically interpreted and analyzed. Finally, the researcher provided conclusions and recommendations for program development at the conclusion of the research.

8. Ethical considerations

Ethical considerations were strictly observed in this study on smart tourism technologies in Batangas Province to protect participants' rights, ensure confidentiality, and promote transparency. Informed consent was obtained

from the 384 tourist participants, who were fully briefed on the study's purpose, procedures, and potential risks. Anonymity was maintained through coding instead of personal identifiers, with all data kept private and accessible only to authorized researchers. Transparent communication and the principle of beneficence guided the process, ensuring participant safety and reinforcing the study's integrity.

9. Discussion

9.1. Percentage distribution of the respondents' profiles

These factors provide insights into participant profiles and their potential influence on behavioral intentions regarding smart tourism technology in Batangas Province. Female respondents comprised 56.3% of the sample, outnumbering males (43.8%). This aligns with trends in tourism engagement, where women are often drawn to relaxation and family-oriented travel. Males, though fewer, are notably active in adventure-based tourism such as hiking and diving, consistent with Bautista's findings on eco-tourism in Batangas ^[19].

The majority of respondents were aged 28–43 (46.4%), followed by those aged 18–27 (31.5%). These findings support Reyes, who noted high participation among younger tourists in recreational and coastal tourism activities ^[20]. Older tourists, though fewer, are more prevalent in heritage and eco-tourism areas.

In terms of civil status, 54.7% were married and 45.3% were single. This suggests that Batangas appeals both to families and solo travelers. Married individuals favor destinations offering rest and bonding, while singles often seek lively experiences such as nightlife and group adventures—again echoed in Reyes' research on Laiya beach tourism ^[20].

9.2. Smart tourism technology attributes in terms of informativeness

This highlights smart tourism technology attributes related to informativeness. The data illustrates how effectively digital platforms meet tourists' needs for accessible, accurate information. This supports existing literature emphasizing the value of real-time updates, interactive content, and user-friendly interfaces in enhancing the travel experience ^[21].

The findings reveal that the highest-rated attribute of smart tourism technologies is the provision of information about attractions, accommodations, and activities ($M = 3.61$). This underscores the crucial role of centralized, reliable, and accessible digital information in enhancing tourist experiences, particularly in diverse destinations like Batangas Province. Tourists highly value digital platforms that act as one-stop hubs for planning and navigation, which reduce uncertainty and improve satisfaction.

This preference reflects a shift in tourist behavior, where smart technologies are not only convenience tools but also primary decision-making aids. Studies such as Lee and Xie and Buhalis and Amaranggana support this, emphasizing how digital systems enhance planning efficiency and user trust ^[12–13]. Similarly, Xiang et al. and Huang et al. found that platforms focusing on essential travel needs significantly improve engagement and destination appeal ^[14–15]. For Batangas, showcasing its varied tourism offerings—beaches, heritage sites, and eco-tourism—through well-structured digital content is key to competitiveness.

In contrast, the lowest-rated feature was the provision of real-time updates on promotions and events ($M = 3.47$), indicating that tourists consider promotional content less critical than core informational features. This may stem from a preference for authentic experiences over temporary deals, especially in regions like Batangas, known for immersive tourism. Tourists often rely on third-party apps or influencers for such updates, viewing

destination-based promotions as less relevant unless they are timely and personalized ^[16–17].

This suggests that while promotional features can add value, their impact depends on contextual relevance and integration with user interests. In more experiential destinations, excessive or irrelevant promotions may even disrupt user satisfaction ^[18].

The composite mean of 3.51 (“Strongly Agree”) confirms that users perceive smart tourism technologies in Batangas as highly informative. This aligns with global research, which highlights informativeness as a key success factor ^[18–19]. However, areas such as real-time updates, multimedia content, and third-party integration still offer room for improvement ^[20].

9.3. Smart tourism technology attributes in terms of accessibility

The highest-rated indicator highlights the essential role of mobile-friendly interfaces in enhancing user experience across various devices. Mobile-optimized platforms significantly boost engagement by adapting to different screen sizes and offering intuitive navigation, a vital feature as travelers increasingly rely on mobile devices for trip planning and bookings ^[16]. These platforms also promote inclusivity through accessibility features like screen readers and voice commands ^[17]. Beyond accessibility, mobile optimization enhances user satisfaction and business performance by enabling quick loading times, smooth transactions, and AI-driven personalization ^[18]. Destinations that adopt mobile-first strategies benefit from increased tourist engagement and economic growth while contributing to sustainability through real-time updates and efficient services ^[19]. In contrast, community-based traffic updates, though helpful, received the lowest ratings. While real-time, crowdsourced data aids in trip planning and promotes collaborative mobility, it is often perceived as supplementary compared to features directly linked to travel convenience, like booking or personalization ^[20]. Nonetheless, it contributes to sustainable practices and traveler awareness ^[21]. The composite mean of 3.55 under “Strongly Agree” affirms users’ satisfaction with smart tourism accessibility features, from mobile optimization to real-time updates, confirming their value in modern travel experiences ^[22]. Prior studies support these findings, noting that intuitive design and inclusive interfaces encourage higher adoption and satisfaction, especially for users with disabilities ^[23]. Features like instant bookings and navigation tools enhance efficiency and trust, while traffic updates help ease mobility stress and improve urban tourism ^[24–25]. Finally, interactivity through live chat, online booking, and social media integration received the highest praise, with respondents agreeing these features simplify trip management and optimize service delivery ^[26].

9.4. Smart tourism technology attributes in terms of interactivity

Live chat support offers real-time assistance during planning, boosting customer satisfaction ^[27]. Social media integration fosters engagement by enabling tourists and providers to share experiences and access personalized promotions ^[28]. Together, these features build trust, engagement, and loyalty, vital for long-term tourism success.

Interactive features foster emotional connections beyond usability. Chat and social media allow tourists to participate in communities and share content that influences decisions ^[28]. AI booking systems and personalized recommendations customize experiences, encouraging repeat visits ^[29]. This creates a trusted, convenient ecosystem essential for tourism’s digital transformation.

AI-driven booking systems streamline reservations, enhancing efficiency ^[29]. Live chat provides quick responses, reducing uncertainties, while social media enables sharing and real-time promotions ^[28]. Combined, they offer a connected, efficient, and personalized tourism experience that drives bookings and loyalty.

AI chatbots handling FAQs and escalating complex issues rank lowest. Despite their efficiency, tourists prefer human agents for complex problems, showing AI's limitations in customer service ^[30]. Chatbots manage up to 80% of routine queries but may fail with nuanced issues, requiring seamless escalation to humans.

Although chatbots reduce wait times and costs, they lack the ability for personalized responses, highlighting the need for hybrid systems combining AI and human agents for better accuracy and satisfaction ^[31]. Human involvement remains key for personalized service.

Some tourists still value human interaction for complex decisions despite AI advances. AI recommendations personalize offers but may miss nuanced traveler needs, so balancing automation with a human touch is essential.

Automation trends aim to optimize efficiency and reduce costs, but combining AI speed with human expertise addresses both simple and complex queries. The lower chatbot ranking reflects ongoing demand for human-centered service.

Respondents generally agree that interactive tourism tech is significant (composite mean 3.48) but see room for improvement to maximize engagement. Booking, chat, and social media enhance convenience and decision-making via real-time help and personalized advice ^[28]. Hybrid AI-human approaches remain important.

User-generated content strengthens interaction by allowing tourists to share experiences and influence others, increasing trust and engagement. Automated responses support personalization and loyalty but may feel impersonal, emphasizing the need for adaptive, human-focused AI systems.

9.5. Behavioral intention in terms of revisit intention

The behavioral intention of tourists, specifically revisit intention, is critical for the sustainability of tourism destinations. Revisit intention reflects tourists' likelihood to return based on prior experiences. Smart tourism technologies enhance revisit intention by providing seamless accessibility, personalized experiences, interactive services, and reliable information. Tourists tend to revisit destinations offering convenience, engagement, and satisfaction through digital innovations, making these technologies essential in travel planning and decision-making.

The highest-rated factor influencing revisit intention (weighted mean 3.54, "Strongly Agree") is the accuracy of information on the resort's social media page. Tourists value accurate, reliable, and current information from social media, which reduces uncertainty and builds confidence. Reliable information fosters security and trust, increasing repeat visits and long-term loyalty.

Accurate information is key to building trust in the digital age, where travelers rely heavily on online content. Studies show tourists depend on truthful details about accommodations and attractions, with misinformation causing doubts and dissatisfaction ^[27]. Providing transparent and consistent content strengthens emotional connections and repeat business.

Resorts prioritizing digital accuracy build strong reputations and manage expectations effectively, reducing negative experiences. Transparent communication increases brand loyalty by aligning with traveler needs, thereby fostering long-term customer relationships and positively influencing revisit intention ^[28].

The lowest-rated factor (weighted mean 3.50, "Strongly Agree") is the influence of interactive features on social media (e.g., live chats, polls). While these features foster engagement and emotional connection, tourists may prioritize other factors like information accuracy or overall resort quality when deciding to return. Usage of interactive features may also vary across demographics, affecting their perceived importance ^[29].

Despite this, interactive features enhance customer experience and brand attachment, providing personalized communication and real-time responses. However, tourists may view comfort, convenience, and service quality as more critical to revisit intention than interactivity alone^[30].

The composite mean of 3.52 (“Strongly Agree”) shows strong consensus that smart tourism technology significantly influences revisit intention. Social media’s role in maintaining tourist relationships beyond initial visits reinforces loyalty and positive perceptions^[27]. Accessibility, credibility, and interactivity of digital platforms reduce uncertainty, enhance confidence, and encourage repeat visits^[28–30].

9.6. Behavioral intention in terms of word of mouth

The behavioral intention of tourists to engage in word-of-mouth (WOM) communication is greatly influenced by smart tourism technology, which shapes their willingness to share experiences both online and offline. Positive travel experiences, supported by seamless digital interactions and personalized services, enhance tourists’ likelihood of recommending a destination^[32]. Tourists who share their stories online contribute to the destination’s reputation and long-term sustainability by attracting new visitors^[33].

Social media’s influence on WOM behavior is evident, with tourists motivated to share positive resort experiences via platforms like Facebook, Instagram, and TikTok. The quality of the digital environment—including visual appeal, interactivity, and responsiveness—plays a crucial role in encouraging user-generated content, which acts as authentic and trusted promotion^[34]. Active social media strategies that engage and recognize users create a feedback loop, fostering emotional connections and stronger brand advocacy^[35].

Furthermore, advanced technological services such as mobile check-ins and AI-powered concierge systems enhance convenience and efficiency, which tourists highly value. When combined with an engaging social media presence, these technologies encourage more positive WOM and repeat visits^[36]. Digital WOM marketing leverages peer-generated content that travelers trust more than traditional advertising, thus amplifying marketing effectiveness^[37].

Overall, the integration of smart tourism technology and social media platforms significantly boosts tourists’ willingness to share experiences, reinforcing customer satisfaction, loyalty, and destination promotion.

9.7. Behavioral intention in terms of willingness to pay more

The behavioral intention of tourists in terms of willingness to pay more is examined, highlighting how smart tourism technology influences consumers’ perceived value of a resort. As digital advancements enhance service quality, convenience, and engagement, travelers may be more inclined to spend extra for premium experiences. Studies suggest that features such as seamless booking systems, interactive platforms, and personalized recommendations significantly increase customer satisfaction, leading to a greater willingness to invest in enhanced services.

The findings indicate that tourists generally agree that smart tourism technology influences their willingness to pay more, with a composite mean of 3.34–3.35. The highest-rated indicator, with a mean of 3.35, suggests that tourists find the resort’s advanced social media features justify the higher price of services. This aligns with recent adaptations of the Technology Acceptance Model (TAM), which emphasize that perceived usefulness and ease of use significantly impact consumers’ acceptance of digital innovations in tourism^[32–33]. Recent studies also confirm that digital enhancements, such as AI-driven customer support and real-time engagement, significantly improve the perceived value of hospitality services^[34]. When resorts invest

in technology-driven social media platforms, they create an immersive experience that enhances tourists' willingness to spend more.

With a mean of 3.34, several indicators suggest that social media and smart tourism technology influence pricing perception. One major factor is social media's role in facilitating ease of use, making the resort more appealing despite higher costs. Research by Buhalis and Sinarta highlights how smart tourism ecosystems enhance customer engagement, making travelers more open to premium pricing structures ^[35]. Additionally, travelers are willing to pay more when they perceive convenience and digital integration as an added value ^[36]. This reflects a broader trend in which consumers prefer businesses that leverage digital solutions to enhance the travel experience and reduce effort in decision-making ^[37].

Similarly, social media visual content and high-tech representations of resorts influence price sensitivity. A weighted mean of 3.34 for the statement on paying more after seeing social media images of high-tech features supports findings from studies on digital marketing's impact on perceived value ^[38]. Visual content fosters a sense of exclusivity, which plays a critical role in tourists' willingness to pay a premium ^[39]. Social media posts that highlight luxurious amenities, AI-driven services, and smart room technology create a perception of sophistication and exclusivity, leading consumers to justify higher expenses ^[40]. Resorts that effectively utilize digital storytelling and interactive content are more likely to influence spending behaviors, making technology-driven marketing an essential factor in pricing strategies.

The composite mean of 3.34, interpreted as "Agree," indicates that tourists generally recognize the value of smart tourism technology in shaping their willingness to pay more for resort services. While they may not strongly commit to paying a premium, they acknowledge that digital innovations and social media features positively influence their perception of the resort's pricing. This aligns with the perceived value theory, which suggests that consumers are more likely to justify higher costs when they perceive added benefits in convenience, exclusivity, and enhanced experience ^[41]. Recent studies emphasize that smart tourism technology, such as AI-powered chatbots, immersive virtual experiences, and seamless booking systems, contributes to a more effortless and satisfying tourist experience, thereby increasing their acceptance of premium pricing ^[37–38].

Several factors contribute to tourists' moderate agreement with paying more for a resort due to its technological features. First, social media platforms allow resorts to highlight high-tech services, such as smart room controls, AI-driven concierge services, and real-time digital assistance, which improve tourists' perception of value ^[40]. When travelers see these innovations promoted through engaging social media content, they develop higher expectations for service quality and are more inclined to justify increased prices ^[35]. Additionally, studies suggest that personalized digital marketing, including AI-curated recommendations and targeted promotional campaigns, plays a role in influencing purchasing decisions and pricing acceptance ^[39].

However, the moderate agreement reflected in the composite mean suggests that while technology enhances the travel experience, it does not necessarily guarantee a willingness to pay significantly more. Factors such as perceived affordability, competitor pricing, and overall economic considerations may affect tourists' spending decisions ^[36]. Furthermore, while digital advancements add convenience, some travelers may still prioritize traditional service elements such as customer service, physical amenities, and location over purely digital features ^[34]. Therefore, while smart tourism technology positively influences pricing perception, its impact is dependent on how well resorts integrate technology with exceptional service quality and guest satisfaction.

10. Proposed action plan explanation

To enhance smart tourism accessibility, the primary objective is to improve the digital accessibility of resorts for both local and international tourists. This will be achieved by improving the mobile responsiveness of websites and social media platforms and developing multilingual support features. These strategies aim to create more inclusive and user-friendly digital interfaces, ensuring tourists from diverse backgrounds can easily access information and services. The timeline for these improvements is short-term (0–6 months), and success will be measured by increased user satisfaction, higher engagement rates, and improved accessibility ratings.

The personalized travel experience program focuses on providing customized travel experiences through smart technologies. This initiative will utilize AI-powered chatbots and recommendation systems, alongside data-driven personalization based on tourist behavior. These strategies are designed to create tailored customer journeys that meet individual preferences and needs. Planned for the medium term (6–12 months), the expected outcomes include higher customer satisfaction scores and increased AI-assisted bookings, ultimately leading to greater tourist engagement.

Strengthening digital marketing and social media engagement is crucial to increasing the digital visibility of resorts and enhancing tourist interaction. This will be accomplished by creating interactive campaigns leveraging user-generated content (UGC) and training resort staff in digital marketing techniques. The short-term timeline (0–6 months) for this strategy targets measurable improvements such as a rise in social media shares, positive customer testimonials, and enhanced digital marketing metrics. These efforts aim to build a stronger online presence and boost brand recognition for the resorts.

The customer loyalty and revisit incentive program seeks to encourage repeat visits and foster long-term customer relationships. Key strategies include launching membership and rewards programs, as well as offering exclusive VIP packages to returning guests. This program, scheduled for medium-term implementation (6–12 months), is expected to result in growth in repeat bookings, increased loyalty membership, and higher retention rates, which collectively strengthen brand loyalty and revisit intentions.

To boost tourists' willingness to pay more for innovative digital experiences, the premium smart tourism services initiative will introduce advanced technologies such as augmented reality (AR), virtual reality (VR) features, smart rooms, and seamless booking platforms. Additionally, exclusive bundles incorporating these smart services will be developed. Scheduled over the medium to long term (12–18 months), these efforts aim to increase bookings for premium packages and improve willingness-to-pay survey scores, thereby increasing revenue and enhancing the perceived value of tourism services.

Improving digital informativeness and transparency is essential for building customer trust and providing clear, real-time resort information. This will be achieved by offering real-time digital updates and creating a centralized digital information hub, ensuring tourists have easy access to accurate and timely details. Targeted for short-term implementation (0–6 months), these strategies are expected to enhance customer trust ratings, reduce inquiries, and boost booking confidence, resulting in more informed customers and smoother booking experiences.

Finally, the Smart Tourism Policy and Partnership Support area focuses on institutionalizing support for digital tourism initiatives to ensure sustainable development. This involves forging partnerships with local government units (LGUs), the Department of Tourism (DOT), and private sector stakeholders, as well as formulating enabling policies and guidelines. With a long-term timeline (18+ months), this approach aims to foster a robust ecosystem for smart tourism in Batangas, measured by the number of public-private partnerships

formed, policy adoption rates, and increased technological investment.

Together, these strategic initiatives form a comprehensive action plan that will strengthen Batangas' position as a smart tourism destination, enhancing both the visitor experience and sustainable tourism development.

11. Conclusion

The respondents were predominantly female, mostly within the adult age range, and primarily married, indicating a diverse and balanced demographic profile in the study.

Respondents strongly agreed that smart tourism technology attributes—especially accessibility and informativeness—significantly enhanced their overall travel experience.

Overall, respondents showed a positive behavioral intention toward the resort, with the strongest agreement seen in revisit intention and word-of-mouth recommendations, while willingness to pay more received comparatively lower agreement.

Tourists generally expressed a strong desire to revisit the resorts and to recommend them to others through word of mouth.

The significant positive relationship between smart tourism technology attributes and behavioral intention suggests that improving digital features can foster greater tourist engagement, loyalty, and repeat visits.

Based on these findings, a targeted action plan has been proposed to enhance the implementation of smart tourism technologies in Batangas Province, with tourism strategies tailored to meet the preferences and needs of the predominant demographic—female, married travelers aged 28 to 43.

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References

- [1] Buhalis D, Amaranggana A, 2015, Smart Tourism Destinations Enhancing Tourism Experience through Personalisation of Services, in *Information and Communication Technologies in Tourism 2015*, 377–389. Springer, Berlin.
- [2] Gretzel U, Sigala M, Xiang Z, et al., 2015, Smart Tourism: Foundations and Developments. *Electronic Markets*, 25(3): 179–188.
- [3] Neuhofer B, Buhalis D, Ladkin A, 2015, Smart Technologies for Personalized Experiences: A Case Study in the Hospitality Domain. *Electronic Markets*, 25(3): 243–254.
- [4] Li Y, Hu C, Huang C, et al., 2017, The Concept of Smart Tourism in the Context of Tourism Information Services. *Tourism Management*, 2017(58): 293–300.
- [5] Gretzel U, 2011, Intelligent Systems in Tourism: A Social Science Perspective. *Annals of Tourism Research*, 38(3): 757–779.
- [6] Wang D, Li XR, Li Y, 2013, China's "Smart Tourism Destination" Initiative: A Taste of the Service-Dominant Logic. *Journal of Destination Marketing & Management*, 2(2): 59–61.
- [7] Xiang Z, Fesenmaier DR, 2017, *Analytics in Smart Tourism Design: Concepts and Methods*. Springer, Berlin.
- [8] Kim J, Ritchie JRB, McCormick B, 2012, Development of a Scale to Measure Memorable Tourism Experiences. *Journal of Travel Research*, 51(1): 12–25.
- [9] Lee S, Lee CK, 2020, The Influence of Smart Tourism Technology on Tourist Satisfaction, Technology Satisfaction, and Revisit Intention. *Sustainability*, 12(9): 3707.
- [10] Yovcheva Z, Buhalis D, Gatzidis C, 2012, Overview of Smartphone Augmented Reality Applications for Tourism. *e-Review of Tourism Research*, 10(2): 63–66.
- [11] Huang YC, Backman SJ, Backman KF, et al., 2013, Exploring User Acceptance of 3D Virtual Worlds in Travel and Tourism Marketing. *Tourism Management*, 2013(36): 490–501.
- [12] Amaro S, Duarte P, 2015, An Integrative Model of Consumers' Intentions to Purchase Travel Online. *Tourism Management*, 2015(46): 64–79.
- [13] Buhalis D, Law R, 2008, Progress in Information Technology and Tourism Management: 20 years on and 10 Years after the Internet—The State of eTourism Research. *Tourism Management*, 29(4): 609–623.

- [14] Davis FD, 1989, Perceived Usefulness, Perceived Ease of Use, and User Acceptance of Information Technology. *MIS Quarterly*, 13(3): 319–340.
- [15] Ajzen I, 1991, The Theory of Planned Behavior. *Organizational Behavior and Human Decision Processes*, 50(2): 179–211.
- [16] Creswell JW, 2014, *Research Design: Qualitative, Quantitative, and Mixed Methods Approaches* (4th ed.). SAGE Publications, California.
- [17] Creswell JW, Creswell JD, 2020, *Research Design: Qualitative, Quantitative, and Mixed Methods Approaches* (5th ed.). SAGE Publications, California.
- [18] Sekaran U, Bougie R, 2016, *Research Methods for Business: A Skill-building Approach* (7th ed.). Wiley, New Jersey.
- [19] Bautista RL, 2023, Patterns of Eco-tourism Engagement in Batangas: An Adventure Tourism Perspective. *Journal of Philippine Tourism Studies*, 8(1): 45–59.
- [20] Reyes MC, 2022, Demographic Trends in Coastal Tourism: A Study of Laiya Beach Resort Visitors. *Batangas Journal of Tourism Research*, 12(2): 73–85.
- [21] Park S, Lee J, Chung N, 2021, The Role of Informativeness in Smart Tourism Services. *Information Technology & Tourism*, 23(3): 289–305. <https://doi.org/10.1007/s40558-021-00206-2>
- [22] Smith A, Johnson B, Kim J, 2021, User Satisfaction with Smart Tourism Technologies: Accessibility and Usability Factors. *Tourism Technology Quarterly*, 10(3): 118–135.
- [23] Lee C, Wang Y, 2021, Booking Systems and Consumer Trust in Online Tourism Platforms. *Journal of Consumer Behaviour*, 20(6): 1294–1307.
- [24] Zhang L, Li F, 2021, Real-time Navigation Apps and Tourist Decision-making: A Case Study Of Google Maps and Waze. *Tourism Geographies*, 23(5): 840–859.
- [25] Johnson M, Lee S, Brown K, 2023, Community-driven Traffic Information and Urban Tourism Mobility. *Urban Studies and Tourism*, 29(1): 50–67.
- [26] Wang D, Fesenmaier DR, 2022, Interactivity in Smart Tourism: AI-powered Booking and Social Media Integration. *Journal of Travel & Tourism Marketing*, 39(1): 78–92.
- [27] Kim S, Park H, 2021, The Impact of Accurate Online Information on Tourists' Decision-making and Revisit Intention. *Journal of Travel Research*, 60(4): 675–689. <https://doi.org/10.1177/0047287520961234>
- [28] Rahman M, Hossain M, Miah M, 2023, Transparency and Trust: How Digital Content Accuracy Influences Brand Loyalty in Tourism. *Tourism Management Perspectives*, 2023(40): 100930. <https://doi.org/10.1016/j.tmp.2021.100930>
- [29] Mariani M, Baggio R, Buhalis D, 2021, Enhancing Customer Experience through Digital Interactivity in Tourism. *Information & Management*, 58(4): 103449. <https://doi.org/10.1016/j.im.2020.103449>
- [30] Neuhofer B, Buhalis D, Ladkin A, 2020, Smart Technologies for Personalized Experiences: Tourism and Hospitality Perspectives. *Journal of Travel Research*, 59(2): 212–230. <https://doi.org/10.1177/0047287519861921>
- [31] Wang D, Fesenmaier D, 2021, Digital Booking Services and Customer Retention in Hospitality: The Role of User-friendly Design. *International Journal of Hospitality Management*, 2021(94): 102841. <https://doi.org/10.1016/j.ijhm.2020.102841>
- [32] Mariani M, Baggio R, Buhalis D, 2021, Enhancing Customer Experience through Digital Interactivity in Tourism. *Information & Management*, 58(4): 103449. <https://doi.org/10.1016/j.im.2020.103449>
- [33] Rahman, M, Hossain M, Miah M, 2023, Transparency and Trust: How Digital Content Accuracy Influences Brand Loyalty in Tourism. *Tourism Management Perspectives*, 2023(40): 100930. <https://doi.org/10.1016/j.tmp.2021.100930>

j.tmp.2021.100930

- [34] Liu B, Kim S, Park H, 2021, Social Media Engagement and Customer Advocacy in Tourism. *Journal of Travel Research*, 60(6): 1253–1270. <https://doi.org/10.1177/00472875211010040>
- [35] Gursoy D, Chi CG, Lu L, 2022, Experiential Marketing in Hospitality and Tourism: Emotional Connections through Social Media. *Journal of Hospitality Marketing & Management*, 31(1): 1–18. <https://doi.org/10.1080/19368623.2021.1895876>
- [36] Kim J, Kim M, Lee C, 2020, Technology-enhanced Experiences and Customer Loyalty in Hospitality. *International Journal of Hospitality Management*, 2020(90): 102609. <https://doi.org/10.1016/j.ijhm.2020.102609>
- [37] Bilgihan A, Seo S, Choi H, 2021, The Role of Digital Word-of-mouth in Tourism Marketing. *Tourism Management*, 2021(82): 104163. <https://doi.org/10.1016/j.tourman.2020.104163>

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The Nationality and Cosmopolitanism of Modern Chinese Literary Tradition

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Abstract: Since the twentieth century, Chinese literary theory has manifested strong cosmopolitanism and nationality, presenting a modern tradition different from the classical literary tradition. The direction of literary tradition is an important path to continue the tradition and build a modern tradition of literary theory. Based on the world perspective, tracing the historical lineage of aesthetic research and literary practice, and scrutinizing the complex changes of Chinese literary theories in the world's literary theories are important content for the genesis of national literary theories nowadays. On the one hand, it is important to carefully review and sort out the discourse system on which the Chinese literary tradition has been based for the past one hundred years, so as to continue the essential spirit of the literary tradition. On the other hand, it is important to re-explore the way of occurrence of the literary tradition and the vitality in the discourse paradigm, so as to provide impetus for the modernization and internationalization of the modern Chinese literary theory.

Keywords: Literary tradition; Cosmopolitanism; Nationality; Language

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1. Introduction

The development of modern Chinese literary theory is closely related to medium, time, language, and national identity, and is a complex process of continuous development and evolution through constant contact with foreign literary theory. How to realize the modern transformation of Chinese literary theories in the cultural fusion of the ancient and the modern, the internal and the external, is not only an important path for the innovative development of the Chinese nation, but also a requirement of the times to face the international competition in the world. Since the 20th century, Chinese scholars in the construction of literary theories have, on the one hand, emphasized the research and influence of Western “human”-oriented literary criticism theory and aesthetics theory; on the other hand, they have been comparing and interpreting Chinese and Western literary theories, and looking at the Chinese literary theories and the world's literary theories with objective and dialectical eyes^[1].

2. Controversies in modern literary theory

In the late nineteenth and early twentieth centuries, China continued to learn from the West, from artifacts to institutions to spirituality, and more and more theorists realized the correlation between literary change and social change. Scholars specializing in the translation of literary theories appeared relatively late in China, and more theoretical scholars like Wang Guowei and Liang Qichao took the initiative to translate and disseminate the literary theories of other countries, and to actively learn from the Western-centered literary theories of the world.

The modern Chinese literary theorists, represented by Wang Guowei, have fully embodied their literary and artistic theories that transcend the origin of Chinese culture in specific texts. Wang Guowei's idea of "breaking down Chinese and foreign views" is essentially a challenge to the linear view of the past and a dismantling of the barriers between Chinese tradition and Western modernity. The development of Chinese literary theories is constantly derived from the process of practice, and at the same time, it is also a continuation of the literary theories of its predecessors. The influence of Western literary theory on China is not only theoretical, but also manifested in practice. The modern Chinese intellectuals represented by Liang Qichao, Yan Fu, and Xia Zengyou reconstructed the ancient Chinese traditional culture from the modern concept of the nation-state, and created such national literary concepts as "Chinese novel" and "Chinese literature." This set of concepts was derived from Western learning and Japanese cultural contexts, and is intrinsically and closely related to Western concepts of literature and its categorization. This concept is widely recognized, on the one hand, as being founded in the roots of traditional Chinese culture, and on the other hand, as the emergence and establishment of the modern concept of the nation-state. It is thus clear that his attitude towards world literary theories and cultures was open, equal, friendly, and complementary. This fully illustrates the consensus of literary theory researchers at that time on the ownership of Chinese culture, i.e., Chinese literature and Chinese literary theories belonged to the Chinese nation and at the same time to world literature.

During the same period, the "Guo Min Jing Shen", "Guo Cui", and so on, were further emphasized by scholars, and in 1902, Huang Jie published "The Preservation of the National Essence", which was echoed by Zhang Taiyan, Liu Shipei, and others. In the New Culture Movement, Lu Xun and Hu Shi emphasized the need to distinguish between national essence and national dregs with a critical attitude and scientific spirit, so as to sort out the existing theories and realize the purpose of inheriting the spirit of classical literature and art in traditional academics. In 1911, Liang Qichao's "Zhong Guo Qian Tu Zhi Xi Wang Yu Guo Min Ze Ren", based on his support for Yan Fu's "Drumming up the people's power, opening up the people's wisdom, and renewing the people's morality", revealed that "national essence" was the most important principle of China's future. In 1911 Liang Qichao's "Zhong Guo Qian Tu Zhi Xi Wang Yu Guo Min Ze Ren" supported Yan Fu's idea of "Gu Min Li, Kai Min Zhi, Xin Min De", exposed the four weaknesses of China's national character, and put forward the idea of national character, and emphasized the need for the people to "Jian Lie Xia Zhi Gen Xing" and develop "Wan Cui Zhi Pin Ge."

The development of literary theory and criticism in the early 20th century was mainly characterized by the conflict and fusion of the dichotomy between the political and religious centrism and the aesthetic centrism. These two values not only reflect the distinctive characteristics of traditional Chinese literary criticism but also the profound influence of Western literary theory systems, aesthetic thought, and humanism. Of course, these two critical concepts, related to the specific social conditions and social culture of the feudal era, have a specific significance for the times. Whether from the perspective of disciplinary construction or from specific theoretical and practical activities, it is not difficult to see that Chinese literary theory draws on the world's excellent literary

theories. In addition, Cai Yuanpei's "Digestion of Civilization" and "Combination of Eastern and Western Cultures", Liang Qichao's "Record of the Heart of European Travels", and Lu Xun's "Moro Poetry and Power" and other writings on literary theories are not a simple substitution of China for the West, or of the West for China, let alone of China plus the West. On the contrary, in the process of learning from the West, their literary theories emphasized the fusion, innovation, and regeneration of the East and the West, led by the Chinese national spirit. The concept of pure literature that emerged in China during this period reflects the fact that the interpretation of world literature based on the paradigm of modern Western literary theory was greatly utilized in the Chinese literary world. It also illustrates that the entry of foreign doctrines in the process of globalization produces a multitude of new perspectives, which, despite certain contradictions and exclusions, can always complement each other in specific cultural contexts and work together to promote the understanding and creation of cosmopolitan literary theories.

3. The beginning of modern literary theory

In 1919, a linguistic movement similar to that which took place at the beginning of the formation of certain major modern Western nation-states, the vernacular language movement, took place in China, which was a thorough and intense linguistic movement of anti-traditional gestures. This movement was not a complete abandonment of the original written language, nor was it simply the use of dialectal colloquialisms for writing, but rather the creation of a new written language based on the absorption of elements of literary and colloquialisms, which was then popularized and made into the common language of the nation. This is profoundly reflected in the fact that the script retained the beauty of ancient images while absorbing foreign phonetic systems, meeting the requirements of simplicity of expression in the modern sense.

The change of literary language from classical Chinese to vernacular language, ancient poetry to modern free verse, and Peking opera to drama marked the end of the classical Chinese form of literary theory and criticism. To put it simply, this linguistic change prompted Chinese literary theory to gradually abandon its past metaphorical criticism and fragmented writing style, and to use more of the holistic research methods of modern Western science. Along with the change in literary language and style, there was also a change in literary concepts, i.e., a shift from the traditional lyrical concept of literature to the realistic and narrative concept of literature. On the basis of the accumulation of literary change, more and more Western literary theories and aesthetic ideas were introduced into China.

The "Creation Society" represented by Zhou Zuoren and Guo Moruo discussed the nature of art, i.e., whether it is pure or purposive, and whether the beauty of art can achieve the realization of human nature. The appearance of Zhu Guangqian's monographs such as "Poetry" and "Psychology of Literature and Art" during this period shows that modern Chinese intellectuals have not been completely hostage to Western literary theories and ideas, and that the memory of the traditional Chinese culture to a certain extent counteracted the European-centered construction of the literary world. He wrote in "Poetry in the Words of Zhi" that "the importation of Western culture has changed our idea of 'history' and our idea of 'literature'." [2]. He puts the concepts of "Shi Yan Zhi", "Bi Xing", "Shi Jiao", and "Zheng Bian" in the context of a larger historical view for examination, reflecting classical Chinese compositional theory. Zhu Ziqing's modern interpretative poetics is a reflection of the classical Chinese theory of creativity, which embodies the concept of "all-embracing." Zhu Ziqing's modern poetic thought is gradually accomplished through the two-way absorption and fusion of modern Western criticism and traditional methods of poetic interpretation, which is a modern reconstruction of theoretical methods and a dynamic new form

of literary theory.

From 1919 to 1949, before and after the founding of China, various trends of literary theory developed rapidly in the process of controversy, and were characterized by “pluralistic modernity.” Intellectuals at this stage, on the one hand, were deeply imbued with classical culture and had great enthusiasm for traditional Chinese literary theories; on the other hand, they also actively accepted the influence of foreign literary and artistic thoughts and had a deep understanding of foreign cultures, showing a tendency to transform classical aesthetics into modern aesthetics. Influenced by other literature, paintings, movies, music and theater, they not only pursued Western modern literary ideas, such as free thinking, aestheticism and other literary trends, but also integrated traditional Chinese classical literary ideas, such as harmony, rhyme and other traditional aesthetic pursuits, and ultimately created modern literature and art with Chinese characteristics.

The special logic of the literary world is to ignore ordinary geographical and political factors to define literature as a unified world field (or a world field on the way to unification). It is difficult to realize the construction of the national literary theory through the rapid transplantation and application of foreign theories, and it is also impossible to realize the real meaning of mutual interpretation in different language expressions when the fence of cultural contexts cannot be broken down^[3]. Chinese literary theory has great inclusiveness, and the translation and application of foreign theories, such as the theories of sublimity and magnificence, embodiment and acquiescence, beauty and taste, blankness and rhyme, etc., have been widely and deeply researched in modern Chinese literary theory. The use of foreign literary theories, especially Western literary theories, gave rise to a more profound reflection in the late 1990s on the generalization and meaninglessness of Chinese-Western mutual interpretations caused by differences in cultural contexts.

Literary theory from 1919 to 1949 was both a theoretical reflection on literary works and, at the same time, a theoretical achievement of hyperliteracy. The emergence of Marxist-guided literary theories with Chinese characteristics during this period not only rapidly became a mainstream voice in China, but was also translated in large numbers to Japan, the United States, Germany, Italy, and other countries, exerting a significant influence on Western scholars such as Nick Wright, Pushcock, and Dubney, and facilitating exchanges and interactions between Chinese and Western literary theorists. In the process of research, foreign scholars found that a large number of literary works were involved, which indirectly promoted Western scholars’ understanding and research of classical Chinese literature and art. These literary theories are the theories of individual scholars, as well as supra-individual literary theories. The process of literary theory development is not a simple westernization of the transformation of traditional culture, but a fusion of tradition and modernity, China and the world. Shen Congwen’s “Impressionistic Criticism”, Li Changzhi’s “Biographical Criticism”, and Li Jianwu’s “Essayistic Criticism” have implanted modern Western critical discourse on the outside, but creatively inherited and developed ancient Chinese literary theories on the inside. Inheriting and developing the ancient Chinese literary criticism styles, this stage of scholars’ “Western” road is actually the “Eastern” road; the process is complex and continuous^[4].

4. The complex development of modern literary theory

From the 1950s to the end of the 1970s, China’s national consciousness was further established, and the future direction of Chinese literary theory was basically laid down. The development of Chinese literary theory in this period went through three main stages: first, the development at the early stage of the founding of New China; second, the literary controversy from the 1950s to the mid-1960s; and third, the decade of the Cultural Revolution at the end

of the 1960s and 1970s. The theoretical discussions of Li Zehou and Qian Zhongshu laid the foundation for the development of Chinese literary theory, with the continuation of national beliefs and traditional characteristics as well as the tendency to participate in world literature; the practice of overseas Chinese literature and art by Xia Zhiqing and Zhang Eiling broadened the path for the later study of Chinese novels; and the translation and dissemination of the theory of modern Chinese literature and art around the world with Mao Zedong as an example, fully embodied the literary world's internal The globalization of literary theory and its structure.

The globalized development of literary theory and structural ethnocentrism draws on the discussion of the interaction between the individual and society and its internal changes, which are extremely obvious in the metaphorical nature of language. The transformation of Li Zehou's literary thought in the context of globalization reflects the co-temporality of historical events influencing the historical trajectory of literary theory development in an entangled pattern.

In the face of the richness and variability of the literary world, Qian Zhongshu's *The Collection of Seven Embellishments* is based on the subjectivity and independence of literature, emphasizing the dialectical unity of the relationships between the East and the West, borrowing and innovation, tradition and modernity, inheritance and development, and so on, so as to achieve a state of open and tolerant development. He pointed out that "pain is more capable of producing poetry than pleasure" is a common phenomenon in both Chinese and Western literary traditions, which illustrates the interoperability between the East and the West. With his typical global perspective, he blends the East and the West, the past and the present, and provides a paradigm for the interpretation and acceptance of Chinese and Western literary ideas, concepts, and methods, which is still of great significance to the construction of modern literary theories nowadays. Qian Zhongshu skillfully utilizes palimpsests and proverbs from many countries, such as England, France, and Germany, etc., and takes all human literature as the object of his examination with a broad cosmopolitan vision and a distinctly modern stance, not only assembling the outstanding classical works of national literature, but also embodying a cosmopolitan outlook that is different from that of Western-centrism. The readers of the world are mainly dominated by the official languages of the central countries. Therefore, Qian Zhongshu, who was in a non-central language, was bound by the ruling regional language of literature, English, in his specific practical activities.

In short, in terms of modern literary thought's acceptance of Western literary thought and literary tradition, both content and form began to shift from pluralism to monism. More importantly, this process of transformation, which no longer favored the interaction of European countries with themselves, but with Soviet or other regions and countries, was orienting the construction of modern world literary theory. At the same time, clarifying such important issues as local and global, national and world, classical and non-classical is of great significance for further research on the theory of national and world literature.

5. Recognition and reconstruction of modern literary theory

Against the background of globalization in the development of the literary world, literary theorists and countries, civilizations, and collectives do not develop in isolation, but are related to each other. Along with China's reform and opening to the outside world, the process of marketization and aesthetic daily life has brought about the gradual emergence of Chinese contemporary literary theory in the global literary world. The national and local tradition of literary criticism exists "a priori" in the collision and fusion of Chinese and Western literary discourses, and has formed a hidden or visible expression in the development of Chinese literary theory. Zhou Youguang puts

forward the theory of “biculturalism”: “The era of globalization is the era of biculturalism. People of all countries ‘co-create, share, and common’ international modern culture, while preserving and renewing the traditional culture of the region”, which also includes “the two-way process of specialization of universality and universalization of particularity”^[5-6]. In the process of modernization and development with Chinese characteristics, the development of Chinese literature and art is a new quality of literary theory formed under the double fusion of traditional-national literary theory and contemporary-worldly literary theory vision.

In the 1980s, the connection and flow between China and the world became closer, and the relationship between the individual, the state, the market, the intellectuals, and the public became intertwined, presenting a different landscape from the past literary import. China’s cultural community, formed under the influence of thousands of years of history and tradition, will not easily lose its strong centripetal force and independent thinking. Even if, in order to further realize the renaissance of China, Chinese scholars translate and introduce a large number of foreign literary theories, Chinese scholars are still able to consciously choose and take the initiative to cater to the national expectations of the world’s literary theories in these two or more heterogeneous cultures. On the basis of constant comparison and interpretation with the established literary theories, the ways of deleting, replacing, simplifying, reconstructing, and even hijacking the established literary theories show the independence and creativity of Chinese scholars’ understanding of literary theories. In the controversy of theories, disintegration and reorganization were carried out in the course of development, and division and combination, antagonism and unification alternated and mixed with each other, which jointly promoted the national literary theories to the world.

During this period, creators coincidentally changed from the “big narrative” to a personal “small narrative”, emphasizing more on the aesthetic criticism of personal feelings. New ideas, new spirit, new methods, and new forms were presented in the context of the new era. Literary theories showed the same mechanism of change as culture, paying more attention to similarities than differences in circulation. Chinese literary researchers living in different regions adhere to the principles of purely literary objectivity and truthfulness in the selection and study of writers and works. In the words of Panofsky, this instinctive response is the “literary habit” of the space he has been bending^[7]. The creator’s love for the world of literature forms a specific “literary habit”, i.e., inheriting the artistic expression of traditional literature, in order to achieve inner conviction. Maintaining a Chinese and Western knowledge structure and a broad multicultural vision is one of the ways to reach the peak of art.

Since the twentieth century, Chinese literature has evolved from the political and religious demands of lyricism to the realistic choice of awakening the people, and then to the market demands of being based on the people and satisfying the aesthetic psychology of the masses, causing a great uproar in the literary world. Xia Zhiqing, who has long insisted on the study of the pure world of literature, has developed a writing perspective that is different from that of the early Japanese and Western “history of imaginary Chinese literature.” From his literary practice and theoretical criticism, on the one hand, their expectation of fairness in the literary world can be seen; on the other hand, it also shows that the development of modern Chinese literary criticism will not march in the way of “homogeneity”, but rather expresses the pursuit of world plurality and the thinking of ethnicity in various possibilities. It can be said that the tradition of modern Chinese literary criticism has been deeply integrated with the atmosphere of dialogue between the Chinese self and the foreign Western other in the era of “China of the World”, forming a specific discourse system and its uniqueness^[8].

The content of modern Chinese literary theory has actively absorbed another literary system, and has continuously attempted to circulate its works in other literary systems. In this process, Chinese literary theory

involves not only the classical literary theories that have been imbued with the local culture, but also the ideological connotations beyond the linguistic components of the global literary theories that have been “embraced.” Facing the requirement of revitalizing Chinese contemporary literary theory, in the impact of the fusion of Chinese local and foreign cultures, creating a national literary theory that is not identical with the pilgrimage and pursuit of the Western-centered literary world as seen in the West is not only a basic requirement for the development of literary theory, but also a practical need for the nation to gain the right of literary discourse.

In short, there is incommensurability between cultural externals, and so is the study of literary theory. In contrast to the distinction between universal and portable “national forms” and the specific cultural representations of “national forms” at the theoretical level, Chinese scholars have been deepening their understanding of the meaning of the term “nation” and the way it is practiced, and they have been able to understand the meaning of “nation” and the way it is practiced, as well as the way it is practiced. Chinese scholars have continued to deepen their understanding of the meaning of the term “nation” and the way it is practiced, placing them in a global context. Modern Chinese literary theory, as an important component of the overall construction of global culture for the future of mankind, has made the transition from purely national culture to the aesthetic culture of each body in the sense of the overall aesthetic culture of mankind, and in the process of adhering to the trend of historical development, and with the humanistic spirit as a guideline, it has truly realized the fusion of the aesthetic culture of the general public with the vision of the elegant culture, and the fusion of the traditional national culture with the vision of contemporary global culture and contemporary cosmopolitan culture.

6. Conclusion

World literary theory has a wide scope, the internal flow of the literary world is extremely complicated, and there are many external factors influencing the development of literary theory. The changes in Chinese literary theory cannot simply be applied from the model of economic globalization to the examination of national literature in the context of globalization. The nationalism and popularity required by modern Chinese literary theory reflect the “encapsulation” of foreign cultures, and the constant application of foreign theories, or even new methodological practices inspired by misinterpretation, is extremely different from the theoretical context of the cultural system to which it belongs. Faced with the differences between Chinese and Western cultures, millions of scholars consciously incorporate the excellent foreign theories into the historical and cultural memory of the nation, realizing the internalization and regeneration, and at the same time demonstrating the inheritance and promotion of the national factors. Putting the development of modern Chinese literary theory in the world’s perspective shows China’s enthusiasm in communicating and exchanging with the world, and also illustrates the entanglement and connection between Chinese literary theory and the world’s literary theory. In the process of theoretical practice and construction, Chinese scholars have always insisted on treating the achievements of world literary theories with a global vision and an open multicultural perspective, leaving the imprint of their own research tradition and influencing the present.

The emergence of different literary phenomena in the world literary theory is not a rigid copy of the Chinese literary theory, but is created, changed, and exchanged. The traditional critical style of Wang Guowei’s commentary, Zhou Zuoren’s critical principle of daily life, and Li Jianwu’s critical method of beautiful writing not only show the national imprint and personal charm of literary criticism in a specific historical period, but also fully reflect the worldwide development of literary theory. Liang Qichao, Wang Guowei, Cai Yuanpei, Li Zehou, Zhu

Guangqian, and so on, who had both a sense of rootedness in tradition and a very deep origin in Western learning, invariably adopted a cosmopolitan vision to re-examine classical Chinese culture.

Linguistic changes and economic reforms have brought about a pluralistic modernity in the discussion of literary theories. Among them, language has profoundly influenced the modernity and cosmopolitanism of modern literary theory development. With the long historical imprint of the Chinese nation, a short period of foreign cultural impact cannot completely overthrow the traditional culture of the past. The rise of China has prompted China to rethink its own national consciousness, and in the past two decades, China no longer tends to rush to foreign literary theories, but thinks about how to link the excellent world literary theories with its own nation in the real situation. Emphasis on rationality will lead to the over-expansion of instrumental rationality, and the traditional literary discourse in the past is not the same as that in the contemporary “globalized industry”, “information age”, “image age”, or “post-emotional age.” How to realize the symbiosis between traditional literature and art in the “Gao Shan Yang Zhi”, “Jing Hang Hang Zhi”, “Ji Mu You You”, and “Mei Jie Cheng Wu” needs to be solved urgently. In the process of building the modernity of Chinese literary theory, the act of treating and instrumentalizing literature and art only as tools can no longer be continued in the past practice, but should also focus on the combination of instrumental rationality and humanism to realize the construction of national, aesthetic, humanistic and individual modernization theories.

Disclosure statement

The author declares no conflict of interest.

References

- [1] Conrad S, 2018, *What is Global History*, translated by Du Xianbing. CITIC Press, Beijing, 24.
- [2] Zhu ZQ, 1947, *Poetry in the Words of the Will to Discern*. Kai Ming Bookstore, Shanghai, 3.
- [3] Casanova P, 2015, *The Republic of the Literary World*, translated by Luo Guoxiang. Peking University Press, Beijing, 5.
- [4] Li JZ, 2008, The Modern Resurrection of Classical Critical Styles—Taking Three Beijing School Critics as Examples. *Journal of Sun Yat-sen University (Social Science Edition)*, 2008(1): 32–38.
- [5] Zhou YG, 2007, Globalization and Cosmopolitan Ideal. *Qunyan*, 2007(7): 38–39.
- [6] Robertson R, 2000, *Globalization: Social Theory and Global Culture*, translated by Liang Guangyan. Shanghai People’s Publishing House, Shanghai, 255.
- [7] Panofs I, 2022, *Gothic Architecture and Scriptural Thought*, translated by Chen Ping. Commercial Press, Beijing, 83–113.
- [8] Wang YC, 2019, *Modern Chinese Literary Tradition*. Beijing Normal University Press, Beijing, 338.

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A Review of Research on the Concept of Digital Agriculture Competitiveness in Domestic and International Contexts

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Abstract: Digital agricultural competitiveness reflects the development status of agriculture in a region. Studying the concept of digital agricultural competitiveness can provide a theoretical foundation for the modernization of agriculture. This paper explores the concepts of both digital agriculture and agricultural competitiveness to define the notion of digital agricultural competitiveness.

Keywords: Digital agriculture; Agricultural competitiveness; Conceptual research

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1. Research background

The documents of the 20th CPC National Congress have further clarified the implementation pathway of the national digitalization strategy. As a core component of this strategic framework, the intelligent transformation of the agricultural sector has become a critical direction for industrial upgrading.

Digital agriculture, as the product of deep integration between modern information technologies and digital tools in agricultural applications, is centered on data collection, transmission, storage, analysis, and utilization. Leveraging technologies such as the Internet of Things, big data, and artificial intelligence, it drives comprehensive digital transformation across agricultural production, management, and services, thereby realizing intelligent, precise, and efficient agricultural development.

The strength of digital agricultural competitiveness determines a region's capacity to develop its agricultural industry and increase farmers' income. It serves as a crucial supporting force in the process of agricultural modernization and represents a novel approach to promoting rural economic development and lifting farmers out of poverty. Therefore, conducting a literature review on the concept of digital agricultural competitiveness both domestically and internationally can lay a solid foundation for the transformation and upgrading of agricultural

modernization and rural economy, thereby advancing the development of digital agricultural competitiveness.

Regarding the concept of digital agricultural competitiveness, there has yet to be a universally accepted and unified definition within the industry. As people's understanding of modern agriculture continues to evolve and improve, the perception of digital agriculture has also undergone a process of continuous change and updating.

In light of this, this paper will separately examine domestic and international literature on the concepts of digital agriculture and agricultural competitiveness. Through summarization, analysis, and synthesis, it aims to develop a new and comprehensive understanding of the concept of digital agricultural competitiveness, while accurately grasping its relevant characteristics.

2. Literature review of domestic and international research

2.1. Digital agriculture

In the 1990s, with the rapid global proliferation of internet technology, the concept of digital agriculture emerged. Expert teams from the U.S. National Academy of Sciences and the Chinese Academy of Sciences first systematically articulated this concept ^[1]. According to the 1997 definition by the U.S. National Academies of Sciences and Engineering, digital agriculture refers to “a precision agricultural management model supported by geospatial information technologies.” Al Gore further elaborated it as “a novel agricultural management paradigm integrating digital earth theory with intelligent agricultural machinery and equipment” ^[2]. Kamble and Gunasekaran subsequently expanded the concept to “an innovative agricultural production system that incorporates modern technological approaches, including computer science and spatial information technologies” ^[3].

In November 1999, China hosted the International Symposium on “Digital Earth” in Beijing. This conference focused on exploring the application prospects of digital agriculture technologies in the agricultural sector, identifying it as one of the key directions for implementing the Digital Earth strategy. Chinese academia has been actively engaged in exploration and research in this field.

Ge Jiakun and Liu Shuxia defined digital agriculture as the deep integration of traditional agriculture with information technologies and intelligent systems, enabling dynamic monitoring and intelligent regulation of agricultural production processes ^[4]. Wang Limin et al. proposed that through the comprehensive application of modern technologies such as the Internet of Things and big data analytics, digital agriculture can effectively mitigate agricultural production risks and significantly enhance production efficiency ^[5]. Zhou Qingbo et al. argued that digital agriculture essentially represents the digital transformation of the entire agricultural production process, with its core lying in the application of digital technologies to achieve visual representation and intelligent management of agricultural elements. Their study also systematically differentiated digital agriculture from related concepts such as smart agriculture ^[6]. Tian Na et al. further expanded the scope of this concept, noting that digital agriculture encompasses not only traditional crop cultivation and animal husbandry but also involves multiple dimensions such as agricultural IoT system development, big data analytics applications, and e-commerce platform construction ^[7]. Wu Xinke characterized digital agriculture as an advanced stage of agricultural modernization, with its essential feature being the deep integration of digital information technologies with the agricultural industry. Digital agriculture is not only an imperative requirement for building a “Digital China” but also an effective measure to promote rural revitalization and enhance rural governance efficiency through the agricultural big data system ^[8].

2.2. Agricultural competitiveness

The international academic community has not yet reached a consensus on the definition of agricultural competitiveness, and the conceptualization remains relatively limited. Fischer and Schornberg, from an industrial perspective, argue that agricultural competitiveness is primarily reflected in the profitability, production efficiency, and output growth potential of agricultural products ^[9]. Anna and Agnieszka suggest that agricultural competitiveness is shaped by multiple factors collectively influencing agricultural development ^[10]. Matyja posits that, under fair and open market conditions, agricultural competitiveness manifests as higher production efficiency compared to competitors and the ability to sustainably generate profits using available resources ^[11]. These studies explore the connotation of agricultural competitiveness from different perspectives but have yet to establish a unified definitional framework.

Chinese scholars hold diverse perspectives on the conceptualization and constituent elements of agricultural competitiveness. The Competitiveness and Evaluation Research Center of Renmin University of China posits that the core essence of agricultural competitiveness lies in the comprehensive manifestation of agricultural production capacity in a specific country or region. From a research perspective, this concept can be categorized into narrow and broad dimensions. The narrow dimension primarily refers to improvements in agricultural production efficiency and the enhancement of agricultural product supply capacity. The broad dimension further encompasses key elements underpinning sustainable agricultural development, including the level of infrastructure improvement, agricultural technological innovation, the professional competence of practitioners, as well as institutional policies and financial services as supporting mechanisms.

Su Hang proposed that agricultural competitiveness should encompass multiple dimensions, including market adaptability, value creation capacity, risk resilience, and sustainable development capability. The integration of these capacities constitutes the overall strength of agriculture ^[12]. Liu Feixiang et al. emphasized the dynamic characteristics of agricultural competitiveness, suggesting that evaluation systems should incorporate dual indicators reflecting both current performance and future potential ^[13]. Liu Shumei, from an industrial perspective, argued that agricultural competitiveness manifests as the ability of agriculture, forestry, animal husbandry, and fishery sectors to allocate resources more efficiently and realize product value, specifically including national security safeguarding capacity, international market share, and potential for stable industrial development ^[14]. Luo Dan proposed a five-dimensional analytical framework that decomposes agricultural competitiveness into five aspects: industrial efficiency, market responsiveness, risk management, sustainable development, and scale expansion capabilities ^[15]. Cui Hongfang constructed a more comprehensive system of agricultural competitiveness elements, highlighting key factors such as technological innovation, factor allocation, organizational forms, talent reserves, policy support, and market performance ^[16]. Liu Rui and Deng Hui, from a systems theory perspective, viewed agricultural competitiveness as the synergistic outcome of multiple factors, including production factors, technological levels, institutional environments, and capital investment ^[17]. These studies provide multi-layered theoretical perspectives for understanding agricultural competitiveness.

3. Literature review

From the conceptual synthesis and analysis of digital agriculture and agricultural competitiveness, the following findings emerge.

3.1. The enhancement of digital agricultural competitiveness facilitates optimized resource allocation and reduced agricultural production costs

Through big data analytics, agricultural producers can more accurately comprehend market demand and price fluctuations, thereby making more informed production decisions. Concurrently, the application of IoT technologies enables real-time monitoring and precision management of agricultural production processes, effectively reducing resource waste and environmental pollution.

3.2. The improvement of digital agricultural competitiveness drives innovation in the agricultural industry

The adoption of next-generation information technologies fosters novel agricultural business models and formats, including agricultural e-commerce, crowdfunding, and insurance. These emerging models not only expand market opportunities for producers but also provide consumers with more convenient and safer agricultural product experiences.

3.3. Strengthening digital agricultural competitiveness enhances the global competitiveness of the agricultural sector

In the context of globalization, the agricultural industry faces intense international competition. Digital transformation enables productivity improvements, quality enhancement, and brand influence amplification, thereby securing greater competitive advantages in global markets

3.4. The advancement of digital agricultural competitiveness further promotes sustainable agricultural development

Through the application of a new generation of information technology, the agricultural industry can realize the economic utilization of resources, the protection and restoration of the environment, and the virtuous cycle of ecology, so as to realize the green, low-carbon, and circular development of the agricultural industry.

Based on the above analysis and existing research, this paper defines digital agricultural competitiveness as: in the field of modern agriculture, the advantages and capabilities demonstrated through the application of advanced digital technologies, information-based methods, and intelligent approaches to achieve optimized resource allocation, improved production efficiency, reduced production costs, enhanced agricultural product quality, strengthened agricultural innovation capacity, and reinforced marketing effectiveness.

This competitiveness is manifested not only across various stages of agricultural production but also throughout the entire industry chain, including processing, distribution, and sales of agricultural products. Digital agricultural competitiveness is a multidimensional, complex, and evolving comprehensive concept. It encompasses not only the digitization and intelligent transformation of agricultural production processes but also involves holistic coordination, information sharing, and resource optimization across the agricultural value chain. Its ultimate goal is to drive innovative development in the agricultural sector, enhance its competitiveness, and promote sustainable development through the application of next-generation digital technologies.

Disclosure statement

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References

- [1] Agyekumhene C, Vries DRJ, Paassen VA, et al., 2020, Making Smallholder Value Chain Partnerships Inclusive: Exploring Digital Farm Monitoring through Farmer Friendly Smartphone Platforms. *Sustainability*, 12(11): 4580.
- [2] AI Gore, 1998, Digital Earth: Understanding Our Planet in the 21st Century. *World Science*, 1998(10): 2–4.
- [3] Kamble SS, Gunasekaran S, Gawankar SA, 2020, Achieving Sustainable Performance in a Data-driven Agriculture Supply Chain: A Review for Research and Applications. *International Journal of Production Economics*, 2020(219): 179–194.
- [4] Ge JK, Liu SX, 2017, Development Status and Prospects of Digital Agriculture. *Journal of Northeast Agricultural Sciences*, 42(3): 58–62.
- [5] Wang LM, Liu J, Yang LB, et al., 2018, Basic Concepts and Construction Content Design of Digital Agriculture in China. *China Agricultural Informatics*, 30(6): 71–81.
- [6] Zhou QB, Wu WB, Song Q, 2018, Analysis of Research Status and Development Trend of Digital Agriculture. *China Agricultural Informatics*, 30(1): 1–9.
- [7] Tian N, Yang XW, Shan DL, et al., 2019, Current Situation and Prospects of Digital Agriculture in China. *Journal of Chinese Agricultural Mechanization*, 40(4): 210–213.
- [8] Wu XK, 2023, Research on the Status, Problems and Countermeasures of Traditional Agricultural Digital Transformation in China under Rural Revitalization Strategy. *Agricultural Economy*, 2023(10): 34–35.
- [9] Fischer C, Schornberg S, 2007, The Competitiveness Situation of the EU Meat Processing and Beverage Manufacturing Sectors. *Food Economics: Acta Agriculturae Scandinavica*, Section C, 4(3): 148–158.
- [10] Anna N, Agnieszka K, 2016, Agricultural Competitiveness: The Case of the European Union Countries. *Agricultural Economics*, 2016(64): 507–516.
- [11] Matyja M, 2016, Resources Based Factors of Competitiveness of Agricultural Enterprises. *Management*, 20(1): 368–381.
- [12] Su H, 2005, Connotation Definition of Agricultural Product Competitiveness and Agricultural Competitiveness. *Economic Forum*, 2005(24): 125–127.
- [13] Liu FX, Pan GL, Zhan JW, et al., 2009, Construction of Measurement Model and Comprehensive Evaluation of Provincial Agricultural Competitiveness. *Journal of Jiangxi Agricultural University (Social Sciences Edition)*, 8(1): 43–47.
- [14] Liu SM, 2013, Research on Evaluation and Enhancement Strategies of China's Agricultural Competitiveness, thesis, Jilin University.
- [15] Luo D, 2017, Evaluation and Enhancement of Creative Agricultural Competitiveness in Fujian Province. *Journal of Putian University*, 24(3): 44–46 + 56.
- [16] Cui HF, 2017, Analysis of Agricultural Export Competitiveness of BRICS Countries from the Perspective of Trade Value Added. *World Agriculture*, 2017(6): 122–127.
- [17] Liu R, Deng H, 2019, Structural Decomposition and Type Classification of Agricultural Comprehensive Strength in Gansu Province Based on SSM Model. *Chinese Journal of Agricultural Resources and Regional Planning*, 40(11): 136–145.

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Exploration of Sustainable Development Pathways for Cultural Tourism under the Perspective of the “Priority of Historical Landscape Value” Theory in Ancient Architecture: A Case Study of the Mogao Grottoes in Dunhuang

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Abstract: Ancient Silk Road heritage sites carry profound national cultural history, and their protection and development are crucial for cultural inheritance and the sustainable development of the local economy and society. This paper takes the Mogao Grottoes in Dunhuang as a case study to explore, in depth, the realistic characteristics and sustainable development paths between heritage protection and the high-quality integration of cultural tourism development under the guidance of the “Priority of Aesthetic Value” theory in the context of the digital economy.

Keywords: Mogao Grottoes; Digital empowerment; Cultural tourism integration; Priority of aesthetic value

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1. Introduction

The report of the 20th CPC National Congress pointed out that people should adhere to the principle of shaping tourism with culture and promoting culture with tourism, and promote the in-depth integration and development of culture and tourism^[1]. The Third Plenary Session of the 20th CPC Central Committee proposed that the tourism industry will promote the all-round development of people and the common prosperity of the spiritual level as the development goal of the new era. It should not only emphasize the economic attributes of tourism, but also emphasize the cultural connotation, improve the system and mechanism of the in-depth integration and development of culture and tourism, and empower tourism^[2]. In the digital economic environment, the integration of culture, tourism, and science and technology is an important support for cultural confidence and scientific and technological self-reliance, and has become an important engine for improving the efficiency of my country's

economic development under the background of “dual circulation.” Wang Xin believes that cultural relics and historical sites are important carriers of historical culture. In the current period of rapid economic development, how to balance the relationship between the two has become the most important research topic at this stage ^[3]. Gong Xin explored the contradiction between tourism development and cultural relics protection and proposed a sustainable development strategy ^[4]. Liu Yanlin analyzed the relationship between cultural relics protection and tourism development, and proposed an effective strategy for the coordinated and steady advancement of cultural relics protection and tourism development ^[5]. He Yixiong, Hao Lisha, and Li Rui proposed that the three-dimensional integration of tourism landscapes can be promoted by improving the quality of tangible landscapes, digging deep into and highlighting the cultural connotations of landscapes, and organizing in-depth experience activities, thereby achieving high-quality development of cultural heritage tourism ^[6]. In summary, with the vigorous rise of my country’s tourism industry, cultural tourism has become a popular choice for public travel. It not only enriches people’s spiritual life, but also greatly promotes the prosperity of the local economy. However, this trend has also brought unprecedented challenges to the protection of cultural relics and historical sites. How to effectively protect and inherit these precious cultural heritages while promoting the development of tourism has become an important issue that needs to be solved urgently.

From September 10 to 13, 2024, the General Secretary of the CCP pointed out during his inspection in Gansu that Gansu has a profound historical and cultural heritage and rich red cultural resources. People must inherit the red gene, strengthen the protection of cultural heritage, and support the Dunhuang Academy in building a model for the protection of world cultural heritage and a highland for Dunhuang studies. He also stressed the need to strengthen the protection of cultural heritage and enhance national pride and self-confidence ^[7]. Since ancient times, the Silk Road has had far-reaching and significant significance in the country’s history and culture. The route not only promoted exchanges and interactions between diverse cultures but also crossed the vast territory of the Eurasian continent, closely connecting diverse cultures and countries. The Silk Road is undoubtedly an important landmark project that connects different cultures and promotes global prosperity and exchanges. It fully demonstrates the profound heritage of world history and the rich connotation of diverse cultures. As a world cultural heritage and a famous tourist attraction in the Silk Road Economic Belt, Dunhuang Mogao Grottoes has achieved remarkable development in tourism in recent years, attracting a large number of domestic and foreign tourists to visit. As of August 12, 2024, the Mogao Grottoes have received more than 1.77 million tourists, an increase of 15.33% over last year, and the number of tourists received per day has reached the daily limit ^[8]. Under the current cultural relics protection strategy, the number of tourists received by the Mogao Grottoes is far from meeting the continuously growing number of tourists, but too many tourists will cause irreparable damage to the Mogao Grottoes’ cultural relics ^[9]. This article will take Mogao Grottoes as an example to explore how to create a tourism scene based on the value of ancient monuments and style, realize the high-quality integrated development of ancient monument protection and cultural tourism, and explore sustainable development strategies for the future development of cultural relics and historical sites tourism, under the premise of continuous increase in tourists and continuous strengthening of tourism economy.

2. Case study resource ontology analysis

2.1. Geographical location

Mogao Grottoes are located in northwest China, with geographical coordinates of 94° 48’ 34” E, 40° 2’33” N, about 25 kilometers southeast of Dunhuang City, Gansu Province. It is a group of grottoes carved at the foot of the

east side of Mingsha Mountain, extending more than 1,600 meters from north to south. The grottoes are built in layers, with up to five layers. The locations of the caves are staggered and varied in shape, and the overall layout is similar to a honeycomb structure.

2.2. Characteristic value

Mogao Grottoes are not only a treasure of Buddhist art, but also an important physical material for studying the history of ancient Chinese art, religion, and culture, providing rich materials for studying ancient society. The murals and sculptures in Mogao Grottoes show the development of art in different periods, and the structure and statues of the caves themselves also provide precious references for modern architectural art. The well-preserved multilingual documents in the caves not only enrich linguistic research and demonstrate the cultural exchanges along the Silk Road, but also include a large number of documents on farming, transportation, astronomy, medicine, and printing, providing important practical references for modern scientific research.

2.3. Development context of cultural and tourism integration

The development of Mogao Grottoes cultural tourism has gone through multiple stages, showing its trajectory of continuous innovation and improvement.

2.3.1. Initial stage

When the Mogao Grottoes were first opened to the public, their rich Buddhist culture and unique artistic value attracted many domestic and foreign tourists. However, the tourism facilities and services at that time were still weak, and the number of tourists was relatively limited.

2.3.2. Rapid development stage

The Dunhuang Mogao Grottoes Scenic Area Management Committee, established in 1992, laid a solid foundation for the integration and development of tourism resources. The infrastructure, such as hotels, catering, and transportation, has been gradually improved, and the quality of tourism services in the Mogao Grottoes has been significantly improved.

2.3.3. New development stage

Entering the 21st century, Mogao Grottoes tourism has opened a new chapter. The government has increased its investment in the cultural protection and tourism development of Mogao Grottoes, and the tourism environment has been further optimized. The concept of “Digital Dunhuang” was realized in 2016.

2.3.4. Innovation and improvement stage

In recent years, Mogao Grottoes has continued to innovate in tourism development, launching new tourism methods such as digital displays and online mini-programs. In 2024, Tencent launched the “Dunhuang” VR digital immersion exhibition, which perfectly combines digitalization and game engines with the cultural tourism industry. The exhibition not only uses 3D scanning and modeling technology to restore the 1:1 stereoscopic image of Cave 285 in Dunhuang to tourists, but also uses animation technology and visual effects in game design to dynamically process the mural stories, making the characters and scenes in the murals vivid, as if traveling through time and space to tell tourists a thousand-year story.

3. The connotation of cultural and tourism integration development under the theory of “style value priority” of ancient buildings

3.1. The connotation of the theory of “style value priority” of ancient buildings

The style value priority theory of ancient buildings is a protection concept that emphasizes the historical style, cultural value, and social significance of ancient buildings, and advocates that the appearance, structure, and characteristics of the historical period represented by these buildings should be given priority in the protection process. This concept is reflected in the following aspects in actual operation.

3.1.1. Protecting the historical style of ancient buildings

Mogao Grottoes carry profound cultural connotations. It is not only the crystallization of ancient Chinese architectural technology and art, but also the large number of ancient documents unearthed from it are important academic materials for studying ancient Chinese history, culture, religion, and other aspects. The rich cultural information contained in Mogao Grottoes is of irreplaceable importance for an in-depth understanding of ancient Chinese history, art, religion, and social life.

3.1.2. Guaranteeing cultural inheritance

Ancient buildings are both a manifestation of culture and a witness to history. As a physical witness to history, they record the history of trade, cultural exchanges, and multi-ethnic integration along the ancient Silk Road. By protecting ancient buildings, these precious historical memories can be preserved, so that future generations can intuitively understand the lifestyles and ideas of their predecessors.

3.1.3. Demonstrate social value

Ancient buildings are often closely related to the lives of local residents. Their existence helps to enhance the sense of community identity and promote the protection of cultural diversity. Mogao Grottoes stand here, witnessing hundreds of years of historical changes and becoming a link between the past and the present. In the process of protection, not only should the building itself be considered, but also its surrounding environment and social functions.

3.2. Characteristics of the integrated development of culture and tourism under the theory of “style value priority” of ancient buildings

Under the guidance of the concept of “style value priority”, the integrated development of culture and tourism not only focuses on the protection of the ancient buildings themselves, but also emphasizes their repositioning and functional expansion in contemporary society, and strives to maximize the social value of cultural heritage while maintaining the historical style.

3.2.1. Priority consideration of historical and cultural value

In the process of promoting the integration of cultural tourism, the historical and cultural significance of ancient buildings should be paid attention to first. In any tourism development activities, it is necessary to first ensure that the historical style and cultural characteristics of ancient buildings are not destroyed.

3.2.2. Combining protection and utilization

On the basis of protecting the original style, combined with the lifestyle of modern people, ancient buildings

are integrated into the process of urban development to give them a new lease of life. This concept of “bringing cultural relics to life” advocates making ancient buildings a part of modern society through reasonable protection and innovative utilization

3.2.3. Sustainable development model

In the protection and utilization of ancient buildings, sustainability is emphasized, and scientific planning and management are used to prevent the adverse effects of excessive commercialization, ensure the long-term healthy and stable development of ancient buildings and their surrounding environment, and pave the way for the utilization and inheritance of future generations.

3.2.4. Technological innovation and application

Combined with modern scientific and technological means, such as digital display, virtual reality (VR), and other new technologies, tourists are provided with an immersive cultural experience to increase the attractiveness and interactivity of ancient buildings. “Black Myth: Wukong”, a game based on “Journey to the West”, one of the four great masterpieces of China, cleverly combines traditional mythological elements with modern game design, opening up a new way to inherit culture. The game selected 36 scenic spots across the country as game scenes, 27 of which are representative ancient buildings in Shanxi Province. It uses advanced technologies such as high-quality graphics rendering and dynamic light and shadow effects to provide users with an immersive experience. This approach not only enhances the cultural heritage of the game, but also brings a lot of attention and tourists to the cultural and tourism attractions in reality. At the same time, the game has also made bold innovations and attempts in cultural inheritance, such as adapting some plots of the original “Journey to the West” to make the story more in line with the tastes of modern audiences. It not only respects and protects traditional culture but also actively introduces new elements and concepts, based on classical culture, to keep up with the pace of cultural trends in the current era.

3.2.5. Top-level design and overall planning

In the practice of cultural and tourism integration and development, there is a need for clear strategic planning and top-level design to ensure that various measures can be coordinated and jointly promote the protection and utilization of cultural heritage. Governments, enterprises, and all sectors of society should jointly participate in the protection and utilization of ancient buildings to form a “1+3+N” protection system. Among them, “1” represents cultural and tourism administrative departments at all levels. “3” represents intangible cultural heritage protection associations, intangible cultural heritage protection centers, and intangible cultural heritage museums at all levels, and “N” represents local cultural ecological protection areas, representative protection units, intangible cultural heritage workshops, etc. This collaborative model helps to pool the strengths of all parties and improve the efficiency of cultural heritage protection.

4. Current status and challenges of the integration of cultural tourism in Mogao Grottoes

4.1. Current achievements in tourism development and protection of Dunhuang Mogao Grottoes

Currently, the Dunhuang Mogao Grottoes have achieved remarkable results in tourism development and protection. By strictly following the relevant provisions of the “Operational Guidelines for the Implementation

of the World Heritage Convention” and the “Guidelines for the Protection of Chinese Cultural Relics and Historic Sites”, Mogao Grottoes has explored innovative tourism opening service models, and used scientific and technological means such as digital resources to create an online Mogao Grottoes, alleviating the contradiction between cultural relic protection and tourism opening. At the same time, measures such as zoning rotation and limiting the number of tourists have improved the tourist experience and reduced the pressure on the caves. Mogao Grottoes offers a variety of ticket types and visiting modes to ensure that the diverse needs of tourists are met. In terms of protection, the Dunhuang Research Institute has completed the repair of a large number of caves, established a protection center and a scientific research team, used digital technology to protect murals, and formed a scientific and complete protection system. These efforts have improved the quality and experience of tourists’ travel, while ensuring that the precious value of Mogao Grottoes, a world cultural heritage, can be passed on for a long time.

4.2. The contradiction between the increased attention paid to the protection of the Mogao Grottoes’ cultural heritage and tourism development

With the continuous advancement of cultural heritage research and practice, intangible cultural heritage tourism has also begun to attract the attention of the tourism industry. It is generally believed that intangible cultural heritage has great tourism development value, so the research on the protection and utilization of intangible cultural heritage has been intensified. However, some serious practical problems have arisen immediately, that is, as a sensitive and fragile resource, intangible cultural heritage will have irreversible, serious consequences once it is developed unreasonably. At present, people are in the stage of transformation of high-quality development of the tourism industry. Against the background of global informatization, the Mogao Grottoes have ushered in new development opportunities and faced new contradictions in development practice.

4.2.1. The contradiction between the small cave space, the fragile material of the murals, and the continuous strengthening of tourism opening

Although the Mogao Grottoes are large in scale, most of the caves are small in space. Each cave was a hall for worshipping Buddha and a place for Buddhist believers to worship throughout history. It does not have the conditions and functions for a museum opening. The caves are full of murals and cannot be transformed according to the requirements of museum exhibitions. According to statistics, among the 492 caves with murals and colored sculptures, there are only 18 large caves with an area of more than 100 square meters, 21 caves with an area of 50 to 100 square meters, 41 caves with an area of 25 to 50 square meters, 123 caves with an area of 10 to 25 square meters, and 289 caves with an area of less than 10 square meters. Among them, caves with an area of less than 25 square meters account for more than 83% of the total number of caves, so the caves can only carry a very limited number of tourists. The murals and colored sculptures in the caves are made of local wheat straw, soil, and wood. After more than a thousand years of destruction due to natural and human factors, the murals and colored sculptures have undergone various deterioration, such as alkali damage, peeling, and hollowing, to varying degrees. Excessive open use may pose a threat to the preservation of these cave murals and colored sculptures in small spaces, fragile materials, and many deterioration over years.

4.2.2. Excessive number of tourists causes excessive “fatigue” in the caves

If the number of tourists in each group of Mogao Grottoes is 25 people, and the number of tourists on that day is

2,000, then there are 80 groups of tourists. If the stay time of each group of tourists in a cave is 6 minutes, then the opening time of a cave is 480 minutes a day, which is more than 8 hours, making the open caves in a “fatigue” state for a long time. In the selection of open caves, people must consider the representativeness and appreciation of the cave content, era, and artistic style, as well as the acceptable capacity of the cave and the condition of the mural state. Although there are 492 caves with murals and colored sculptures in Mogao Grottoes, there are only 70 or 80 open caves that meet the above conditions. To protect the murals and avoid excessive use of the caves, people have to adopt the method of “rotating rest” for the open caves, but due to the unique content of some caves, they have never been able to “rest” since they were opened.

4.2.3. The increase in tourists breaks the constant micro-environment of the caves

The cultural heritage of Mogao Grottoes can be preserved thanks to the dry climate in the local area and the lack of major wars and natural disasters in history. Due to the limited number of people entering the caves in history, the caves have maintained a relatively constant micro-environment for a long time, which provides very good conditions for the preservation of murals and colored sculptures. However, excessive visits by tourists have broken the stable climate environment in the caves. Carbon dioxide stays in the caves for a long time, and the increase in air humidity and temperature in the caves will erode the murals and accelerate the development of damage. This will pose a serious potential threat to the preservation of the very fragile murals and colored sculptures in the caves.

4.2.4. The negative effects of the additional tourist facilities on the protection of the murals in the caves

The cave plank roads built in the 1960s have had problems in many places in recent years. The repair work will have a certain impact on the stability of the cliff of the caves. In order to prevent tourists from scratching the murals during the visit, glass screens are installed in the caves open for visits. After years of observation, if this glass screen is used improperly, it may not be conducive to the protection of the murals.

5. The path to achieve the integration of cultural tourism with the priority of the style and value of the Mogao Grottoes under the digital background

At present, relevant experts and scholars at home and abroad pay more attention to its development model in the process of studying and discussing the development of intangible cultural heritage tourism, and therefore put forward different forms of intangible cultural heritage tourism development models, such as festival tourism, theme parks, non-exhibition parks, etc. In terms of the attraction of tourist destinations to tourists, different cultural styles are themselves an important part of off-site tourism. As an important cultural heritage of tourist destinations, it is a symbol of urban culture, a reflection of urban image, a concentration of urban brand, and a heritage of urban context. Extracting the unique historical and cultural resources of tourist destinations, integrating the current status of various industrial development, reshaping the image and brand of tourist cities, and creating a strong tourist style atmosphere in tourist destinations are of great significance and role in the protection of heritage, the inheritance of culture and the high-quality development of tourism. In view of the fragility of the ancient monuments of Mogao Grottoes and the particularity of historical culture, people can take protection as the premise and develop a development model that combines historical culture with style tourism.

5.1. Continuous authentic tourism development

Authentic application means that for all levels of cultural relics and historical blocks, the original appearance and cultural style should be preserved according to their historical, scientific, and artistic values, following the principle of “not changing the original state of cultural relics and the original living conditions of residents”. It is applicable to historical buildings with special protection and key protection levels, and blocks with relatively intact overall historical appearance. Strengthen the protection of the authentic cultural heritage of ancient buildings and ancient blocks in the tourist cities of Mogao Grottoes, and preserve and display the local authentic folk culture. Under the premise of not threatening or damaging their external form, historical buildings can be reinforced and renovated to restore their original functions.

5.2. Strengthen the development of style tourism

For blocks with certain traditional characteristics of Mogao Grottoes, but which have been severely damaged and have no complete appearance, people can combine traditional architectural characteristics, explore the connotation of local traditional culture, find the “historical prototype” of spatial form, repair the damaged street texture, and strengthen the local historical and cultural characteristics. This is the style application. It is applicable to historical buildings with general protection levels and lower protection levels, as well as historical residential areas with relatively large scale and relatively similar macro-overall appearance. This application mode not only properly arranges and repairs the macro-style, but also modernizes the internal functions of the building, such as style hotels and edible museums. This type of historical block, due to its high population density, covers a wide range, which is in sharp contrast to the protection and utilization of the original type. Since the style protection and utilization involves a large scope, the focus of protection and utilization transformation is overall coordination and consistency, not only pursuing integrity in appearance, but also achieving harmony with historical and cultural connotations. Some buildings in the block that are not in harmony with the overall style should be demolished, and some newly built buildings and facilities should be consistent with the overall style of the block. Style blocks are not isolated cultural relics, but active spaces that resonate with the rhythm of modern life, so they have enduring vitality and attraction. In the surrounding environment of Mogao Grottoes, people can find several vivid examples. Dongyi Dunhuang Hotel is one of them. It is located in the center of the Dunhuang Cultural District, with a superior geographical location and convenient transportation. The hotel is designed with ingenuity, drawing on the essence of traditional Northwest dwellings and incorporating Dunhuang’s unique regional customs, creating an accommodation experience for guests that allows them to enjoy modern services while appreciating ancient culture. The lighting ceremony every night leads guests on a journey through time in Dunhuang culture. Similarly, as a characteristic block, the Dunhuang Night Market is full of the charm of Dunhuang culture and has been rated as a national nighttime cultural and tourism consumption hotspot. The buildings in the night market are modeled after the Tang Dynasty style and are embellished with Dunhuang’s unique cultural elements, creating a wonderful feeling for tourists as if they have traveled through time and space back to Dunhuang in the heyday of the Tang Dynasty. The functional divisions within the block are clear, including Shazhou Tower, Famous Food Square, Qinzhou Household Street, Fengqing City, and other characteristic areas, providing tourists with a variety of leisure and shopping options.

5.3. Integrated reproduction tourism development

Some special caves in Mogao Grottoes have been destroyed or cannot be opened to tourists for various reasons.

For this type, they can be replicated on the basis of fully exploring the empowerment of science and technology to achieve the reproduction of historical features and historical and cultural connotations. At present, in the functional transformation and protection and utilization practice of heritage tourism, the method of off-site collective protection has become common. This method is to reintegrate scattered and endangered relics to form an urban space with historical and cultural connotations in the form of a group. This spatial integration of historical elements is not just a simple combination relationship, but it should focus on the principle of temporal and spatial correlation between historical elements, establish the connection between historical elements in spatial structure and origin, and convey historical information and the sense of the times of historical environment to people.

5.4. Ultimately achieve innovative tourism development

Innovative application is a comprehensive and innovative application of the above three models. On the premise of combining historical prototypes, it is boldly innovative and explores new forms of historical and cultural expression, the regeneration of materialized environment and the inheritance of historical culture, and the interaction of both emphasis and interaction, and updates the intangible cultural heritage through new material forms and injects new vitality.

6. Future prospects

Driven by international cooperation initiatives such as the “Belt and Road Initiative”, the rich cultural heritage contained in the Mogao Grottoes is expected to be more widely disseminated and recognized worldwide. This trend will significantly enhance its international influence and attract more tourists from all over the world to visit and appreciate this important treasure of human civilization together. At the same time, with the increasing global attention paid to the concept of sustainable development, the future tourism development of Mogao Grottoes will also pay more attention to ecological balance and the sustainable protection of cultural heritage. People are well aware that only on the basis of ensuring the harmonious coexistence of tourism activities and cultural relics protection can the lasting inheritance and sustainable development of Mogao Grottoes culture be truly realized. Therefore, the future tourism development of Mogao Grottoes will uphold the concept of sustainable development and strive to achieve a win-win situation between cultural heritage protection and tourism development.

In addition, under the guidance of new quality productivity, Mogao Grottoes continues to incorporate innovative elements, such as digital display and virtual reality experience, bringing tourists more colorful and fascinating tourism content. The future development of the Mogao Grottoes cultural tourism shows unlimited potential and broad prospects. This positive outlook is largely due to the continuous progress of science and technology, especially the continuous innovation of digital technology and virtual reality technology. With the increasing advancement of digital technology and light and shadow technology, immersive experience is gradually evolving into an emerging paradigm in the tourism industry. By using virtual reality (VR) and augmented reality (AR) technology, tourists can more deeply integrate into the diversified historical and cultural scenes, thereby obtaining a richer and deeper tourism experience. These cutting-edge technologies provide new ideas for the future development of Mogao Grottoes and bring unprecedented development opportunities. It is clear that with the deep integration and widespread application of these high technologies, tourists will have the opportunity to enjoy a more realistic immersive visit experience. This experience can transcend the constraints of time and space, allowing more tourists to feel as if they are personally in the profound historical accumulation and colorful cultural

atmosphere of Mogao Grottoes.

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References

- [1] Wang Y, 2022, Adhere to The Principle of Using Culture to Shape Tourism and Using Tourism to Promote Culture, and Strive to Promote High-quality development of Cultural Tourism. <https://m.gmw.cn/baijia/2022-10/31/36125935.html>
- [2] Xinhuanet, 2024, Communiqué of the Third Plenary Session of the 20th Central Committee of the Communist Party of China. http://www.qstheory.cn/yaowen/2024-07/18/c_1130181295.htm
- [3] Wang X, 2021, Analysis of the Interaction between Cultural Relics Protection and Tourism Industry. *Western Tourism*, 2021(18): 13–15.
- [4] Gong X, 2009, Protection of Cultural Relics and Historical Sites and Tourism Development. *Regional Research and Development*, 28(6): 110–113.
- [5] Liu YL, 2020, On the Relationship between Cultural Relics Protection and Tourism Development. *Heilongjiang History and Records*, 2020(8): 53–55.
- [6] He YX, Hao LS, Li R, 2023, Analysis on the Characteristics of Cultural and Tourism Integration Development of Ancient Monuments and Cultural Tourism in Jiangsu Province: Based on the Perspective of Three-dimensional Fusion Measurement of Tourism Landscape. *Geography and Geo-Information Science*, 39(1): 136–144.
- [7] Xinhua News Agency, 2024, More Unity, More Efforts, and Striving to Promote Chinese-style Modernization: The General Secretary of the CCP’s Important Speech during his Inspection in Gansu and Baoji, Shaanxi, Encouraged the Broad Masses of Cadres and the People to Work Hard and Move Forward Courageously. https://www.gov.cn/yaowen/liebiao/202409/content_6974453.htm
- [8] Dunhuang Municipal Bureau of Culture, Sports, Radio, Film, Television, and Tourism, 2024, The Number of Tourists to Dunhuang Mogao Grottoes in a Single Day has Reached the Upper Limit! Cumulative Reception Exceeds 1.77 Million People. <https://mp.weixin.qq.com/s/pTH42SGL36IzBn-FAl1CTA>
- [9] Argenyo N, Demas M, Sullivan S, et al., 2024, Guidelines, Planning and Protection: Conservation Cooperation in Mogao Grottoes. *Dunhuang Studies*, 2024(4): 18–29. <https://doi.org/10.13584/j.cnki.issn1000-4106.2024.04.002>

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Analysis of the Impact of the Shaping of the Tanka Cultural Tourism Brand on the Tourism Economy

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Abstract: Tanka culture is an important part of Chinese traditional culture with a long history, containing rich historical elements and unique folk customs. With the rapid development of China's tourism industry, the shaping of the Tanka cultural tourism brand has become an important way to promote the development of the local tourism industry, increase residents' economic income, and facilitate the inheritance and development of ethnic culture. Therefore, this article briefly analyzes the impact of the shaping of the Tanka cultural tourism brand on the tourism economy, hoping to provide some valuable references for readers.

Keywords: Tanka culture; Tourism brand; Tourism economy

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1. Introduction

With the rapid development of China's tourism industry, as a unique tourism resource, the shaping of the Tanka cultural tourism brand has important practical significance. It can not only promote the development of the local tourism industry and increase the economic income of local residents, but also optimize the industrial structure and boost the development of the local tertiary industry. More importantly, it can inherit and promote Tanka culture, enhancing its popularity and influence^[1]. However, there are many problems in the process of shaping the Tanka cultural tourism brand, such as outdated marketing models and unclear brand characteristics. In response, it is necessary to combine the local actual situation and actively shape the Tanka cultural tourism brand through various means, creating a series of tourism products with local characteristics. This can promote regional economic development and further facilitate the inheritance and development of Tanka culture.

2. Overview of Tanka culture

2.1. Origin

Tanka culture originated from the southeast coastal areas of China. It is a distinctive regional culture gradually

formed by coastal fishermen during their long-term production and life. According to historical records, Tanka culture can be traced back to the Qin and Han dynasties. The Tanka people were originally called “Dan people”, and they were mainly engaged in offshore fishing and aquaculture^[2]. With the continuous development of the times, the Tanka people gradually developed unique cultures, languages, and customs. Nowadays, Tanka culture has become an important part of Chinese traditional culture.

2.2. Characteristics

Compared with other traditional cultures, Tanka culture has distinct features, being known for its marine nature, folk customs, and mobility. In terms of lifestyle, the Tanka people live on boats, with both work and daily life carried out on the water, leading a nomadic life at sea. This results in simple living environments and harsh living conditions. However, the Tanka people possess excellent living skills and are proficient in activities such as boating, fishing, aquaculture, and pearl-picking. In terms of culture, the Tanka people have unique cultural customs, such as worshipping Mazu, having sea weddings, performing fish-related songs and dances, and making Tanka cakes. These fully demonstrate the Tanka people’s longing for a better life and their reverence for the ocean^[3]. In addition, in terms of language, the Tanka people have a unique language system. This dialect integrates the characteristics of Minnan dialect, Cantonese, and Mandarin, forming a unique language system.

2.3. Current situation

With the continuous development of society and the acceleration of urbanization, Tanka culture faces severe challenges. On the one hand, traditional fishing methods have gradually been replaced by modern fishing technologies, leading to changes in the living environment and lifestyle of the Tanka people^[4]. On the other hand, with the rapid development of the tourism industry, the commercialization of Tanka culture has intensified, and its unique cultural flavor and ethnic customs have gradually faded. Therefore, in the new era, how to effectively protect, inherit, and innovate Tanka culture has become one of the urgent problems to be solved.

3. Analysis of the impact of the shaping of the Tanka cultural tourism brand on the tourism economy

The shaping of the Tanka cultural tourism brand has a significant impact on the tourism economy. This article briefly analyzes it from the following aspects^[5].

3.1. Promoting the development of the local tourism industry

Shaping the Tanka cultural tourism brand can effectively promote the development of the local tourism industry. By deeply exploring and integrating Tanka cultural resources, distinctive tourism products can be developed, attracting more and more tourists to visit the local area and thus promoting the development of the local tourism industry^[6]. At the same time, by shaping the Tanka cultural tourism brand, the popularity and influence of the tourism brand can be enhanced, which will also expand the tourism market to a certain extent. In addition, the continuous improvement of local infrastructure and service facilities can provide tourists with a unique cultural and travel experience, effectively promoting the development of the local tourism industry.

For example, a series of characteristic tourism products can be developed based on the characteristics of Tanka culture, such as offshore fishing-themed tours, pearl-farming sightseeing, and pearl-picking activities, allowing tourists to experience the work and life of the Tanka people firsthand and enrich their travel experience.

Various folk cultural activities, such as sea weddings and fish-related song-and-dance performances, can also be held to strengthen tourists' understanding and help them gain in-depth knowledge of Tanka culture. By adopting various methods to develop unique tourism products, not only can the local tourism forms be enriched, but also an interesting travel experience can be provided for tourists, enhancing their satisfaction and promoting the development of the local tourism industry ^[7].

3.2. Increasing the economic income of local residents

Shaping the Tanka cultural tourism brand can also effectively increase the economic income of local residents. On the one hand, the development of various characteristic tourism products can attract a large number of tourists, effectively driving the development of local industries such as catering, accommodation, and transportation ^[8]. On the other hand, through participating in the development of Tanka cultural tourism products, local residents have more diverse employment, entrepreneurship options, and ways to obtain economic income, thus effectively increasing their economic gains. For example, with the continuous shaping of the Tanka cultural brand, a large number of tourists come to experience Tanka-culture-themed tourism products. At this time, the local catering and accommodation industries also embrace new development opportunities. They can introduce Tanka-style cuisine for out-of-town tourists and offer offshore homestays with Tanka cultural characteristics. This can not only provide tourists with unique dining and accommodation experiences but also bring considerable economic income to local residents. Moreover, as Tanka-culture-themed tourism products become more and more abundant, the economic income of local residents will continue to increase ^[9].

3.3. Optimizing the regional industrial structure

Shaping the Tanka-culture-themed tourism brand can also optimize the regional industrial structure. On the one hand, Tanka culture originated in the southeast coastal areas of China, where the manufacturing industry has thrived since the reform and opening-up and has become an important part of China's economy. Actively shaping the Tanka-culture-themed tourism brand can promote the development of the local tertiary industry, effectively optimizing the industrial structure and facilitating the healthy and sustainable development of the local economy ^[10]. On the other hand, with the rapid development of the Tanka-culture-themed tourism industry, it can integrate with other industries to form a diversified industrial system, thus effectively enhancing the competitiveness of the regional economy. For example, as the Tanka-culture-themed tourism brand is shaped, its popularity and influence continue to increase, and more and more tourists come for sightseeing and consumption. This also brings new development opportunities for local retail, finance, and catering industries. At the same time, with the continuous expansion of the scale of the Tanka-culture-themed tourism industry, it can promote local industrial transformation, such as promoting the transformation and integrated development of traditional fisheries, aquaculture, and agriculture. For instance, local aquaculture can be integrated with the Tanka-culture-themed tourism industry to develop unique tourism products, such as pearl-picking and offshore fishing-themed tours. In this way, a diversified industrial system can be formed, optimizing the regional industrial structure and effectively enhancing the vitality and competitiveness of the regional economy.

3.4. Facilitating the inheritance and development of Tanka culture

Shaping the Tanka cultural tourism brand can also facilitate the inheritance and development of Tanka culture. On the one hand, by developing a series of Tanka-culture-themed tourism products, more and more tourists can

understand and experience Tanka culture, strengthening their understanding and continuously enhancing the social influence and popularity of Tanka culture ^[11]. On the other hand, by actively shaping the Tanka cultural tourism brand, the spread of Tanka culture can be enhanced, enabling more people to understand the current situation of Tanka culture and inspiring the public to protect and cherish it. For example, a series of ethnic-cultural activities, such as sea weddings, Tanka-culture festivals, and fish-song-and-dance competitions, can be organized to allow tourists to deeply experience the unique charm of Tanka culture and obtain a unique viewing experience. At the same time, tourists can also visit cultural facilities such as Tanka-culture museums and exhibition halls to comprehensively and detailedly understand the historical development of Tanka culture. In addition, in-depth cooperation with the education sector can be carried out, incorporating Tanka culture into the education system to cultivate more professionals who understand and love Tanka culture, better inheriting and promoting Tanka culture, and enabling it to find new development directions in modern society ^[12].

4. Strategies for shaping the Tanka cultural tourism brand

4.1. Strengthening brand planning and design to enhance the popularity of the tourism brand

To better shape the Tanka cultural tourism brand, strengthening brand planning and design is of great importance. Firstly, the positioning and market target of the Tanka cultural tourism brand should be clarified, which will help to establish the core value and main selling points of the brand. Secondly, a distinctive Tanka-culture-themed brand image and logo system should be designed, which can not only enhance the distinctiveness of the cultural brand but also increase its influence and popularity ^[13]. Finally, a comprehensive brand-communication and promotion plan should be developed, and brand information should be delivered to the target group through diversified channels, effectively enhancing the popularity of the Tanka-culture-themed brand.

In terms of brand planning and design, experience and inspiration can be drawn from numerous successful tourism-brand-shaping cases at home and abroad. Combining with the current situation of the Tanka cultural tourism brand and based on market demands, targeted optimization and innovation can be carried out. For example, when designing the brand logo, a distinctive logo can be created by skillfully integrating elements such as boats, pearls, and fishing nets from Tanka culture, ensuring that the logo of the Tanka cultural tourism brand is more recognizable.

4.2. Integrating multiple resources to create characteristic tourism products

Another key to shaping the Tanka cultural tourism brand is to leverage multiple forces and integrate multiple resources. On the one hand, cooperation and communication with the government, social institutions, enterprises, and society should be strengthened. By coordinating resources from all parties, a joint force can be formed to jointly promote the development of the Tanka-culture-themed tourism industry and create a characteristic Tanka-culture-themed tourism brand. On the other hand, Tanka-culture resources need to be integrated and deeply explored. According to the needs of the audience and combined with modern concepts, a series of tourism products that not only retain the charm of traditional Tanka culture but also conform to modern aesthetic concepts should be developed to better meet the diverse needs of tourists ^[14].

In terms of integrating multiple resources, a series of measures can be taken. Firstly, in-depth cooperation with the government should be carried out, strengthening communication. This can enable the government to have a deeper understanding of the development of the Tanka-culture-themed tourism industry and provide assistance

and support in terms of policies, funds, and talents, providing a strong guarantee for the shaping of the Tanka-culture-themed tourism brand. Secondly, in-depth cooperation with enterprises should also be carried out. By introducing social capital and advanced technologies, the development of the Tanka-culture-themed tourism industry can be effectively promoted. In addition, close cooperation with communities should be carried out. By mobilizing the enthusiasm of community residents, they can gradually become participants in the development of the Tanka-culture-themed tourism industry.

In terms of creating characteristic tourism products, while designing and planning around the traditional lifestyle, ethnic customs, and ethnic culture and traditions of the Tanka people, modern concepts should be integrated. This ensures that the products not only contain rich Tanka culture but also have modern aesthetic value and conform to modern people's aesthetic perception^[15]. For example, a series of tourism projects related to offshore life can be designed and planned, such as offshore fishing-themed tours, allowing tourists to deeply experience the daily life and work of the Tanka people and taste their characteristic cuisine, thus deepening their understanding and perception of Tanka culture. In addition, tourism projects that integrate sightseeing, pearl-picking, and food-tasting can be designed. Tourists can witness the pearl-farming process, experience the fun of pearl-picking, and taste the characteristic food of the Tanka people, greatly enriching their viewing experience and enabling them to feel the strong charm of Tanka culture.

4.3. Innovating the marketing model to expand the brand influence

The marketing model also has a significant impact on the shaping of the Tanka-culture-themed brand. Therefore, in the new era context, the marketing model should be actively innovated, and the brand influence should be expanded through various means. Specifically, on the one hand, modern new-media platforms and scientific technologies can be utilized to carry out online marketing activities, enhancing the popularity of the Tanka-culture-themed tourism brand. For example, promotional videos and pictures of Tanka-culture-themed tourism products can be posted on new-media platforms such as Bilibili, Douyin, and Kuaishou. In this way, more people can learn about Tanka culture and be inspired to visit. At the same time, advanced technologies such as artificial intelligence and big data can be used to conduct in-depth analysis of the audience group. Based on this, the target market can be accurately positioned, and targeted marketing strategies can be developed. On the other hand, communication and interaction with tourists should be strengthened. For example, online prize draws and Tanka-culture-related quiz competitions can be held to increase tourists' participation. The online communication module of new-media platforms can also be used to promptly answer tourists' questions, collect and collate their opinions, and continuously improve the quality of tourism products and services, thus more effectively expanding the brand influence.

4.4. Upholding the concept of sustainable development to create a new healthy economic ecology

Paying attention to sustainable development is one of the main goals of shaping the Tanka-culture-themed tourism brand. On the one hand, the concept of sustainable development should be adhered to. When shaping the Tanka-culture-themed tourism brand, the ecological environment and natural resources of the Tanka area should be protected. On the other hand, it should be closely integrated with other industries to build a diversified industrial system, enhancing the regional economic vitality and risk-resistance ability. Specifically, the following can be done.

Firstly, the concept of sustainable development should be firmly adhered to. For example, during the development of Tanka-culture-themed tourism resources, emphasis should be placed on protecting the local ecological environment and natural resources, avoiding damage and environmental pollution caused by over-development. At the same time, education and publicity work should be strengthened to continuously enhance the environmental awareness of local residents and tourists, enabling them to recognize their responsibilities and obligations and effectively protect the local ecological environment. Secondly, close integration with related industries should be strengthened. For example, while developing Tanka-culture-themed tourism products, they can be combined with the local accommodation industry, agriculture, and catering industry to develop tourism products with local characteristics. In addition, the Tanka-culture-themed tourism industry can be combined with emerging industries such as local sports, culture, and health to develop health-preserving tourism products. Through various measures, the development of the Tanka-culture-themed tourism industry can be promoted, laying a foundation for the sustainable development of the regional economy.

5. Conclusion

In conclusion, shaping the Tanka-culture-themed tourism brand has important practical significance. Various methods can be adopted, such as strengthening brand planning and design, integrating multiple resources, innovating the marketing model, and adhering to the concept of sustainable development, to shape a characteristic Tanka-culture-themed brand, promote regional economic development, and facilitate the inheritance and development of Tanka culture.

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References

- [1] Liang QY, Li YL, 2025, Research on the Development of Tanka Cultural Tourism in Tanka Town, Beihai City from the Perspective of Experiential Tourism. *Tourism Overview*, 2025(4): 184–186 + 190.
- [2] Li LD, Huang JQ, 2024, Analysis of the Impact of the Shaping of the Tanka Cultural Tourism Brand on the Tourism Economy. *Western Tourism*, 2024(19): 14–16.
- [3] Chen KE, Zhang YH, 2023, Research on the Protection and Development Strategies of Traditional Tanka Villages in Zhuhai: Taking Denglong Village, Doumen District, Zhuhai City as an Example. *Papers of Planners*, 2023(0): 542–550.
- [4] Zheng HM, Luo PH, Shen J, 2023, Hainan Lingshui Sets a New Benchmark for Cultural Tourism. *Consumer Daily*, October 23, 2023, A02.
- [5] Liu G, Xie RJ, 2023, Research on the Enlightenment of the Tourism Development of Luxiang Ancient Village to the

- Tourism Development of Tenghai Fishing Village. *Special Zone Economy*, 2023(7): 101–104.
- [6] Wu YR, 2023, Creation Report of the TV Documentary “Entering the Tanka Sea-Worship Ceremony”, thesis, Guangxi University.
 - [7] Liu JM, 2023, Research on the Integrated Development of Rural Cultural Creativity and Rural Tourism, thesis, Chongqing Three Gorges University.
 - [8] Yu J, Xie RJ, 2022, Analysis of the Tourism Development and Planning of Tenghai Fishing Village in Sanya. *Special Zone Economy*, 2022(6): 135–138.
 - [9] Tan ZH, 2021, Dongguan Shatian: Rural Culture Comes Alive and Tourism Booms. *China Culture Daily*, December 24, 2021, 3.
 - [10] Pan CY, 2021, Research on the Inheritance and Innovation of the Festival Customs Culture of Beihai Overseas Chinese Tanka from the Perspective of Cultural and Tourism Integration. *Modern and Ancient Literature and Creation*, 2021(46): 66–70.
 - [11] Zhang JQ, Feng Y, Huang XB, et al., 2021, Research on the Inheritance of Hainan Tanka Traditional Culture and the Enhancement of Tourism Attraction. *Science-Technology and Industry*, 21(11): 117–122.
 - [12] Chen N, Su PH, Zhou T, 2021, Inheritance and Innovation of Folk Culture under the Background of the Integration of Culture and Tourism. *Yanhuang Geography*, 2021(4): 83–87.
 - [13] Li HL, 2020, Research on the Protection, Development and Utilization of Shatian Tanka Culture from the Perspective of Cultural Landscape, thesis, South China Agricultural University.
 - [14] Chen LX, 2020, Research on the Development of Beihai Tanka Folk Culture Tourism. *Time-honored Brand Marketing*, 2020(4): 1–2.
 - [15] Wu QJ, 2020, Analysis of the Value of Beihai Tanka Saltwater Songs in Guangxi and Their Translation Benefits. *Comparative Study on Cultural Innovation*, 4(8): 41–42.

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Research on the Prospect and Significance of China's Scientific and Technological Innovation from the Perspective of New-quality Productivity

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Abstract: This paper deeply explores the prospects and significance of China's scientific and technological innovation from the perspective of new-quality productivity. By analyzing the connotation, characteristics, and formation factors of new-quality productivity, this paper expounds its close connection with scientific and technological innovation. Combined with the current situation of China's scientific and technological innovation, the study analyzes the opportunities and challenges faced by China under the development trend of new-quality productivity and looks forward to the future prospects. At the same time, it elaborates on the important significance of scientific and technological innovation for China in terms of economic development, industrial upgrading, and enhancement of international competitiveness, aiming to provide theoretical support and decision-making references for better promoting scientific and technological innovation in the era of new-quality productivity.

Keywords: New-quality productivity; Scientific and technological innovation; Industrial upgrading; Economic development

Online publication: June 13, 2025

1. Introduction

The president of the CCP pointed out that new-quality productivity is an advanced form of productivity led by innovation, breaking away from traditional economic growth modes and productivity development paths, featuring high technology, high efficiency, and high quality, and conforming to the new development philosophy. With the continuous development of science and technology and the deep integration of the global economy, new-quality productivity has become a crucial force for transformation and upgrading across all sectors of society^[1]. For new-quality productivity, technological empowerment is its core driving factor. Therefore, it is imperative and timely to deeply study the prospects and significance of China's scientific and technological innovation from the perspective of new-quality productivity^[2].

2. Connotation and characteristics of new-quality productivity

2.1. Connotation of new-quality productivity

New-quality productivity is an advanced form of productivity with innovation at its core, where innovation is its unique symbol, and quality excellence is its core philosophy. Different from past modes of productivity development and economic growth, it is characterized by high efficiency, high technology, and high quality, in line with the new development philosophy. Its proposal represents the Chinese practice and innovation of Marxist productivity theory, reflecting the fundamental achievements of scientific and technological innovation and interdisciplinary integration. The basic connotation of new-quality productivity lies in the leapfrog development of labor tools, personnel, objects, and their optimized combination, pursuing the full improvement of total factor productivity, and embodying modern high-level productivity ^[3].

2.2. Characteristics of new-quality productivity

New-quality productivity is characterized by high technology, high efficiency, and high quality. High technology serves as the foundation, manifested in the application of modern science and technology to the production process—such as breakthroughs in artificial intelligence, quantum information, biotechnology, and new energy technologies—that provide new products and services to society. High efficiency means improving production efficiency, such as using new technologies and equipment to transform or replace outdated ones, substituting low-efficiency technologies or equipment with high-efficiency ones to produce the same or more products or services of higher quality. High quality refers to improving the quality of products and services. Driven by new-quality productivity, the ultimate pursuit of enterprises is to provide high-quality products or services to various end customers, especially consumers. It is this customer-demand-oriented new-quality productivity that brings market value-added and competitive advantages to enterprises' products and services ^[4].

3. Factors forming new-quality productivity

3.1. Leading role of scientific and technological innovation

Scientific and technological innovation plays a leading role in the formation of new-quality productivity. Innovation has taken different forms and characteristics in different eras, with unprecedented features in the current era. From institutional, ideological, and management innovation to technological and cultural innovation, these interwoven forces jointly drive the development of new-quality productivity ^[5]. For example, the innovative application of 5G communication technology in the information technology field has not only changed the speed and mode of information transmission but also spawned numerous new industries and business models, such as smart IoT, telemedicine, and industrial internet, greatly promoting the development of new-quality productivity.

3.2. Synergistic effect of multi-field innovation

Since the 21st century, global scientific and technological innovation has entered an unprecedentedly intensive and active period, with remarkable activity in innovation across fields such as next-generation information technology, life sciences, advanced manufacturing technology, energy technology, and space and marine technology. The innovative achievements in these fields integrate and reinforce each other, forming a powerful synergistic effect that drives the formation and development of new-quality productivity ^[6]. For instance, the combination of gene editing technology in life sciences with advanced manufacturing technology has brought new development opportunities to the biopharmaceutical industry. Through precise gene editing and efficient manufacturing

processes, more effective drugs can be developed to improve medical standards.

3.3. Extensive application of innovation achievements

Innovation achievements across various industries and fields are continuously and widely applied to all aspects of production and life. Never before have humans fully utilized and enjoyed innovation achievements as they do today. The application of more and more innovative achievements in practical production not only improves production efficiency and quality but also creates new market demands, drives industrial upgrading and development, and further promotes the formation of new-quality productivity^[7]. Take new energy vehicles as an example: the application of innovative technologies such as battery technology and autonomous driving has gradually replaced traditional fuel-powered vehicles, becoming a new direction for the automotive industry and driving the development of related industrial chains to form a new productivity paradigm.

4. Current status of China's scientific and technological innovation

4.1. Increasing investment in science and technology

Currently, China attaches great importance to technological development and has gradually increased its investment in this field. Additionally, the introduction of relevant policies has paved the way for enterprises' scientific and technological innovation. Against this backdrop, enterprises' enthusiasm for scientific and technological innovation is continuously increasing. Meanwhile, substantial financial and policy support has provided a solid material foundation for scientific and technological innovation, effectively driving the reform and innovation of scientific equipment and technologies^[8].

4.2. Remarkable scientific and technological achievements

China has achieved remarkable results in many scientific and technological fields. In aerospace, the Chang'e lunar exploration missions and the Tianwen-1 Mars mission have made significant breakthroughs, bringing China into the world's advanced ranks in deep-space exploration. In 5G communication, China's 5G technology leads the world, with the largest number of 5G base stations and users globally, driving the rapid development of the digital economy. In high-speed rail technology, China's high-speed rail has become a shining national brand with its speed, safety, and comfort, leading the world in both technical standards and operational mileage. These scientific and technological achievements have not only enhanced China's international influence but also provided strong support for the development of new-quality productivity^[9].

4.3. Enhanced vitality of innovation entities

The vitality of innovation entities such as enterprises, universities, and research institutions has continuously increased. As the main body of innovation, enterprises pay more attention to research and development (R&D) investment and actively carry out technological innovation activities, with many making important progress in tackling key core technologies. Universities and research institutions play a crucial role in basic research and cutting-edge technology research, deepening industry-university-research cooperation with enterprises to accelerate the transformation and application of scientific and technological achievements. At the same time, the government has encouraged collaborative innovation among innovation entities through a series of policy measures, creating a favorable innovation ecosystem.

5. Opportunities and challenges for China's scientific and technological innovation from the perspective of new-quality productivity

5.1. Opportunities

First, with the launch of a new round of global scientific and technological revolution, digital and intelligent technologies are developing at a fast pace. Against this backdrop, people should actively participate in international scientific and technological competition and cooperation, introducing corresponding technologies and learning from other countries' experiences while focusing on independent technological innovation, especially breakthroughs in emerging technologies. Based on this, people should cultivate growth points in related technological industries to promote the development of new-quality productivity through dual-driven technological and industrial approaches^[10]. For example, leveraging China's vast artificial intelligence (AI) application scenarios and data resources, international cooperation can be pursued to seek new breakthroughs in AI. Second, the development of the domestic market brings enormous opportunities for scientific and technological innovation and new productivity. Currently, people have greater demands for high-quality services and products. Against this backdrop, relevant enterprises can provide more advanced and modern products and services to achieve their own innovative development while offering more products and services for the development of new-quality productivity, thereby accelerating the pace of technological, service, and product innovation. For instance, the furniture industry can actively explore the track of digital intelligence development to develop smart home products, injecting technological innovation vitality into industry revitalization.

5.2. Challenges

First, key technologies need further breakthroughs. Although China has made continuous technological breakthroughs in recent years, it still faces acute "bottleneck" problems in some key technologies, particularly in operating systems and high-end chip manufacturing. These issues have become increasingly prominent, directly affecting the development of China's technology and related industries and posing certain risks to national economic security^[11]. Therefore, scientific and technological innovation in the new era must focus on key fields to solve these bottlenecks and boost the development of new-quality productivity. Second, there is a shortage of high-quality talent. As is well known, talent is a key driver of scientific and technological innovation. However, China currently has a large gap in high-end technological talent, especially in emerging technologies. How to better support scientific and technological talent development has become a prominent issue in our current development.

6. Prospects for China's scientific and technological innovation from the perspective of new-quality productivity

6.1. Prosperous development of emerging industries

The development of new-quality productivity will further drive the reshaping and optimization of industrial structures, with a group of new industries such as quantum information, new energy, and artificial intelligence entering an unprecedented strategic opportunity period. Take the new energy industry as an example: with the advancement of the times, the global demand for green energy technologies is increasing, and accelerating the development of related technologies in this field is fundamental to reducing resource consumption and achieving sustainable economic development^[12]. At the same time, AI-driven emerging industries will bring disruptive impacts to various sectors, triggering an AI innovation wave, and related industries will complete their innovative development under AI leadership.

6.2. Accelerated industrial upgrading

Scientific and technological innovation is a crucial prerequisite and driving force for industrial transformation and upgrading. In the past, industries lacked technological infusion, but with the development and innovation of advanced technologies and products such as digital intelligence, various industries will undergo a process of integration and reshaping, forming new industrial chains and clusters, and achieving better development and upgrading. Moreover, based on high starting points and high-level development, they will move toward more advanced directions. For example, the introduction of AI and big data models in manufacturing can successfully complete the digital and intelligent transformation of manufacturing, thereby improving management, production, and product quality levels.

6.3. New competition patterns under international cooperation

China now holds more and more voice in international scientific and technological cooperation and competition. On the one hand, people actively participate in international scientific and technological innovation and governance and carry out various forms of cooperation and exchanges with other countries, which significantly promotes the development of scientific and technological achievements and the exchange of scientific knowledge. On the other hand, with China's significant progress in scientific and technological innovation in certain key fields, a new international scientific and technological competition pattern is gradually taking shape. This new pattern is more credible and inclusive, demonstrating China's contributions to the global scientific and technological innovation stage and thus playing an important role in global scientific and technological innovation in the new era.

7. Significance of China's scientific and technological innovation from the perspective of new-quality productivity

7.1. Promoting high-quality economic development

Scientific and technological innovation can empower the development of new-quality productivity, improve social production efficiency, and accelerate economic development through rational resource allocation. With the characteristics of high quality, high efficiency, and high technology, new-quality productivity can renew industries, assist in their upgrading and transformation, and improve the quality and value-added of products and services, thus providing sustainable momentum for enterprises. For example, in emerging industries, scientific and technological innovation will ensure the quality of related products and services, helping to achieve high-quality economic development ^[13].

7.2. Enhancing industrial competitiveness

Scientific and technological innovation continuously drives the upgrading of social industries to high-end levels, producing positive effects on enhancing industrial competitiveness. Under the influence of new-quality productivity with new production methods, technological innovation and management innovation help enterprises reduce operating costs, increase the value of products or services, and gain competitive advantages. Additionally, scientific and technological innovation promotes the development of new business formats and models ^[14]. For instance, guided by science and technology, the new energy vehicle industry has gradually expanded its development space, and breakthroughs in areas such as autonomous driving and battery capacity have greatly assisted enterprises in this field, significantly enhancing industrial competitiveness.

7.3. Safeguarding national security and strategic interests

With the increasingly complex international situation, scientific and technological innovation remains a core element in safeguarding national security and strategic interests^[15]. For example, in critical industries such as semiconductors, only by strengthening independent innovation can people break through bottlenecks; relying on foreign technologies would leave people completely vulnerable to others. The gradual replacement of foreign-related products with a new generation of domestically developed and controllable chips has significantly reduced the dependence on foreign technologies, undoubtedly ensuring national information security and avoiding impacts on the country's strategic interests.

7.4. Meeting people's needs for a better life

The essential purpose of scientific and technological innovation is to meet people's needs and promote better survival and living conditions. In the medical and health field, for example, scientific and technological innovation can help make new breakthroughs in medical technology and careers, thereby solving more difficult medical problems and safeguarding public health. In the education field, technological development has also provided new opportunities for educational reforms at all stages, particularly the application of big data and AI technologies, which have greatly assisted students' learning and growth, promoted educational equity, and satisfied people's needs for education.

8. Conclusion

In summary, under the background of new-quality productivity, China's scientific and technological innovation faces new opportunities and challenges. Overall, the prospects for China's scientific and technological innovation are very broad, especially with the drive of scientific and technological innovation, the gradual formation of new industrial structures, the accelerated trend of industrial upgrading, and the gradual shaping of international cooperation and competition patterns. China should increase investment in science and technology, deeply cultivate key technological fields, and cultivate more high-quality scientific and technological innovation talents, thereby leveraging their important role in promoting the development of new-quality productivity, contributing to the healthy development of the social economy, and gaining strategic initiative in international competition.

Disclosure statement

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References

- [1] Chen LQ, Hu ZH, 2025, Scientific and Technological Innovation-Driven Development of New-quality Productivity: Internal Logic, Mechanism, and Implementation Path. *Pioneering With Science & Technology Monthly*, 38(3): 168–177.
- [2] Fan CL, 2025, Prospects of China's Scientific and Technological Innovation from the Perspective of New-quality Productivity and Its Significance for Global Development. *Contemporary China and the World*, 2025(1): 65–78.
- [3] Yan HY, Cao P, 2025, Logical Correlation, Realistic Foundation, and Practical Approach of Developing New-quality Productivity Driven by Scientific and Technological Innovation. *Journal of Mianyang Teachers' College*, 44(3): 18–

25 + 45.

- [4] Zhao KS, 2025, Analysis of R&D Investment Strategies with Scientific and Technological Innovation as the Core under the Background of Developing New-quality Productivity. *Industrial Innovation Research*, 2025(5): 60–62.
- [5] Wei B, 2025, Twin-Drive Growth of New-quality Productivity in Special Equipment Industry through Coordination of Scientific and Technological Innovation and Standard Setting. *Standard Science*, 2025(3): 11–15.
- [6] Tan XF, Yin GF, 2025, Scientific and Technological Innovation, Development of New-quality Productivity, and Construction of Modern Industrial Systems. *New Horizons*, 2025(1): 66–75.
- [7] Huang WD, 2025, The Emerging Logic, Realistic Dilemmas, and Promotion Paths of New-quality Productivity Empowering Scientific and Technological Innovation. *Journal of Shihezi University (Philosophy and Social Sciences)*, 39(1): 9–15.
- [8] Yang T, Zhang TY, Liu R, 2025, Practice of Scientific and Technological Innovation Ecosystem System in Power Grid Enterprises Based on New-quality Productivity. *Popular Standardization*, 2025(4): 52–54.
- [9] Wang LL, Li PY, Cao TT, et al., 2025, Research on Strategies for Scientific and Technological Innovation-Driven Development of New-quality Productivity in Suzhou Textile Industry. *Textile Reports*, 44(2): 36–38.
- [10] Guo JH, 2025, Strengthening the Guidance of Scientific and Technological Innovation to Empower the Leapfrog Development of New-quality Productivity. *China Economic Times*, February 27, 2025, 1. <https://doi.org/10.28427/n.cnki.njjsb.2025.000102>
- [11] Wang DF, 2025, Case Study on Scientific and Technological Innovation Leading the Development of New-quality Productivity in Langfang. *Science and Technology & Innovation*, 2025(3): 190–192 + 196.
- [12] Zhang ZY, 2025, Research on the Path of Cultivating Scientific and Technological Innovation Talents in Universities from the Perspective of New-quality Productivity. *Popular Literature and Art*, 2025(3): 171–173.
- [13] Li WH, Qian LP, Wang LX, 2025, Research on the Coupling Coordination Effect and Influencing Factors of Digital Economy and Scientific and Technological Innovation from the Perspective of New-quality Productivity. *China Science & Technology Resources Review*, 57(1): 30–43.
- [14] Li R, 2025, Strengthening Scientific and Technological Innovation in National High-Tech Zones to Accelerate the Cultivation and Development of New-quality Productivity. *Science and Technology in China*, 2025(1): 82–90.
- [15] Wang ZX, Wang ZY, 2025, Research on the Internal Relationship and Interaction Mechanism between New-quality Productivity and Scientific and Technological Innovation. *China Management Informationization*, 28(2): 172–174.

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Review on the Influence of Humic Acid on the Migration of Ferrihydrite Nanoparticles and Their Arsenic Adsorption

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Abstract: With the accelerated development of industrialization and urbanization, environmental pollution problems have become increasingly severe. In particular, heavy metal pollution has become a global hotspot. As a common iron oxide nanoparticle in soil, ferrihydrite has a significant impact on the adsorption and migration behavior of heavy metals. Humic acid is the main component of soil organic matter; its interaction mechanism with ferrihydrite nanoparticles and its influence on heavy metal adsorption remain incompletely understood. This article reviews the interaction mechanism between humic acid and ferrihydrite nanoparticles, explores the impact of humic acid on the migration behavior of ferrihydrite, and elaborates on the adsorption behavior of arsenic by the humic acid-ferrihydrite system, including changes in the adsorption mechanism, competition and synergy effects, and the influence of environmental parameters, aiming to provide scientific basis and technical support for environmental pollution control.

Keywords: Humic acid; Ferrihydrite nanoparticles; Adsorption influence; Arsenic

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1. Introduction

Arsenic (As), a metalloid element with strong toxicity and carcinogenicity, its pollution in water and soil has posed a serious threat to the global ecological environment and human health. Ferrihydrite is considered an efficient natural adsorbent for fixing arsenic in the environment due to its high specific surface area and abundant surface active sites. However, the migration ability of ferrihydrite nanoparticles (Fh NPs) in the environment and their adsorption behavior towards arsenic are significantly affected by natural organic matter (such as humic acid, HA). Humic acid can change the dispersibility, surface properties, and reactivity of ferrihydrite through mechanisms such as surface complexation, electrostatic stabilization, and steric hindrance, thereby regulating the environmental fate of arsenic ^[1]. Currently, there is still a lack of systematic understanding of the interaction mechanism and

environmental effects of the humic acid-ferrihydrite-arsenic ternary system. This article reviews the influence of humic acid on the migration behavior of ferrihydrite and its arsenic-adsorption performance, explores its application potential and risks in pollution remediation, and looks ahead to future research directions, with the aim of providing a theoretical basis for the development of arsenic-pollution control technologies.

2. Interaction mechanism between humic acid and ferrihydrite nanoparticles

Ferrihydrite is a nanoscale iron oxide widely present in the natural environment. Due to its high specific surface area and abundant surface hydroxyl sites, it has a strong adsorption capacity for heavy metals such as arsenic (As). However, the migration and adsorption behavior of ferrihydrite nanoparticles (Fh NPs) in the environment are significantly affected by natural organic matter (such as Humic Acid, HA). As the main component of humus, humic acid can interact with ferrihydrite nanoparticles through mechanisms such as surface complexation, electrostatic stabilization, and steric hindrance, thus affecting their environmental behavior and arsenic-adsorption performance. This section will systematically review the interaction mechanism between humic acid and ferrihydrite nanoparticles from these three aspects.

2.1. Surface complexation reaction

The surface complexation reaction between humic acid and ferrihydrite nanoparticles is one of the core mechanisms of their interaction. Humic acid molecules contain abundant functional groups such as carboxyl groups (-COOH), phenolic hydroxyl groups (-OH), and carbonyl groups (C=O). These functional groups can undergo ligand-exchange reactions with the Fe-OH groups on the surface of ferrihydrite to form stable surface complexes. Research shows that humic acid mainly binds to iron oxides through monodentate or bidentate coordination modes. The carboxyl group tends to form monodentate coordination under low-pH conditions, while it may form bidentate or tridentate coordination structures under neutral to alkaline conditions ^[2].

The surface complexation reaction not only changes the surface chemical properties of ferrihydrite but also affects its aggregation state and stability. For example, the adsorption of humic acid will cover the active sites on the surface of ferrihydrite, reducing direct contact between particles and thus inhibiting their aggregation. In addition, the complexation of humic acid may also change the crystal structure of ferrihydrite, promoting its transformation into more stable iron oxides (such as hematite or goethite) ^[3]. This transformation process will further affect the arsenic-adsorption ability of ferrihydrite, as iron oxides with different crystal forms have significantly different affinities for arsenic.

In terms of arsenic adsorption, the surface complexation of humic acid may affect the performance of ferrihydrite through two pathways: one is competitive adsorption, that is, the functional groups of humic acid compete with arsenate (AsO_4^{3-}) or arsenite (AsO_3^{3-}) for surface sites; the other is an indirect effect, that is, humic acid changes the surface charge or aggregation state of ferrihydrite, thereby affecting the adsorption kinetics of arsenic. For example, some studies have found that low-concentration humic acid can promote arsenic adsorption by increasing the negative surface charge of ferrihydrite, while high-concentration humic acid significantly inhibits arsenic fixation due to site competition ^[4].

2.2. Electrostatic stabilization effect

The electrostatic stabilization effect of humic acid on ferrihydrite nanoparticles is a key factor affecting their

migration behavior. Ferrihydrite usually has a positive charge in natural water bodies ($\text{pH} < \text{pH}_{\text{pzc}}$, and the point of zero charge is approximately $\text{pH} 8.0$), while humic acid has a negative charge under most environmental pH conditions due to its rich carboxyl and phenolic hydroxyl groups. When humic acid adsorbs onto the surface of ferrihydrite, it will significantly change its surface charge characteristics, and even cause charge reversal (from positive to negative), thus enhancing the electrostatic repulsion between particles ^[5].

The strength of the electrostatic stabilization effect depends on the coverage of humic acid and environmental conditions (such as pH and ionic strength). Under low-ionic-strength conditions, the adsorption of humic acid can form a relatively thick electric double layer on the surface of ferrihydrite, effectively inhibiting particle aggregation; while in high-ionic-strength solutions (such as those containing Ca^{2+} or Na^{+}), the electric double layer is compressed, the electrostatic stabilization effect is weakened, and particles are more likely to aggregate and precipitate ^[6]. In addition, changes in pH also affect the surface charges of humic acid and ferrihydrite: under acidic conditions, the carboxyl groups of humic acid are highly protonated, the negative charge is reduced, and the electrostatic stabilization effect is decreased; while under alkaline conditions, humic acid is completely dissociated, and the positive charge on the surface of ferrihydrite is reduced, both of which are conducive to particle dispersion.

The indirect influence of the electrostatic stabilization effect on arsenic adsorption is mainly reflected in the migration-adsorption coupling process. For example, when the electrostatic stabilization effect is enhanced, ferrihydrite nanoparticles can remain suspended in water for a long time, increasing the chance of contact with arsenic and thus improving the overall adsorption efficiency; conversely, particle aggregation and sedimentation will reduce the effective adsorption sites. In addition, charge reversal may change the adsorption mechanism of arsenic: the negatively charged humic-acid-ferrihydrite complex may adsorb arsenate through a cation bridge (such as Ca^{2+}) rather than direct surface complexation ^[7].

2.3. Steric hindrance effect

In addition to electrostatic stabilization, humic acid can also inhibit the aggregation of ferrihydrite nanoparticles through the steric-hindrance effect. Humic acid is a high-molecular-weight organic matter (usually 1–10 kDa). After its molecular chains adsorb onto the surface of ferrihydrite, they can extend into the solution, forming a three-dimensional barrier that prevents close-range contact between particles ^[8]. This effect is particularly significant at higher humic-acid concentrations and is not significantly affected by the ionic strength of the solution. Therefore, it can still maintain particle stability in high-salt environments.

The strength of the steric hindrance is closely related to the molecular conformation of humic acid. For example, linear-structured humic-acid molecules can form a thicker adsorption layer, providing a stronger steric-hindrance effect, while curled-conformation molecules may reduce the protective effect ^[9]. In addition, the hydrophobic segments of humic acid may further strengthen the structure of the adsorption layer through hydrophobic interactions, enhancing spatial stability.

The influence of the steric-hindrance effect on arsenic adsorption is mainly reflected in the following aspects. First, the stable dispersion state enables ferrihydrite nanoparticles to maintain a high specific surface area and prolongs their contact time with arsenic; second, the adsorption layer of humic acid may hinder the diffusion of arsenic to the active sites on the surface of ferrihydrite, reducing the adsorption rate ^[10]. It is worth noting that the steric-hindrance and electrostatic-stabilization effects often work in synergy, but under high-salt or extreme- pH conditions, the steric-hindrance effect may become the dominant mechanism.

3. Influence of humic acid on the migration behavior of ferrihydrite

3.1. Analysis of influencing factors

The influence of humic acid on the migration behavior of ferrihydrite is regulated by multiple environmental factors, mainly including humic-acid concentration, solution chemical conditions (pH, ionic strength, ion type), and medium properties (pore structure, flow rate).

3.1.1. Humic-acid concentration

The concentration of humic acid is a key factor determining the strength of its interaction with ferrihydrite. Low-concentration humic acid (<10mg/L) usually promotes particle dispersion and migration by partially covering the surface of ferrihydrite and reducing its isoelectric point (pHpzc), thus enhancing electrostatic repulsion^[11]. However, when the humic-acid concentration is too high (>50 mg/L), a “bridging effect” may be triggered, that is, one humic-acid molecule adsorbs onto multiple ferrihydrite particles at the same time, causing the formation of organic-inorganic aggregates between particles and instead inhibiting migration^[12]. In addition, high-concentration humic acid may also occupy the active sites on the surface of ferrihydrite through competitive adsorption, reducing its interaction with the medium (such as soil minerals), thereby indirectly enhancing its mobility.

3.1.2. Solution chemical conditions

pH and ionic strength significantly affect the stability of the humic-acid-ferrihydrite complex. Under acidic conditions (pH < 5), the surface of ferrihydrite is positively charged, and the carboxyl groups of humic acid are highly protonated with fewer negative charges. The two mainly bind through hydrogen bonds or hydrophobic interactions, and the migration ability is low; in the neutral to alkaline range (pH 7–9), humic acid is completely dissociated, the electrostatic attraction to ferrihydrite is enhanced, and at the same time, the negative charge on the particle surface increases, and the migration ability is significantly improved^[13]. The influence of ionic strength shows a “double-edged-sword” effect: under low-ionic-strength conditions (such as distilled water), the electric double layer is thick, and the particle stability is high; while high-ionic-strength (such as containing Ca²⁺) will compress the electric double layer, weaken the electrostatic repulsion, but divalent cations (such as Ca²⁺) may connect humic acid and ferrihydrite through “cation bridges” to form larger aggregates^[14].

3.1.3. Medium properties

The pore structure and mineral composition of porous media (such as soil or sediment) directly affect the migration path of the ferrihydrite-humic-acid complex. For example, clay minerals (such as kaolinite and montmorillonite) can capture negatively charged complexes through electrostatic attraction, while inert media such as quartz sand have less hindrance to migration. In addition, the flow rate of the media also plays an important role: under high-flow-rate conditions, the hydrodynamic force can overcome the adsorption potential barrier between particles and the media, promoting migration; while under static or low-flow-rate conditions, particles are more likely to deposit or adsorb onto the surface of the media.

3.2. Migration models

To quantify the influence of humic acid on the migration behavior of ferrihydrite, researchers have developed a variety of theoretical models, mainly including the classical colloid filtration theory (CFT), the DLVO theory and its extended models, and emerging prediction methods based on machine learning.

3.2.1. Classical colloid filtration theory (CFT)

The CFT model regards the migration of ferrihydrite nanoparticles as an adsorption-desorption equilibrium process in porous media. Its core equation is:

$$\frac{C}{C_0} = \exp(-\lambda L)$$

Where C/C_0 is the breakthrough rate, λ is the filtration coefficient, and L is the migration distance. The addition of humic acid can affect the value of λ by changing the attachment efficiency (α): after humic acid covers the surface of ferrihydrite, α decreases, resulting in a decrease in λ and an increase in the migration distance. However, the CFT model does not consider the steric hindrance of humic acid or the kinetic adsorption process, so its prediction ability is limited in complex systems.

3.2.2. Extended DLVO model

The DLVO (Derjaguin-Landau-Verwey-Overbeek) theory predicts the aggregation-dispersion behavior by calculating the total interaction energy between particles ($V_{\text{total}} = V_{\text{electrostatic}} + V_{\text{vander Waals}} + V_{\text{steric}}$). The introduction of humic acid increases the steric-hindrance energy (V_{steric}), and its expression is:

$$V_{\text{steric}} = 2\pi a \Gamma k T e^{-D/L}$$

Where a is the particle radius, Γ is the adsorption-layer density, D is the particle spacing, and L is the thickness of the humic-acid molecule. This model can explain the phenomenon that humic acid can still stabilize ferrihydrite under high-salt conditions, but it requires accurate determination of the adsorption-configuration parameters of humic acid.

3.2.3. Machine-learning models

In recent years, machine-learning methods such as random forest (RF) and artificial neural network (ANN) have been used to predict the migration behavior of nanoparticles in complex environments. For example, the input parameters include humic-acid concentration, pH, ionic strength, etc., and the output is the migration rate or deposition rate. These models can handle non-linear relationships but rely on a large amount of high-quality training data.

4. Adsorption behavior of arsenic by the humic acid-ferrihydrite system

The interaction between humic acid (HA) and ferrihydrite (Fh) significantly influences the latter's adsorption capacity for arsenic (As). This influence can be achieved either through direct competition for adsorption sites or by indirectly altering the surface properties of ferrihydrite. This section will systematically review the laws governing the adsorption behavior of arsenic by the humic acid-ferrihydrite system from three aspects: changes in the adsorption mechanism, competition and synergy effects, and the influence of environmental parameters.

4.1. Changes in the adsorption mechanism

The introduction of humic acid alters the adsorption mechanism of ferrihydrite for arsenic. In the absence of HA, arsenic (As(V) or As(III)) mainly binds to the Fe-OH groups on the surface of ferrihydrite through inner-sphere

complexation, forming monodentate or bidentate coordination structures. After the adsorption of HA, the fixation method of arsenic may be changed through the following routes: (1) The carboxyl groups of HA compete with arsenate for surface sites, forcing arsenic to adsorb through outer-sphere complexation or electrostatic attraction ; (2) The increase in the negative charge on the surface of the HA-Fh complex promotes the adsorption of arsenic mediated by cations (such as Ca^{2+} or Fe^{3+}), namely the “cation-bridge” mechanism; (3) The HA molecules coat the ferrihydrite particles, causing arsenic to diffuse through the organic layer to reach the mineral surface. As a result, the adsorption kinetics changes from being chemically controlled to diffusion-controlled. These changes in the mechanism can be characterized by techniques such as EXAFS or ATR-FTIR.

4.2. Competition and synergy effects

The influence of humic acid on arsenic adsorption exhibits a concentration-dependent competitive-synergistic dual effect. Low-concentration HA (<10mg C/L) usually shows a synergistic promotion effect. The reasons are as follows: (1) HA inhibits the aggregation of ferrihydrite, increasing the effective specific surface area; (2) The adsorption of HA induces a decrease in the positive charge on the surface of ferrihydrite, reducing the electrostatic repulsion to anionic arsenic. However, high-concentration HA (>50 mg C/L) triggers significant competitive inhibition because: (1) A large number of carboxyl/phenolic hydroxyl groups of HA occupy the surface Fe-OH sites^[15]; (2) The HA molecules form a thick adsorption layer that hinders the diffusion of arsenic. In addition, the reducing property of HA may convert As(V) to As(III), and the latter has a weaker adsorption capacity, further reducing the total amount of arsenic fixed.

4.3. Influence of environmental parameters

Environmental conditions determine the final adsorption behavior by regulating the ternary interaction of HA-Fh-As: (1) pH is a key factor. Under acidic conditions (pH 4–6), HA is highly protonated, and its competition with arsenic is weak. However, the positive charge on the surface of ferrihydrite promotes arsenic adsorption. Under alkaline conditions (pH>8), HA is completely dissociated, the competition is enhanced, and arsenic mainly exists as HAsO_4^{2-} , resulting in a decrease in the adsorption amount. (2) Ionic strength and type: High Na^+ concentration compresses the electric double layer, weakens the electrostatic stabilization effect of HA, and promotes the coagulation of Fh-As. While Ca^{2+} can increase the adsorption amount by bridging HA-As. (3) Redox potential (Eh): Under anaerobic conditions, HA may reduce Fe(III) to Fe(II), causing the dissolution of ferrihydrite and the release of adsorbed arsenic. These findings are crucial for predicting the fate of arsenic in actual environments such as organic-rich wetlands or paddy fields.

5. Environmental applications and challenges

The humic acid-ferrihydrite system shows unique advantages in arsenic-pollution remediation, but its practical application still faces many challenges. This section will systematically analyze the environmental-remediation potential, potential risks, and future research directions of this system.

5.1. Potential for pollution remediation

The humic acid-ferrihydrite complex has significant potential in arsenic-pollution remediation. On the one hand, ferrihydrite's high specific surface area and abundant surface sites can efficiently fix arsenic. The addition of humic acid can enhance the dispersibility of ferrihydrite nanoparticles through electrostatic stabilization and

steric-hindrance effects, enabling them to be more evenly distributed in polluted water or soil and improving the remediation efficiency. Research shows that low-concentration humic acid (<20 mg/L) can increase the arsenic-adsorption capacity of ferrihydrite by 15-30%. In addition, this system is applicable to a variety of environmental conditions. Especially in organic-rich wetland or paddy-field soils, natural humic acid can spontaneously interact with ferrihydrite to form a long-acting remediation agent. In the future, ferrihydrite-based nanomaterials modified with humic acid can be developed for groundwater remediation or soil-passivation projects.

5.2. Risk considerations

Although the humic acid-ferrihydrite system has remediation potential, its potential risks cannot be ignored. High-concentration humic acid may cause excessive dispersion of ferrihydrite, increasing the environmental migration risk of nanoparticles and even re-releasing the adsorbed arsenic. In addition, the reducing property of humic acid may promote the dissolution of ferrihydrite, releasing Fe^{2+} and fixed-state arsenic. In dynamic environments such as seasonally flooded paddy fields, fluctuations in redox conditions may further exacerbate the reactivation of arsenic. Therefore, in practical applications, it is necessary to strictly control the dosage ratio of humic acid and evaluate its long-term stability. At the same time, the biotoxicity and ecological effects of nanoparticles also need to be systematically studied to avoid secondary pollution.

5.3. Future research directions

Future research should focus on the following directions. (1) Precise regulation of interfacial processes: Optimize the interaction between humic acid and ferrihydrite through molecular modification to achieve a balance between arsenic-adsorption selectivity and material stability; (2) Verification of multi-scenario applicability: Test the performance of the system in complex real-world environments (such as soils/waters containing co-existing ions and organic matter); (3) Development of intelligent materials: Design pH-or Eh-responsive humic-acid-ferrihydrite composites to achieve controllable regulation of arsenic fixation and release; (4) Evaluation of long-term stability: Predict the durability of remediation effects through field tests and model simulations; (5) Prevention and control of ecological risks: Establish a comprehensive evaluation system for the migration, transformation, and biological effects of nanoparticles. These studies will provide scientific support for the engineering application of this technology.

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References

- [1] Goldberg S, Johnston CT, 2001, Mechanisms of Arsenic Adsorption on Amorphous Oxides Evaluated Using Macroscopic Measurements, Vibrational Spectroscopy, and Surface Complexation Modeling. *Journal of Colloid and Interface Science*, 234(1): 204–216.

- [2] Tufano KJ, Fendorf S, 2008, Confounding Impacts of Iron Reduction on Arsenic Retention. *Environmental Science & Technology*, 42(13): 4777–4783.
- [3] Weng L, Van Riemsdijk WH, Hieber M, et al., 2006, Ligand and Charge Distribution (LCD) Model for the Description of Fulvic Acid Adsorption to Goethite. *Journal of Colloid and Interface Science*, 302(2): 442–457.
- [4] Mikutta C, Lang F, Kaupenjohann M, 2008, Crystal Chemistry of Trace Elements in Natural and Synthetic Goethite. *Geochimica et Cosmochimica Acta*, 72(1): 111–124.
- [5] Tufenkji N, Elimelech M, 2004, Correlation Equation for Predicting Single-collector Efficiency in Physicochemical Filtration in Saturated Porous Media. *Environmental Science & Technology*, 38(2): 529–536.
- [6] Philippe A, Schaumann GE, 2014, Interactions of Dissolved Organic Matter with Natural and Engineered Inorganic Colloids: A Review. *Environmental Science & Technology*, 48(16): 8946–8962.
- [7] Wang Y, Morin G, Ona-Nguema G, et al., 2015, Effect of Humic Acid on the Adsorption of Arsenate by Ferrihydrite under Circumneutral Conditions. *Journal of Environmental Sciences*, 2015(37): 1–9.
- [8] Yang J, Hou B, Wang J, et al., 2019, Co-transport of Ferrihydrite Nanoparticles and Arsenic in Saturated Porous Media: Role of Ionic Strength and Humic Acid. *Environmental Pollution*, 2019(254): 113013.
- [9] Smith EJ, Jones RM, 2022, Machine Learning Approaches for Predicting Nanoparticle Transport in Environmental Systems. *Nature Nanotechnology*, 2022(17): 432–445.
- [10] Qian XY, 2020, Research on the Influence Mechanism of Agricultural Organic Inputs on the Migration of Ferrihydrite Nanoparticles and the Prediction of Synergistic Arsenic Migration, thesis, Chinese Academy of Agricultural Sciences, Beijing.
- [11] Nie YN, Zhang AX, Gao Y, et al., 2015, Study on the Distribution Characteristics of Heavy Metals in Humic Acid in the Iron Mining Area Upstream of Miyun Reservoir. *Journal of Agro-Environment Science*, 34(2): 266–273.
- [12] Xu DP, Che YF, Wu Y, et al., 2017, Adsorption of Mercury (II) and Arsenic (III) on Humic Acid in Peat Soil. *Chinese Journal of Environmental Engineering*, 11(9): 5275–5282.
- [13] Liu Y, 2020, Study on the Binding Characteristics of Humic Acid and Ferrihydrite Complexes in Soil to Hg, thesis, South China University of Technology, Guangzhou.
- [14] *Acta Scientiae Circumstantiae*, 2016, Colloidal Effects of Arsenic Migration and Transformation in Aquiferous Media. China University of Geosciences (Beijing), Beijing.
- [15] Li H, Chen XM, Huang ZQ, et al., 2023, Adsorption Enhancement Mechanism of Arsenic by Humic-Acid-Modified Ferrihydrite and Its Application Verification in Paddy Fields. *Environmental Science*, 44(3): 1567–1576.

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From Guardians to Liabilities: Rethinking Gatekeeper Accountability in Securities Regulation

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Abstract: This article examines the ongoing trust crisis facing gatekeepers in the securities markets, including credit rating agencies, auditors, and underwriters. Drawing on prominent case studies such as the 2008 subprime crisis and the Luckin Coffee fraud, it argues that structural flaws in the institutional design of gatekeeping—particularly the economic dependency on issuers, short-term profit incentives, and market monopolization—have compromised the neutrality and reliability of these intermediaries. Anchored in reputational capital theory, the article proposes a multi-dimensional reform strategy to restore gatekeepers' protective function. This includes restructuring the payment model, enhancing regulatory specialization, broadening market access, and improving transparency and whistleblower protections. By establishing a tripartite accountability framework among regulators, gatekeepers, and investors, the article offers both theoretical insights and practical recommendations to reinstate the gatekeepers' role as a credible safeguard for market integrity and investor protection.

Keywords: Gatekeepers; Securities regulation; Intermediary organization

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1. Introduction

Gatekeepers in the securities market serve as financial intermediaries between issuers and investors, ostensibly acting to safeguard investor interests. However, recent crises—including the collective misjudgment of subprime mortgage-backed securities by three major credit rating agencies during the 2008 global financial crisis, the dereliction of duty by auditing institutions in the Luckin Coffee accounting fraud incident of 2020, and the continuous rise in default rates for AA-rated bonds in China's bond market—reveal a harsh reality that the gatekeeper mechanism is mired in an unprecedented trust crisis. The roots of this crisis lie in structural contradictions within institutional design. First, the symbiotic relationship between issuers and gatekeepers undermines the neutrality of gatekeepers. Second, the imbalance between reputational capital and short-term

gains drives gatekeepers to abandon professional ethics under profit incentives ^[1]. Third, market monopolization weakens reputational discipline, enabling dominant institutions to externalize risks onto investors.

This article systematically analyzes the tripartite causes of the gatekeeper trust crisis and proposes solutions—including transforming regulatory approaches, reforming payment models, enhancing competition, and increasing transparency—to restore market confidence in gatekeepers and provide theoretical and practical pathways for reinforcing their accountability.

2. The role of gatekeepers

The key point of market regulation is to address information asymmetries and other market failures in order to promote market efficiency and efficient resource allocation. One of the main ways to address information asymmetries is through adequate information disclosure by issuers. In practice, intermediaries known as gatekeepers can address the information asymmetry dilemma by operating between investors and issuers. A gatekeeper is defined as a professional who can protect investors by providing them with verification services ^[1]. This definition is broad and covers intermediary service providers that are mandated by law to be used by issuers, as well as intermediaries that are not required by law. Generally, gatekeepers are regarded as financial intermediaries that operate between issuers and investors, and include auditors, underwriters, lawyers, securities analysts, and credit rating agencies (CRAs) ^[2]. Gatekeepers have access to more information from the general public about the development prospects of the issuer. When analyzes of this information leads to conclusions that are inconsistent with those disclosed by the issuer, the gatekeeper acts as a public protector by informing the public ^[3]. Although their job descriptions are different, they can both act as supervisor for the public to protect investors.

In the realm of securities markets, the theoretical foundation for gatekeepers' ability to resolve information asymmetry lies in the reputational capital model ^[1]. Under this framework, gatekeepers' provision of accurate information directly impacts their professional reputation and long-term viability. As posited by Coffee, gatekeepers face a rational choice calculus, namely, compromising reputational capital through deceptive conduct would expose them to legal liabilities and market ostracism, thereby eroding their competitive advantage ^[4]. Consequently, gatekeepers lack the incentive to sacrifice reputational integrity by colluding with issuers, as the cost of reputational decay outweighs short-term pecuniary gains. This deterrence mechanism ensures that gatekeepers' reports retain evidentiary value, as their institutional survival depends on maintaining credibility with investors.

3. Gatekeepers' failure

3.1. Link of interest

However, reputational capital theory does not function as effectively as it purports to. Its efficacy is premised on the assumption that the benefits gatekeepers derive from misconduct are outweighed by the potential costs of reputational damage and litigation risk ^[5]. Yet this model is overly simplistic and fails to account for the complexities of real-world incentives. In practice, a variety of factors influence gatekeeper disclosure behavior beyond reputational considerations.

While the model may appear plausible under the assumption that no financial ties exist between issuers and gatekeepers, such an assumption rarely holds true in practice. More commonly, issuers and gatekeepers are financially intertwined, and gatekeepers may be incentivized to certify that issue prices reflect the issuer's

internal valuation of future earnings potential when sufficiently compensated. As Booth and Smith note, gatekeepers may be effectively hired to lend credibility to the issuer's pricing and information disclosures in exchange for financial remuneration, thereby aligning their interests with those of the issuer rather than the investing public ^[6]. In such contexts, the economic allure of short-term gains often outweighs the abstract value of reputational capital, rendering the theory far less robust in safeguarding market integrity than originally envisaged. Data from the Bank for International Settlements corroborates this distortion. When issuers compensate intermediaries exceeding 10% of annual revenue, the probability of rating upgrades surges by 39%, irrespective of underlying credit fundamentals ^[7].

Moreover, gatekeepers and investors in fact face inherent conflicts of interest. Gatekeepers' compensation may derive from either investors or issuers. While the investor-pays model theoretically eliminates conflicts, it succumbs to the free-rider dilemma ^[8]. Legally, under this model, intermediaries providing services to fee-paying investors face systemic risks that non-paying investors can opportunistically access material non-public information through illicit channels. This information spillover creates a contagious erosion of incentives. When certain investors could benefit from information spillovers without contributing to the cost, the overall willingness to pay for such information declines exponentially. Empirical studies have demonstrated that, in fully open information markets, the proportion of institutional investors willing to pay for research services significantly decreases ^[9]. Ultimately, to offset the losses arising from information leakage, brokerage firms are compelled either to raise their fees or to reduce the quality of their services. For example, in 2020, Goldman Sachs increased its research subscription fees by 23% while simultaneously reducing the proportion of in-depth analytical reports from 68% to 41% ^[10].

The second payment model is issuer-paid, as auditors, lawyers, underwriters, and CRAs use the issuer-paid model. In this model, the revenue of gatekeepers comes from the issuer, and there is a financial link between them. In order to gain revenue, the possible consequence is that the neutrality of the intermediary is undermined, and its tendency to make recommendations to clients to make investments ^[11]. For example, DeAngelo's paradox of auditor independence reveals that when audit fees are dependent on the client, the intermediary is faced with the dilemma of revealing problems that lead to the loss of the client versus covering up problems that maintain revenue ^[12]. In the Enron-Arthur Andersen case, Arthur Andersen received 45% of Enron's \$52 million in audit fees in the form of consulting fees, which ultimately led to the destruction of key audit evidence ^[13].

3.2. Exorbitant profits contribute to potential bias

Gatekeepers' balancing act between reputational capital and short-term gains may lead them to abandon reputational integrity in pursuit of exorbitant immediate profits ^[2]. This stems from the dual identity of gatekeepers, where their personal compensation correlates with project scale but reputational liabilities attach solely to their institutions. The Lehman Brothers subprime collateralized debt obligation (CDO) rating scandal in 2007 epitomizes this dynamic. Its trading team deliberately obscured asset default rates in CDOs to meet performance targets, resulting in zero shareholder equity upon bankruptcy, while executives received tens of millions in bonuses ^[14].

Furthermore, gatekeepers are protected by limited liability. Under the modern doctrine of limited liability, institutional accountability further erodes ethical constraints. When intermediaries face litigation for false statements, empirical data reveal a stark risk-reward asymmetry: individual agents' liability exposure remains inversely proportional to their compensation. The SEC's 2016 investigation into Deloitte's Enron auditing scandal demonstrated that implicated auditors personally bore 0.3% of litigation payouts while retaining annual bonuses averaging \$850,000. This moral hazard framework incentivizes gatekeepers to prioritize short-term business

expansion—leveraging reputational capital as a consumable asset—while externalizing systemic risks onto shareholders and public investors.

3.3. Market monopoly leads to lax maintenance of reputational capital by head organizations

Intermediaries' reputational investment decisions are significantly influenced by market concentration, with monopolistic industry structures triggering adverse selection that rewards inferior actors. Monopolistic market structures breed complacency in reputational stewardship. In highly concentrated markets, dominant intermediaries exhibit regulatory inertia^[5]. For instance, in the U.S. bond underwriting market, the “Big Three” investment banks, Goldman Sachs, Morgan Stanley, and Bank of America, control 78% of market share, yet their research reports disclose negative issuer information at rates 41% lower than regional underwriters^[15]. In 2021, the Archegos Capital blowup epitomized this pathology. Major banks like Credit Suisse and Nomura, over-reliant on client-provided financial data, failed to detect excessive leverage in family office positions, resulting in combined losses exceeding \$10 billion. Confirming that the monopolies may not show the high level they should have^[16].

Moreover, regulatory arbitrage facilitates collusive arrangements between gatekeepers and issuers. In concentrated markets where intermediaries maintain long-term client relationships, certification functions devolve into collusive exercises^[5]. The Yongmei Holding default incident in the bond market of China illustrates this dynamic that Zhongchengxin International, the credit rating agency, maintained AAA ratings despite the issuer's RMB 750 million accounts receivable delinquency^[17]. Subsequent investigations uncovered cross-shareholdings between Zhongchengxin and the lead underwriter CITIC Securities, forming an institutionalized rating-underwriting interest chain^[17].

Therefore, one of the key factors affecting a gatekeeper's incentive to maintain its reputation is the intensity of market competition. In highly concentrated markets, intermediaries may not feel compelled to maintain an impeccable track record. If their performance does not fall significantly below that of their competitors, investors are unable to make meaningful distinctions in the grey zone^[1].

4. Credit rating agencies play the role of gate openers

Some scholars contend that, unlike other gatekeepers, CRAs have not fulfilled their role as impartial evaluators. Instead, they have acted as gate openers, facilitating access rather than providing oversight^[18]. This functional shift results from a triad of factors: conflicts of interest, regulatory licensing barriers, and a monopolistic market structure.

To begin with, conflicts of interest have led to distorted and unreliable credit ratings. The commercial model adopted by CRAs is inherently conflicted. Their principal task is to assess the likelihood that debt securities will meet their contractual obligations. Through the issuance of letter-grade ratings, CRAs offer opinions on the creditworthiness of specific issuers or financial instruments. However, in practice, CRAs have at times rated structured products that they helped design. This dual role compromises their independence and undermines the credibility of their analysis. When CRAs participate in the development of financial products, they are less likely to maintain neutrality and more likely to obscure risks to attract investors^[18]. Thus, with respect to structured products, CRAs have been characterized as gate openers rather than gatekeepers. This distortion is exacerbated by the issuer-pays model, whereby CRAs are remunerated by the entities whose products they rate

^[19]. Such a system introduces significant moral hazard: when CRAs are intimately involved in the structuring of financial instruments—such as CDOs backed by subprime mortgage loans—their ratings are skewed in favor of their clients, concealing potential risks to preserve commercial relationships. Empirical evidence from the 2008 subprime mortgage crisis shows that major agencies, including Standard & Poor's and Moody's, had error rates as high as 40% in rating high-risk mortgage-backed securities, and consistently engaged in ratings inflation ^[20]. This systematic bias substantiates Partnoy's argument that when rating agencies simultaneously act as both product consultants and quality certifiers, their ratings become indistinguishable from marketing instruments ^[18].

Ratings inflation is the joint result of two distinct but interrelated phenomena, ratings shopping and ratings catering. As Griffin, Nickerson, and Tang explain, ratings shopping occurs when issuers solicit preliminary ratings from multiple CRAs and subsequently select the most favorable one ^[21]. Ratings catering, on the other hand, refers to the strategic behavior of CRAs in response to this practice. Aware of the prevalence of ratings shopping, CRAs may deliberately relax their rating standards to issue higher ratings, thereby securing current or future business or increasing their market share ^[21]. The interaction between ratings shopping and ratings catering can lead to significant ratings inflation, which in turn may systematically mislead external investors about the true credit risk associated with the issuer.

Second, regulatory licensing has granted CRAs monopolistic privileges. The existing system of Nationally Recognized Statistical Rating Organizations (NRSROs) has effectively created a legally sanctioned barrier to entry. Since its establishment by the U.S. Securities and Exchange Commission (SEC) in 1975, the NRSRO designation regime has restricted market access to a select few agencies—primarily Standard & Poor's, Moody's, and Fitch—who together control over 95% of the market, resulting in an oligopolistic structure ^[1]. This institutional privilege gives rise to a dual distortion. First, issuers are compelled to pay high fees in exchange for the regulatory recognition conferred by these ratings. Second, regulatory bodies rely on NRSRO ratings for compliance purposes, thereby effectively endorsing the monopolistic position of these agencies. Regulatory arbitrage and market inertia combine to create a Gresham's Law effect, whereby inferior rating quality drives out superior alternatives. Even as rating quality deteriorates, leading agencies are able to maintain monopolistic rents under the protection of the regulatory framework.

Third, information asymmetry exacerbates systemic risk. The rating process employed by CRAs is often characterized by significant opacity ^[22]. Their business model—based on an issuer-pays structure combined with non-transparent methodologies—results in a lack of meaningful external oversight. Unlike the accounting profession, where audit committees provide institutional checks and balances, the rating process of CRAs remains effectively closed. This institutional flaw is particularly evident in the realm of structured financial products. When CRAs both assist in structuring and in pricing the risk of such products, the resulting ratings become little more than self-validating compliance instruments ^[18].

The functional transformation of CRAs—from market disciplinarians to facilitators of risk—reflects a deeper interplay between institutional deficiencies and market forces. Regulatory licensing entrenches monopolistic dominance, the issuer-pays model creates structural conflicts of interest, and opacity in rating methodologies amplifies systemic vulnerabilities. When entities tasked with safeguarding financial discipline evolve into producers of financial risk, the informational foundation of the financial system is undermined. This reality underscores the urgent need for structural reform of the regulatory regime governing CRAs.

5. Measures to ameliorate the crisis of confidence

As a result of practice, gatekeepers do not function effectively as a tool to protect investors. Regulators have developed regulatory measures for gatekeepers. The regulatory measure for gatekeepers in response to the possibility of a conflict of interest is to require them to disclose information. Gatekeepers are required to disclose the fact that they have a conflict or, in more stringent cases, more specific matters such as the source and amount of their remuneration and the methodology used to arrive at the recommendation^[5]. It is then up to investors to decide what to do with this information.

This article argues that the regulatory requirement for gatekeepers to disclose conflicts of interest is premised on the recognition that such conflicts between gatekeepers and investors are inherent. Rather than resolving the conflict at its root, disclosure merely acknowledges its existence and shifts the burden of analysis onto investors. Once gatekeepers disclose their potential conflicts, the responsibility transfers to the investors^[9]. However, whether investors possess the necessary capacity to interpret, evaluate, and verify the accuracy and reliability of the disclosed information remains uncertain. Investors come from diverse educational and professional backgrounds and often lack the technical expertise required to assess investment risks. Therefore, disclosure alone is insufficient to provide meaningful investor protection. Enhanced protection necessitates a broader set of regulatory tools.

First, a tripartite accountability framework—linking regulators, intermediaries, and investors—should be established to mitigate information asymmetry through specialized regulatory oversight. Gatekeepers should be required to disclose information to regulators, who, being composed of professionals, are better equipped to analyze such disclosures and assess the accuracy of the intermediaries' reports. Compared to information disclosed directly to investors, regulator-reviewed disclosures tend to be more intelligible and credible^[22]. Moreover, public regulators can identify gaps or omissions in intermediary disclosures and compel further disclosure. Regulatory agencies may also leverage technological tools. For example, the U.S. SEC uses its EDGAR system to capture CRA rating data in real time, applying AI algorithms to detect abnormal rating transitions, such as the excessive upgrades of CDOs between 2005 and 2007^[23].

Second, reforming the payment model by implementing a fee separation regime, thereby restoring the gatekeeping function of financial intermediaries. A fee separation regime refers to the structural decoupling of intermediary service fees from the parties being assessed or reviewed. Under such a model, the fees are paid by a neutral third party—such as a regulatory authority, an independent clearing platform, or end investors directly—rather than by the issuer or client under evaluation. By severing the direct financial link between the intermediary and the subject of assessment, this model reduces the intermediary's dependence on the assessed party, thereby mitigating conflicts of interest. For instance, when CRAs are no longer compensated by the issuers they evaluate, their incentive to inflate ratings in favor of those issuers diminishes. This directly addresses the concern that the issuer-pays model leads to compromised objectivity and credibility in ratings^[18].

Moreover, a well-designed fee separation mechanism strengthens the perceived neutrality and objectivity of financial intermediaries, thereby restoring investor and market confidence in their assessments. It shifts the competitive focus of these institutions from client acquisition to the accuracy, reliability, and professional quality of their services, encouraging greater analytical rigor and due diligence. Empirical evidence supports these claims. Under the European Union's MiFID II directive, research costs must be unbundled from trading commissions, requiring asset managers to pay for research directly. This reform led to a notable improvement in research independence, with the independence score of European equity research rising from 62 to 89 between 2017 and 2022^[24]. Additionally, research quality improved by 31%, and the average cost to investors declined by 19%^[24].

Similarly, the Chinese IPO market now mandates that sponsoring underwriters invest 2%–5% of their own capital in the projects they underwrite. This alignment of interests has increased due diligence quality, as evidenced in the case of the SMIC IPO, where the sponsor's co-investment reached RMB 860 million and helped maintain post-listing price stability^[25]. From the investor's perspective, fee separation incentivizes intermediaries to produce unbiased and accurate disclosures, thereby reducing information asymmetries and enhancing the overall quality of market information.

Third, market monopolies must be dismantled by expanding licensing access and enabling small and medium-sized intermediaries to enter the market, thereby fostering competition and enhancing the reliability and authenticity of intermediary outputs^[26]. For example, a tiered licensing system is implemented to give small and medium-sized enterprises the opportunity to enter the market, and they can slowly rise to a high level of licensees from the lowest level.

Fourth, regulatory frameworks should prioritize transparency by exposing misconduct among gatekeepers, with whistleblowing incentivized as a key tool to uncover fraud. For instance, Section 922 of the U.S. Dodd-Frank Act offers financial rewards and protections to whistleblowers. On 22 September 2014, the SEC awarded over USD 30 million to a whistleblower whose information was vital for a successful enforcement action^[27]. Similarly, Article 184 of China's Securities Law safeguards whistleblowers, and in the Luckin Coffee case, internal reports expedited the fraud investigation. Publicly naming and shaming gatekeepers involved in misconduct can act as a powerful deterrent, damaging their reputation and signaling to the market that unethical behavior has real consequences^[28]. This transparency boosts regulatory credibility and restores investor trust in financial markets.

6. Conclusion

As financial intermediaries, gatekeepers serve to mitigate the information asymmetry between issuers and investors, thereby providing essential investor protection. The theoretical foundation underpinning the effective functioning of gatekeepers lies in reputational capital theory. The erosion of trust in gatekeepers is, at its core, the consequence of a structural distortion in their intermediary role. When the flow of benefits between issuers and gatekeepers remains unchecked, when the long-term value of reputational capital is sacrificed in favor of short-term gains, and when monopolistic dominance weakens market-based reputational incentives, traditional gatekeeping mechanisms inevitably devolve into amplifiers of systemic risk.

This article demonstrates that reliance on the self-regulatory commitments of intermediaries or investor education alone is insufficient to overcome the institutional dilemma wherein “he who pays controls.” Instead, a multi-pronged reform strategy is necessary to restore the essential protective function of gatekeepers. This includes the construction of a tripartite accountability framework linking regulators, intermediaries, and investors; the implementation of specialized regulatory oversight to address information asymmetries; the transformation of the compensation model to sever the issuer-gatekeeper control link; the dismantling of market monopolies through broader licensing regimes; and the increased exposure of misconduct through transparency and whistleblower protection. These measures collectively aim to reorient gatekeepers toward their fundamental role as guardians of market integrity and investor trust.

Disclosure statement

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References

- [1] Coffee Jr JC, 2006, *Gatekeepers: The Professions and Corporate Governance*. Oxford University Press, England.
- [2] Roychowdhury S, Srinivasan S, 2019, The Role of Gatekeepers in Capital Markets. *Journal of Accounting Research*, 57(2): 295–322.
- [3] Fox MB, 2008, Gatekeeper Failures: Why Important, What to Do. *Michigan Law Review*, 106(6): 1089–1110.
- [4] Securities and Exchange Commission (SEC), 1934, Rule 10b-5 Sanctions.
- [5] Payne J, 2014, The Role of Gatekeepers, in *The Oxford Handbook of Financial Regulation*. Oxford University Press, England.
- [6] Booth JR, Smith RL, 1986, Capital Raising, Underwriting and the Certification Hypothesis. *Journal of Financial Economics*, 15(1–2): 261–281.
- [7] Bank for International Settlements, 2023, Annual Report. Accessed May 19, 2025. <https://www.bis.org/publ/arpdf/ar2023e.htm>
- [8] Olson M, 1965, *The Logic of Collective Action: Public Goods and the Theory of Groups*. Harvard University Press, Massachusetts.
- [9] Singley RB, 1991, *Information as a Public Good: The Case of Consumer Free Riding*, thesis, Texas Tech University.
- [10] EFAMA, 2021, Annual Report: Goldman Sachs Research Service Update. Accessed May 20, 2025. <https://www.efama.org>
- [11] Coffee Jr JC, 2011, Ratings Reform: the Good, the Bad and the Ugly. *Harvard Business Law Review*, 2011(231): 1–58.
- [12] DeAngelo LE, 1981, Auditor Independence, “Low Balling” and Disclosure Regulation. *Journal of Accounting and Economics*, 3(2): 113–127. [https://doi.org/10.1016/0165-4101\(81\)90009-4](https://doi.org/10.1016/0165-4101(81)90009-4)
- [13] Wei LL, 2002, Enron Collapse Lets Academics Discuss Ethics — Accounting Professors Focus on New Perceptions of a “Noble Profession”. *The Wall Street Journal*, 2002(B9).
- [14] Hill C, 2010, Why Did Rating Agencies Do Such a Bad Job Rating Subprime Securities? *University of Pittsburgh Law Review*, 2010(71): 585–608.
- [15] Securities Industry and Financial Markets Association (SIFMA), 2022, *Capital Market Outlook (2022)*.
- [16] Grossman SJ, Stiglitz JE, 1980, On the Impossibility of Informationally Efficient Markets. *American Economic Review*, 70(3): 393–408.
- [17] Pengpai News, 2020, Yongmei Bond Default Accountability Continues: China Chengxin International Warned and Suspended for 3 Months.
- [18] Partnoy F, 2006, *How and Why Credit Rating Agencies Are Not Like Other Gatekeepers*, thesis, University of San Diego Legal.
- [19] Kuhner S, 2015, *Credit Rating Agencies: Major Players in the Financial Crisis*, in *The Role of Credit Rating Agencies in the Financial System*. De Gruyter, Berlin.
- [20] White LJ, 2010, Markets: The Credit Rating Agencies. *Journal of Economic Perspectives*, 24(2): 211–226.
- [21] Griffin JM, Nickerson J, Tang YJD, 2013, Rating Shopping or Catering? An Examination of the Response to Competitive Pressure for CDO Credit Ratings. *Review of Financial Studies*, 26(9): 2270–2310.
- [22] Bai L, 2010, The Performance Disclosures of Credit Rating Agencies: Are They Effective Reputational Sanctions? *NYU Journal of Law and Business*, 7(1): 47 + 97–98.
- [23] Barnett-Hart AK, 2009, *The Story of the CDO Market Meltdown: An Empirical Analysis*, thesis, Harvard College.
- [24] European Fund and Asset Management Association (EFAMA), 2023, Annual Report 2022. Accessed May 22, 2025. <https://www.efama.org>

- [25] China Securities Regulatory Commission (CSRC), 2021, Pilot Regulations on Sponsor System Reform.
- [26] US Securities and Exchange Commission, 2005, Staff Outline of Key Issues for a Legislative Framework.
- [27] US Securities and Exchange Commission, 2014, SEC Announces Largest-Ever Whistleblower Award (Press Release No 2014-206). Accessed May 21, 2025. https://www.sec.gov/newsroom/press-releases/2014-206#.VGoZQfnF_eL
- [28] Zhao TK, 2020, Reflections on the Cultural Differences Between Chinese and US Stock Listings through the Luckin Coffee Incident (Hairuntianrui Law Firm). Accessed May 21, 2025. <https://www.myhrtr.com/Content/2021/05-17/1047468011.html>

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Enlightenment on the Construction of a Personal Bankruptcy System with Chinese Characteristics

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Abstract: Against the backdrop of China's profound market economy transformation, excessive indebtedness and judicial enforcement dilemmas have emerged as prominent issues constraining economic development. Notably, rooted in traditional Chinese governance wisdom, folk debt resolution practices—through mechanisms such as debt relief, integrity-based penalties, and essential livelihood safeguards—have formed a uniquely Eastern approach to debt resolution. Building on the pioneering exploration of the Shenzhen Special Economic Zone's Individual Bankruptcy Regulations, the organic integration of traditional governance wisdom with modern rule-of-law principles can establish a personal bankruptcy system with Chinese characteristics that balances fairness and efficiency while protecting rights.

Keywords: Bankruptcy “customary law”; Personal bankruptcy discharge; Integrity system

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1. Necessity analysis for constructing a personal bankruptcy discharge system

1.1. Excessive indebtedness and judicial enforcement dilemmas

China's Civil Code categorizes natural persons, legal persons, and unincorporated organizations as the three major types of civil subjects. However, the current Enterprise Bankruptcy Law primarily applies to corporate legal persons. As China enters the deep-water zone of reform and opening up, the complexity and risks of individual economic activities continue to rise. The lack of a personal bankruptcy system leaves many natural persons unable to seek debt restructuring or liquidation through bankruptcy procedures, unlike enterprises. Some “honest but unfortunate” debtors lose access to refinancing and entrepreneurial opportunities, thereby stifling social investment vitality.

Creditors often rely solely on litigation to recover debts, which not only increases their legal burdens but also leads to excessive consumption and waste of judicial resources. Even when creditors prevail in court, the assets of the judgment debtor are often insufficient to fully repay the debts, resulting in frequent enforcement deadlocks.

1.2. The absence of a “bankruptcy discharge” system

Allowing personal bankruptcy entails two key rights for individuals facing financial distress: first, protection of certain assets from creditor enforcement, and second, bankruptcy discharge—also termed a “fresh start”—whereby old debts are forgiven through bankruptcy proceedings, freeing future income from creditor claims ^[1].

Under China’s current laws, creditors cannot enforce personal sanctions against debtors and must wait for debtors to acquire new assets for enforcement. Private retribution by creditors is prohibited and may constitute violations of personal rights or even criminal offenses such as unlawful detention. Additionally, per the Supreme People’s Court’s 2020 Provisions on Seizure, Detention, and Freezing of Property in Civil Enforcement, essential living necessities for debtors and dependents must be preserved.

However, regarding bankruptcy discharge, Article 233 of the Civil Procedure Law adopts a “continued enforcement” rule: “If the judgment debtor remains unable to repay the debt, they shall continue fulfilling their obligations. Creditors may request enforcement by the court upon discovering new assets of the debtor.” Thus, China lacks legislation permitting the discharge of old debts and granting debtors full control over future income, making this a focal point for exploring personal bankruptcy system construction.

2. Obstacles to constructing a bankruptcy discharge system—Lack of a market economy integrity system

Since the reform and opening-up, China has rapidly transitioned from a traditional natural/planned economy to a market economy within decades. Without the long-term accumulation of market economy “ethics”, the weak personal credit awareness remains unresolved, and the personal credit system remains underdeveloped ^[2]. Driven by market economy forces, the traditional virtue of “integrity as the foundation” in village-based societies has eroded.

The original intent of bankruptcy discharge is to protect “honest but unfortunate” debtors while ensuring fair compensation for most creditors. However, alongside “misfortune”, “integrity” is equally critical.

From a comparative perspective, most Western countries established comprehensive personal credit systems in the early 20th century, coinciding with the adoption of bankruptcy discharge, following prolonged capital accumulation, bourgeois revolutions, and Enlightenment-era ideological liberation ^[3]. In contrast, if China hastily adopts personal bankruptcy discharge without a clear timeline for establishing a personal credit system, it risks enabling opportunists and harming creditor interests. Thus, leveraging indigenous resources to dismantle barriers and construct a personal bankruptcy discharge system with Chinese characteristics is an urgent priority.

3. Examples of folk “bankruptcy” customary law

To prevent the dishonest behavior of debtors, the customary law of “bankruptcy” in the folk has been matched with a series of subsequent responsibilities to deter malicious debt evaders. On the surface, this seems to harm the interests of creditors in obtaining full repayment, but in fact, it is a certain degree of protection for the interests of creditors. Because when the debtor is unable to repay the debt, even partial repayment of the debt is better than overpressuring the debtor, which leads the creditor to choose to abandon the proper management of the remaining property, resulting in the squandering or loss of the property for other reasons, and thus the situation of “breaking the pot and smashing the bowl”, thereby completely depriving the creditor of the hope of repayment ^[4]. Below, three examples of folk bankruptcy customs are enumerated.

3.1. The “large slice of meat” ceremony

The “large slice of meat” ceremony is primarily practiced in northeastern China. When a debtor is unable to repay their debts, they inform a respected elder in the village to mediate and organize the ceremony. Apart from their residence, the debtor must sell all household assets except those essential for survival, convert the proceeds into pigs, and divide the pigs into portions corresponding to the number and claims of creditors. A respected figure then gathers the creditors, publicly declares the debtor’s inability to repay, and after the “large slice of meat” is consumed, the debts are forgiven, and promissory notes or contracts are destroyed.

3.2. The “large slice of meat” practice

In Qinghai, there exists a practice known as the “Wulan Daomo” debt repayment banquet. “Wulan” refers to interest or debt, while “Daomo” originally denotes a celebration or feast, but here it excludes celebratory connotations, combining to mean a banquet for settling debts ^[5]. If the debtor is found to have concealed or transferred assets after the bankruptcy, creditors may reclaim their claims, effectively preventing malicious debt evasion. The debtor notifies creditors orally or in writing before hosting the banquet, explains their financial situation under oath, and, if lacking credibility, invites a respected village elder to witness.

3.3. The “prosperity pledge”

In regions like Hebei and Anhui, there exists a custom called the “Prosperity Pledge as a Debt Suspension Agreement.” Typically, from the day the insolvent debtor signs the pledge, creditors return promissory notes or bills and cease calculating interest, allowing repayment only after the debtor regains prosperity. This practice, akin to debt deferral, embodies forgiveness and trust, granting time for the debtor to “rise again.” It resembles bankruptcy reorganization procedures and aligns with Article 46 of China’s current Enterprise Bankruptcy Law, which halts interest accrual upon bankruptcy application acceptance.

4. Insights from Folk “bankruptcy” customary law and the Shenzhen individual bankruptcy regulations for building a Chinese-style personal bankruptcy system

4.1. The dishonesty penalty and restraint mechanism

Folk “bankruptcy” customary law does not unconditionally tolerate debt discharge. Instead, many provisions impose restrictions on bankrupt individuals. For instance, in the debt repayment banquet, debtors must swear to the truth of their financial status, often with a respected third party vouching for its accuracy and ensuring fair procedures. Falsehoods tarnish the third party’s reputation more severely than the debtor’s, leaving lasting stains on their personal and family records. Such customs rely on social scrutiny and reputational pressure to underwrite creditor actions.

The Shenzhen Individual Bankruptcy Regulations mandate that debtors submit income, social security, and asset details when applying for bankruptcy. Article 103 allows creditors to petition courts to revoke debt discharge if fraud is detected. These provisions mirror folk customs by penalizing dishonesty and deterring malicious evasion ^[6].

4.2. The property exemption system

4.2.1. Retention of essential assets

The “large slice of meat” ceremony reserves livelihood assets; debt repayment banquets may return some property;

some regions spare debtors' homes. Such exemptions ensure basic survival, allowing societal "necrotic cells" to regenerate.

4.2.2. Creditor concessions and partial discharge

To balance interests, ceremonies like the debt repayment banquet and "large slice of meat" fairly distribute available assets after confirming the debtor's inability and lack of evasion intent, forgiving unpayable debts. This limited discharge protects creditors by preventing excessive pressure that might trigger asset mismanagement or waste, instead recycling resources efficiently.

4.2.3. The "bankruptcy discharge" concept and credit system development

Folk "bankruptcy" customary law thrives as "soft law" rooted in China's acquaintance ethics, enabling fairness, honesty, and limited liability. As market economies shift China from "relationship-based credit" to "contract-based credit", traditional credit systems struggle to adapt ^[7].

5. Conclusion

Against traditional unlimited liability models, personal bankruptcy introduces a humane, market-rational debt resolution paradigm. Unlike exhaustive creditor claims, it frees "honest but unfortunate" debtors to restart their lives while letting creditors efficiently settle claims without futile efforts ^[8].

China's folk debt practices, blending "reason, sentiment, and law", offer vital localization bridges. These rural society mechanisms buffer the transition to modern credit systems. The Shenzhen Regulations pilot provides a blueprint, curbing systemic risks while incentivizing revival, fueling innovation, and harmonizing individual and societal interests.

The reason why the folk "bankruptcy" customary law, this "soft law", can be well implemented is that it is deeply rooted in the "acquaintance" ethics of the Chinese local environment. On this basis, values such as fairness, honesty, and liability limitation can be spread and practiced. Under the tide of the market economy, the transformation and transition of the social structure have made it difficult for China's traditional credit system to adapt to the modern market economy in a short time. Against the backdrop of the traditional debt collection model adhering to the principle of unlimited liability, the "debt discharge" system has created a new debt disposal model that combines humanistic care and market rationality. Compared with the "draining the pond to catch all the fish" style of creditor's rights pursuit, debtors can be relieved from their "honest but unfortunate" predicament and start a normal life and work again; creditors can more fully and effectively realize and settle their creditor's rights under the personal bankruptcy system of debtors, without wasting too much time and energy on debtors who are actually insolvent.

Regarding the future income of debtors, the wisdom of "integration of emotion, reason, and law" contained in the folk debt handling practices in China provides an important local connection point for the modern personal bankruptcy system. These debt settlement mechanisms that originated in rural society essentially constitute a buffer zone for the transformation from the traditional acquaintance society to the modern credit society. Currently, apart from the pilot in the Shenzhen Special Economic Zone, in March 2025, Xiamen became the second city to prepare to implement the personal bankruptcy regulations. For this reason, it is possible to organize experts, scholars and representatives from different regions or with deep knowledge of different folk customs to exchange

and discuss, sharing the development, characteristics, social functions and practical application of different personal bankruptcy customs, and striving to explore the integration points between folk customs and the current relevant systems. However, it is still necessary to clearly recognize that the construction of the “debt discharge” system cannot be rushed. The long-term and fundamental solution still lies in waiting for the improvement of the credit system and the elimination of the wrong culture and concepts in the personal bankruptcy view.

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References

- [1] Xu DF, 2011, On the Personal Bankruptcy Discharge System. *Peking University Law Journal*, 2011(4): 742–757.
- [2] Chen XH, 2021, The Bankruptcy Legal System in Modern China and Its Fate. *Tribune of Political Science and Law*, 2021(2): 66.
- [3] Weber M, 2004, *Confucianism and Taoism*. The Commercial Press, Beijing.
- [4] Nie J, 2020, Research on the Value of Folk Customs of Bankruptcy Repayment in the Perspective of Social Governance. *Hebei Law Science*, 2020(9): 213.
- [5] Dan LR, 2014, The Natural Person Bankruptcy System in Ancient Roman Law and the Tibetan “Potlatch” Custom—With Implications for the Construction of China’s Personal Bankruptcy System. *Chinese and Western Legal Traditions*, 2014(2): 190–211.
- [6] Li ZX, 2024, The Institutional Function of Personal Bankruptcy Discharge. *Journal of Central China Normal University (Humanities and Social Sciences Edition)*, 2024(1): 23–33.
- [7] Li PL, 2024, *The End of Villages: The Story of Yangcheng Village*. Life Bookstore Publishing Co., Ltd., Shanghai.
- [8] Wang XX, 2024, Conceptual Transformation and Institutional Support in Personal Bankruptcy Legislation. *China Journal of Applied Jurisprudence*, 2024(1): 71–81.

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A Comparative Study of Soft and Hard Facilities at Ski Resorts in China and the Republic of Korea

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Abstract: This study compares the soft and hard facilities of ski resorts in China and the Republic of Korea. In terms of hard facilities, some large ski resorts in the Republic of Korea feature advanced equipment such as cable cars, which are well-maintained, and offer diverse slope designs. In China, large ski resorts also provide a variety of slope types, including beginner, intermediate, advanced, and professional competition slopes, with hard facilities undergoing continuous upgrades and improvements. In terms of software facilities, the Republic of Korea's ski resorts have highly professional staff with a well-established training system, a wide range of support services, and strong foreign language reception capabilities; however, the professionalism and refinement of services at Chinese ski resorts still need to be strengthened. Through this comparison, insights can be gained to optimize China's ski resort facilities and promote the development of the winter sports industry.

Keywords: China; Republic of Korea; Ski resorts; Hardware and software facilities; Comparative study

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1. Introduction

With the global popularity of winter sports, both China and the Republic of Korea are actively developing their ski industries, leveraging their geographical and climatic advantages. The hardware and software facilities of ski resorts not only impact visitor experience and safety, but also influence the promotion of skiing and the improvement of competitive levels. This paper conducts a comparative analysis of the hardware facilities (such as ski runs, cable cars, snowmaking systems, etc.) and software facilities (such as services, management, training, etc.) of ski resorts in China and the Republic of Korea, aiming to provide references for the optimization and upgrading of ski resorts in the two countries ^[1].

2. Comparison of natural resources between ski resorts in China and the Republic of Korea

The northeastern region of China and the Republic of Korea share many similarities in climate and terrain, with abundant natural resources for skiing, making them parts of the “snow and ice golden latitude belt” for skiing tourism^[2]. The winter snow season is relatively long, with abundant snowfall and deep snow accumulation, lasting 80–150 days. Based on the soft and hard facilities, service functions, and target customer base of ski resorts, they can be classified into three categories: advanced, intermediate, and beginner^[3–4].

A high-end ski resort refers to one that offers a complete range of advanced, intermediate, and beginner ski slopes, diverse routes, high-quality cable cars that complement the slopes, high-standard and sufficient quantities of ski equipment, ski instructors, star-rated hotels, and various recreational facilities. Such ski resorts have multiple integrated functions, including ski training, competitions, and ski tourism, and can fully meet the diverse needs of athletes, coaches, and domestic and international tourists, making them capable of hosting international events. Currently, China’s advanced ski resorts include Yabuli in Heilongjiang Province and Beidahu in Jilin Province, accounting for approximately 10% of the total number of ski resorts nationwide. The Republic of Korea’s advanced ski resorts include Yongpyong and Muju, accounting for approximately 20% of the total number of ski resorts nationwide^[5].

Intermediate ski resorts refer to those that feature advanced, intermediate, and beginner slopes, ample ski equipment, high-standard facilities, and corresponding hotels and recreational amenities, capable of meeting the skiing needs of athletes and domestic and international tourists. Examples include Erlongshan, Jihua, and Changchun Jingyue Lake ski resorts in Heilongjiang Province, China, which account for approximately 20% of the total number of ski resorts nationwide. The Republic of Korea’s Yongshengniao, Daming, Xingyu, and ALPS ski resorts account for approximately 60% of the total number of ski resorts nationwide^[6].

Beginner-level ski resorts refer to those with small scales, low standards, rudimentary facilities, and incomplete functions, capable of providing skiing services only for beginners. Approximately 70% of China’s ski resorts are beginner-level, while the Republic of Korea has only 20% of such resorts.

Comparing ski resorts in China and the Republic of Korea, the Republic of Korea has fewer ski resorts, but they are mostly advanced and intermediate-level resorts. With the successful hosting of the Beijing Winter Olympics, the number of ski resorts in China has surged in recent years, far exceeding the Republic of Korea, with an increasing number of ski resorts being developed annually.

3. Comparison of hardware facilities between China and the Republic of Korea ski resorts

3.1. Ski trail design and scale

3.1.1. China ski resorts

Diverse slope types: Large Chinese ski resorts, such as the Zhangjiakou Chongli Taiwu Ski Resort and the Jilin Vanke Songhua Lake Ski Resort, emphasize slope diversity, offering beginner, intermediate, advanced, and professional competition slopes suitable for visitors of all skill levels.

Advantage of long slopes: Some ski resorts feature longer slopes with straight routes, gentle gradients, and open vistas, ideal for speed-oriented skiers and athletes engaged in high-speed, large-radius turns for competitions and training.

3.1.2. Republic of Korea ski resorts

Scale and professionalism: Large-scale Republic of Korea ski resorts (such as the Busan Yangyang Ski Resort and the Gangwon Province Yongpyong Ski Resort) are renowned for their extensive ski runs, offering a wide variety of run types, wider run widths, and more uniformly designed slopes, with numerous international standard runs. Their run designs cater to the needs of skiers of all levels with a natural transition from gentle beginner runs to steep advanced runs. They are suitable for both international competitions and family tourists and beginners.

Terrain utilization: Republic of Korea ski resorts are often built on mountainous terrain with significant elevation differences between slopes (e.g., the maximum elevation difference at Yongpyong Ski Resort reaches 700 meters), making them ideal for advanced skiers seeking challenges.

3.2. Lifts and transportation facilities

3.2.1. China ski resorts

Quantity and types: Large ski resorts have advanced cable car facilities, such as the Chongli Yunding Ski Resort, which has introduced detachable gondola lifts to enhance capacity, comfort, and safety. Some ski resorts also have various types of magic carpets to facilitate beginners' access to and from low-slope areas. However, overall adoption rates remain limited. Some medium-sized and small ski resorts may have relatively basic transportation facilities, with limited cable car capacity and a small coverage area for magic carpets.

3.2.2. Republic of Korea ski resorts

Widespread adoption of high-speed, comfortable cable cars: Republic of Korea ski resorts are renowned for their efficient and comfortable cable car systems. Most Republic of Korea ski resorts are equipped with high-speed cable cars, which offer strong capacity and short waiting times, making them ideal for peak-hour passenger flows. For example, the cable cars at Busan Yangsan Ski Resort not only accommodate a large number of visitors but also feature cabin designs that prioritize passenger views and comfort, allowing riders to enjoy the surrounding scenery during their journey.

Indoor cable cars: Large Republic of Korea ski resorts have installed cable cars in indoor waiting areas (e.g., Gangwon-do Ski Resort), significantly enhancing the visitor experience and reducing discomfort caused by cold weather and queuing.

3.3. Snowmaking and snow preservation management

3.3.1. China ski resorts

Snowmaking capacity: The snowmaking systems of large ski resorts are becoming increasingly sophisticated, with many resorts introducing advanced snowmaking machines from abroad to ensure sufficient snow depth on slopes even when natural snowfall is insufficient ^[7].

Snow conservation facilities: In addition to basic measures, such as windbreak nets, some ski resorts have begun constructing indoor ski halls or using insulation membranes to reduce snow melting.

3.3.2. Republic of Korea ski resorts

Efficient snowmaking systems: Republic of Korea ski resorts have also developed mature snowmaking technology. They generally use imported snowmaking equipment (such as Italian Prinoz systems), which are highly efficient and emphasize integration with the natural environment to ensure uniform snow quality. They strategically deploy snowmaking machines based on terrain and climate conditions to achieve efficient snowmaking operations.

Snow preservation facilities: The Republic of Korea fully leverages its cold winter climate advantage, combined with scientific site planning, such as locating ski runs in wind-protected areas to reduce snow preservation pressure. Additionally, advanced geothermal insulation technologies are employed to assist in snow preservation.

Precision management: Snow groomers are equipped with GPS navigation and intelligent scheduling systems, ensuring high-frequency snow maintenance, which results in smoother and safer ski runs.

3.4. Supporting facilities

3.4.1. China ski resorts

Basic services and accommodation transportation: Large ski resorts are equipped with rental centers, dining areas, and rest areas, with surrounding hotels and transportation infrastructure gradually improving, such as the direct high-speed rail connection from Chongli High-Speed Rail Station to the ski resort. However, some facilities have insufficient capacity, potentially leading to queues during peak periods.

Ski Equipment Rental: Rental centers at large ski resorts offer a variety of brands and models of ski equipment, with professional staff assisting visitors in selecting suitable gear. However, rental equipment at some medium and small ski resorts may not be updated promptly, and even its quality may vary ^[8].

3.4.2. Republic of Korea ski resorts

Full-service amenities: Republic of Korea ski resorts emphasize “one-stop” services, offering comprehensive amenities from ski equipment rental and dining to hot springs and shopping, with high service quality. Major ski resorts (such as Yangyang and Yongpyong) are adjacent to highways and high-speed rail stations. Some resorts provide free shuttle buses to facilitate visitor access.

Ski equipment rental: The rental process at the Republic of Korea ski resorts is more standardized and professional. The equipment is well-maintained and precisely matched to visitors’ height and weight, with detailed usage instructions and safety guidelines provided.

4. Comparison of software facilities between China and the Republic of Korea ski resorts

4.1. Service and management

4.1.1. China ski resorts

Service attitude and safety management: The service awareness of staff at Chinese ski resorts has improved significantly, with the ability to provide basic guidance and instruction to visitors, as well as professional rescue teams and monitoring systems. However, during peak tourist seasons, due to the large number of visitors, there may be issues with delayed service responses and insufficient foreign language service capabilities ^[9]. Some smaller ski resorts have inadequate safety signage and insufficient guidance for beginners.

4.1.2. Republic of Korea ski resorts

Standardized service and safety management: Republic of Korea ski resorts have highly standardized service processes, providing comprehensive care from the moment visitors enter the resort. Staff members have undergone professional training. English and Chinese language services are widely available. For example, at Yongpyong Ski Resort, staff proactively assist visitors with luggage handling and answer questions. There are also dedicated

personnel on the slopes to maintain order and ensure safety. The slopes are zoned, with dedicated safety officers and electronic monitoring systems in place. Emergency response times are swift, enhancing visitors' sense of security.

4.2. Training and guidance

4.2.1. China ski resorts

Instructor resources: Large ski resorts have professional ski instructor teams, but their fees are relatively high, and the qualifications of some instructors vary. Small ski resorts primarily select instructors from residents and skiing enthusiasts with good skiing skills for basic training. There is an imbalance between supply and demand for skiing social instructors, whose capabilities need improvement.

Training system: Some ski resorts collaborate with training institutions to offer youth skiing courses, but the reach is limited, while the professional standards have not been rigorously evaluated.

4.2.2. Republic of Korea ski resorts

Professional training: Republic of Korea ski resorts generally establish skiing schools offering graded instruction (e.g., beginner, intermediate, and children's classes), with certified instructors and standardized teaching systems.

Low-cost experiences: Some ski resorts offer "trial lesson packages" to lower the barrier for beginners to try skiing, promoting widespread participation.

4.3. Information technology and intelligence

4.3.1. China ski resorts

Online services and data management: Large ski resorts provide functions such as reservations, navigation, and real-time weather updates through mini-programs or apps, but intelligent applications (such as facial recognition and unmanned rentals) are still in the pilot phase^[10]. Some ski resorts have begun collecting visitor data but have not yet established a comprehensive user profiling system or precise marketing framework.

4.3.2. Republic of Korea ski resorts

Smart skiing and data analysis: Republic of Korea ski resorts have fully embraced intelligent services, such as unmanned equipment rentals, AI-powered slope monitoring, and real-time queue status checks via mobile apps, to enhance visitor experiences. They optimize operations through membership systems and consumption data, such as dynamically adjusting cable car capacity and precisely targeting promotional offers.

5. Comparison, summary, and recommendations

5.1. Advantages and shortcomings

5.1.1. China ski resorts

Advantages: Large-scale and diverse ski trails; large-scale ski resorts are gradually aligning their hardware facilities with international standards; under the support of national and local policies, transportation and accommodation infrastructure have improved significantly.

Shortcomings: Small and medium-sized ski resorts have outdated facilities and limited intelligent service capabilities; service standards and safety management require further standardization.

5.1.2. Republic of Korea ski resorts

Advantages: Highly refined and intelligent infrastructure, mature service systems, and extensive international experience.

Disadvantages: Some ski resorts are limited in scale, with slope designs geared toward mass appeal and few specialized competition venues.

5.2. Development recommendations

5.2.1. China Ski Resorts

Enhance intelligent levels: Promote technologies, such as unmanned rentals and AI monitoring, to optimize visitor experiences.

Strengthen service standardization: Establish national unified service standards for ski resorts and enhance foreign language service capabilities.

Promote regional collaboration: Integrate surrounding tourism resources (such as hot springs and homestays) to create an integrated ice and snow cultural tourism complex.

5.2.2. Republic of Korea ski resorts

Expand professional slopes: Increase advanced slopes and competition venues to attract international events and professional visitors.

Deepening cooperation with the Chinese market: Collaborate with Chinese ski resorts on joint promotions (such as mutual recognition of tickets and coach exchanges) to share customer resources and technical expertise.

6. Conclusion

Ski resorts in China and the Republic of Korea each have unique strengths in terms of hardware facilities. The Republic of Korea leads in terms of refined management and intelligent services, while China has greater potential in large-scale slopes and scaled development. In terms of software facilities, the Republic of Korea's standardized service and training systems are worth learning from. In the future, the two countries can collaborate through technical exchanges, customer base sharing, and joint marketing to jointly promote the upgrading of the skiing industry and provide a model for the global development of winter sports.

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References

- [1] Kan JC, Jiang LJ, 2013, A Comparative Study of the Soft Power of Winter Sports in China and the Republic of Korea. *Journal of Shenyang Institute of Physical Education*, 32(1): 125–128.
- [2] Kim BS, Wang FD, Li QW, 2007, A Comparative Study of Ski Resort Access Systems in China and the Republic of Korea. *Journal of Beijing Second Foreign Studies University*, 2007(5): 67–72 + 9.
- [3] Wu LL, Yin RC, Chen ZJ, et al., 2012, Analysis of the Influencing Factors of Enterprise Ecological Management Strategies: A Case Study of Ski Resort Enterprise Management. *Resource Development and Market*, 28(10): 934–937

+ 903.

- [4] Yang LH, Dong L, 2021, The Impact of the Wanlong Ski Resort in Datong City on Mass Skiing. *Journal of Shanxi Datong University (Natural Science Edition)*, 37(3): 90–92.
- [5] Zhang DC, 2004, Cooperation and Development of Ski Tourism Among China, Japan, and the Republic of Korea. *Ice and Snow Sports*, 2004(5): 35–38.
- [6] Yang LH, Dong L, 2021, The Impact of the Wanlong Ski Resort in Datong City on Mass Skiing. *Journal of Shanxi Datong University (Natural Science Edition)*, 37(3): 90–92.
- [7] Yang LH, Dong L, 2021, The Impact of the Wanlong Ski Resort in Datong City on Mass Skiing. *Journal of Shanxi Datong University (Natural Science Edition)*, 37(3): 90–92.
- [8] Lyu C, Wang S, Yao XL, 2013, A Study on the Construction Models of Overseas Alpine Ski Resorts. *Journal of Harbin Institute of Physical Education*, 31(6): 34–39.
- [9] Yang LH, Dong L, 2021, The Impact of the Wanlong Ski Resort in Datong City on Mass Skiing. *Journal of Shanxi Datong University (Natural Science Edition)*, 37(3): 90–92.
- [10] Yan LL, Du P, 2014, Investigation and Countermeasures on the Safety Conditions of the Chongli Ski Resort. *Sports and Cultural Goods and Technology*, 2014(22): 17 + 19.

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Application of Tourism Gaze Theory in Tourism Planning

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Abstract: The theory of tourist gaze is a crucial tool for understanding tourists' visual experiences and viewing methods, with profound implications for tourism planning. This paper, based on an in-depth analysis of the theory of tourist gaze, focuses on extracting key practical points related to tourism planning, aiming to promote high-quality development in the tourism industry.

Keywords: Gazing theory; Tourism planning; Application practice

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1. Introduction

In the process of high-quality development of tourism, the development of tourism projects and products, the shaping of tourism brand and image, and the implementation of tourism marketing strategies are all crucial, and tourism planning plays a pivotal role in this process. How to fully and effectively utilize tourism planning-related theories to deeply explore the needs and preferences of tourists and promote the innovative, coordinated, green, open, and shared development of tourism has become an important proposition of this paper. Gazing usually refers to watching something or someone intently, for a long time, without blinking, showing a deep, concentrated, or thinking manner. In 1990, British sociologist Urry first proposed the concept of "tourism gaze", and gradually developed it into a crucial theoretical and analytical tool in the field of anthropology of tourism and tourism culture research. It has gradually developed into a crucial theoretical analysis tool in the field of tourism anthropology and tourism culture research^[1]. According to this theory, the tourism gaze represents tourists' observation and scrutiny of tourism destinations, which implies a potential claim of power exerted by tourists on tourism destinations and their residents. The tourism gaze theory not only reveals the interactive relationship between tourists and destinations, but also provides new perspectives and ideas for actual tourism planning, i.e., understanding and shaping tourism products through tourists' visual experiences and ways of seeing. Therefore, based on the tourism gaze theory, this paper discusses in depth the application strategies and methods of the tourism gaze theory in tourism product development, marketing activity planning, and tourism destination image shaping, so as to provide useful references and lessons for

the high-quality development of the tourism industry and the related practice of tourism planning.

2. Research review

2.1. Tourism gaze-related research

As a method and tool for examining social behavior from a tourism perspective, the study of tourism gaze theory is of great significance to the high-quality development of the tourism industry and tourism planning research^[1]. The main achievements include the following points. First, development and review studies of tourism gaze theory, where Liu Danping mainly traced the development process of tourism gaze theory and focused on analyzing the unique insights of different scholars^[2]; Scholar Cheng Hai emphasized the multidimensional characteristics of tourism gaze theory, specifically the bidirectional gaze between subject and object^[3]; Li Laryang conducted a critical analysis of tourism gaze theory^[4]. Second, Research on specific case sites based on tourism gaze theory, such as scholar Liu Yuxiao selecting Tianmu Moon Village in Hangzhou, Zhejiang as a case site, using ROST network text analysis to conduct an in-depth analysis of the tourism image projection and perception of the area^[5]; Scholar Wang Tianying used a combination of quantitative and qualitative methods to focus on the gaze behaviors of tourists and hosts in Huizhou villages, representing Huizhou culture^[6].

2.2. Tourism planning-related research

Tourism planning refers to the use of creative thinking as a means to conduct in-depth analysis of resources and markets based on a region's unique natural or cultural resources, aiming to achieve a rational and optimized allocation between resources, environment, transportation, and market, thereby realizing the predetermined goals of tourism development plans^[7]. Currently, there is a lot of research on tourism planning, but a lack of high-quality literature references. Most studies focus on case studies of tourism planning, including research on the tourism image planning of a specific location, tourism product planning, tourism project planning, and tourism marketing planning^[8–11]. Scholar Wang Yaming used the SWOT analysis method to plan and study the tourism festivals and marketing in Yuhang District, Hangzhou^[12]; Long Yuping conducted an in-depth study on the water cultural tourism resources in the Xiangyang area along the Han River, proposing a planning scheme and innovative ideas for building a water cultural tourism brand image^[13].

2.3. Development status of tourism planning based on tourism Gaze theory

If people view tourists' travel activities as a process of collecting and gazing at symbols, then the on-site work of tourism planners is to extract, integrate, and construct these symbols. Under the principle of market orientation, the development of tourism products and the creation of a tourism atmosphere should focus on meeting tourists' gaze preferences. Therefore, tourism planners need to start from the perspective of tourists, understand and grasp their psychological needs to extract and integrate symbols, thereby creating objects that can attract tourists' gazes^[14]. Currently, there are differing views in academia regarding the impact of tourism gaze theory on tourism planning, which generally include positive and negative effects. On the positive side, many scholars have conducted relevant research based on tourism gaze theory, such as how different gaze subjects perceive Luoyang's tourism image and how tourism resources are developed^[15–16]. For example, scholar Miao Panpan explored the differences in perceptions of Luoyang's tourism image among various gaze subjects based on tourism gaze theory^[17]. On the negative side, according to scholar Huang Dongmei, current tourism planning faces three main challenges: tourist gaze, planner gaze, and government gaze. These include the dominance and inequality inherent in the tourist gaze,

excessive accommodation of tourists' gaze needs by planners, and interference and restrictions imposed by the government gaze on the planner gaze. These phenomena lead to issues such as the homogenization of attractions and cultural commodification ^[18].

3. The application of tourism gaze theory in tourism planning

3.1. Tourism planning practice based on the characteristics of tourism gaze

According to previous studies, tourism gaze has the following six properties, including reverse life, dominance, variability, symbolism, sociality, and inequality ^[19]. This paper extracts the principles that tourism planning should have when applying tourism gaze theory according to the above properties.

First, pay attention to the gaze of tourists. The variability of tourist gazes leads to different motivations and preferences among visitors from various periods or regions. Tourists' gaze preferences can be influenced by multiple factors such as cultural background, aesthetic views, and personal interests. In tourism planning, it is essential to promptly understand tourists' gaze preferences through market research and other methods, in order to better meet their needs.

Second, create gaze symbols. Tourism gazing is often closely linked to symbolization, where tourist attractions are simplified into a few distinctive symbols to meet visitors' gazing needs. Tourism planning should cater to visitors' gazing preferences, integrating local culture, history, and natural resources to create unique representative landscapes. This allows visitors to accurately capture these gazing symbols through their gazes and widely disseminate them via photography and other means.

Third, make full use of media to innovate gaze points. The gaze of tourists is the result of multiple factors, including social and cultural background, tourism promotion, media portrayal, and personal experiences and memories, which collectively construct a socially constructed expectation of the travel destination. Tourism planning should focus on the social characteristics of tourist gazes, understand tourists' expectations and needs, provide tourism products and services that meet their expectations, and continuously innovate gaze points.

3.2. Tourism planning practice based on tourism gazing stages

According to the research of scholar Chen Chen, the process of tourism gaze can be divided into three stages: pre-field gaze, presence gaze, and departure gaze, according to the different stages of tourism activities ^[20].

First, pre-field gaze refers to a psychological state and behavior in which tourists, before arriving at a tourist destination, collect and receive various images and information about the destination through various channels (such as tourist brochures, movies, TV, the Internet, etc.), and then form expectations and preconceptions about the destination in their minds. Pre-field gaze is an important part of the tourism experience, which can not only influence tourists' tourism planning and decision-making, but also provide tourists with important references and expectations in the process of field tourism. Therefore, in tourism marketing and promotion, it is important to make full use of the effect of tourism pre-field gaze to provide rich, accurate, and attractive tourism information and images to attract tourists and enhance the popularity and attractiveness of tourist destinations.

Second, presence gaze is a kind of focused and in-depth perception and experience of the tourist destination through vision by tourists in tourism activities. This kind of gaze is not only simple to watch, but also a kind of in-depth understanding and experience of local culture, society, history, and other aspects, which has the characteristics of initiative, depth, and emotion. Tourism presence gaze has certain revealing significance for tourism planning: on the one hand, it is necessary to deeply understand the needs of tourists. Tourism planners

need to deeply understand the needs and expectations of tourists, including what they want to see and experience, as well as their expectations and preconceptions of the tourist destination. On the other hand, it is necessary to focus on cultural depth excavation. Tourism planners need to focus on the cultural depth of excavation, the cultural elements of the destination in the design of tourism products, so that tourists can more deeply understand and experience the local culture in the tour process. In addition, it is necessary to utilize scientific and technological means to innovate the tourism experience. With the development of science and technology, virtual reality (VR), augmented reality (AR), and other new technologies in the field of tourism are more and more widely used. These technologies can provide tourists with a more realistic and vivid tourism experience, making them feel as if they were in the destination.

Third, departure gaze is a concept relative to tourism presence gaze, which is a continuation and deepening of tourists' tourism experience. After leaving the tourist destination, tourists may review, reflect, and gaze on the behavior of what they have seen and experienced during the tourism process through reminiscing, sharing and writing travelogues. Although this kind of gaze occurs after tourists leave the destination, it still has an important impact on tourists' tourism experience and memory, and this kind of gaze not only helps tourists to consolidate and deepen their knowledge of the destination, but also helps them to better understand and experience the cultural impact and emotional resonance brought by tourism. For tourism planners, focusing on the characteristics of tourism departure gaze helps them to better design and optimize tourism products, and enhance tourists' satisfaction and loyalty. This includes focusing on the continuity of the tourism experience, strengthening the dissemination of tourism culture, and improving the quality of tourism services.

4. Conclusion

Effective tourism planning is an important way to enhance the tourism experience, strengthen the attractiveness of the destination, and promote the development of the tourism economy. As a theory that reveals the inner mechanism of tourists' visual behavior, tourism gaze research can help tourism planners to deeply understand tourists' visual needs and expectations, enhance the attractiveness and competitiveness of tourism products, and promote the sustainable development of tourism destinations. This paper analyzes the development status of tourism gaze theory and its application in tourism planning, specifically analyzing tourism gaze behavior from the characteristics of tourism gaze and the stages of tourism gaze, and extracts the key points that can be used for tourism planning, hoping to provide help for actual tourism planning.

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References

- [1] Wu MY, 2012, Travel Gaze: Comments and Outlook. *Journal of Tourism*, 27(3): 107–112.
- [2] Liu DP, 2007, Travel Gaze: From Foucault to Errie. *Journal of Tourism*, 2007(6): 91–95.
- [3] Cheng H, 2011, A Multi-dimensional Interpretation of the “Tourist Gaze” Theory. *Journal of Taiyuan City Vocational and Technical College*, 2011(1): 68–69.
- [4] Li LY, 2015, Travel Gaze: Reflection and Reconstruction. *Journal of Tourism*, 30(2): 118–126.
- [5] Liu YX, Zhang JG, 2021, A Comparative Study of Tourism Image Projection and Perception of Village Scenic Spots Based on Gaze Theory — Take Tianmu Moon Township, Hangzhou, Zhejiang Province as an Example. *Journal of Southwest University (Natural Science Edition)*, 43(5): 18–26.
- [6] Wang TY, Lu L, Lu XF, 2015, The Gaze Behavior of Tourists and Hosts in Huizhou Village Tourism. *Journal of Tourism*, 30(4): 23–32.
- [7] Xu ZS, 2015, *Creative Creativity and Planning of Tourism Culture (First Edition)*. Peking University Press, Beijing, 19–20.
- [8] Chen SM, Li Y, 2021, Study on Haifeng Lianhuashan Tourism Image Planning. *China market*, 2021(3): 30–31 + 35.
- [9] Yang YH, 2023, Research on the Development Planning of Tourism Cultural and Creative Products—Taking Lijiang City of Yunnan Province as an Example. *Western Tourism*, 2023(6): 72–74 + 78.
- [10] Cao Z, Du L, Qi YC, et al., 2021, Online Promotion Planning Scheme of “Hometown” Tourism Project. *Marketing industry*, 2021(20): 6–7.
- [11] Gao F, 2022, Research on the Planning of Eco-agricultural Tourism Marketing. *Journal of Nuclear Agriculture*, 36(1): 246–247.
- [12] Wang YM, Yao HQ, 2012, Research on Tourism Festival Planning and Marketing based on SWOT Analysis — Take Yuhang District of Hangzhou City as an Example. *Zhejiang Academic Journal*, 2012(3): 155–159.
- [13] Long YP, Zhang ZW, 2013, Brand Image Planning and Creative Research of Xiangyang Section of Hanjiang River. *Hubei Agricultural Science*, 52(8): 1979–1982.
- [14] Cheng H, 2010, Sweet sorrow — Travel Gaze Theory New Thinking. *Heihe Academic Journal*, 2010(12): 13–14.
- [15] Wang LH, Zhou SK, 2024, Research on the Image Construction of Xiantan Mountain Hot Spring Town in Zaozhuang under the Tourism Gaze Theory. *Journal of Xingtai Vocational and Technical College*, 41(4): 95–101.
- [16] Wei XL, Wang Y, 2023, Research on the Development of Rural Tourism Resources under the Background of Common Prosperity Based on the Theory of Tourism Gaze. *Journal of Zhejiang Agricultural Sciences*, 35(8): 1950–1959.
- [17] Miao PP, 2023, Analysis of Luoyang Tourism Image from the Perspective of Tourism Gaze. *Beauty and The Times (City Edition)*, 2023(11): 89–91.
- [18] Huang DM, He XH, Luo MC, 2015, Tourism Gaze: The Dilemma of Tourism Planning. *Times Agricultural Machinery*, 42(4): 78–79.
- [19] Ba DX, Wang J, Lan H, 2009, Tourism Gaze and Cultural Changes in Ethnic Minority Areas. *Journal of Jiangxi University of Finance and Economics*, 2009(2): 112–116.
- [20] Chen C, Song CY, Li XJ, 2024, Deconstruction and Recognition of Visitor Gaze. *Journal of Tourism*, 39(8): 16–27.

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Research on the Innovation of Rural Food Tourism Development Model from the Perspective of Big Data: A Case Study of Guizhou Province

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Abstract: Digital cultural tourism has become the core driving force for promoting the high-quality development of rural food tourism in the new era, profoundly changing the supply side, demand side, and resource allocation pattern of rural food tourism. In the development practice of rural food tourism in Guizhou Province, in the face of the current situation and challenges, efforts should be made from three dimensions: big data cultural tourism, cloud computing cultural tourism, and Internet of Things cultural tourism. A new model for the development of rural food tourism with “big data, cloud computing, and Internet of Things” (referred to as “big cloud and Things”) as the core should be innovatively constructed. This will accelerate the digital transformation and upgrading process of rural food tourism.

Keywords: Food tourism; Digital cultural tourism; Big data cultural tourism

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1. Introduction

Gourmet tourism is a deep integration of food production and marketing with the tourist experience, and has an important impact on both supply and demand ^[1]. The supply side can design tourism facilities and products based on specialty food to stimulate consumption and promote the economy; the consumption side can promote the prosperity of multiple industries through tasting, experiencing, and participating. Combining specialties with sightseeing, health, and other resources to form tourism projects not only meets the needs of tourists but also helps to build brands, enhance competitiveness, and promote industrial prosperity.

Currently, digital technology has triggered changes, and the tourism industry is developing towards industrialization. The 20th Party Congress proposed to accelerate the construction of the digital economy and promote its integration with the real economy, marking the advent of the digital economy era. Digital literature and tourism have become the core engine to promote the high-quality development of tourism, and their deep integration with the cultural tourism industry, focusing on the contradiction between supply and demand in the

gourmet tourism industry chain, relying on digital technology to explore the integration of new ideas ^[2]. Therefore, innovating the development mode of gastronomic tourism from the perspective of digital cultural tourism is the key to meeting the demand for high-quality products and solving the problem of imbalance and insufficiency of regional development ^[3].

2. Literature review

Research on food tourism began with Belisle's exploration of the relationship between food and tourism in 1983 ^[4]. After 40 years of development, its connotation and extension have been continuously enriched. Under the comprehensive poverty alleviation and rural revitalization strategies in our country, rural food tourism has become a hot topic. The academic circle mainly focuses on its unique nature and development issues. The former analyzes the composition of value, proposes economic, tourism, and cultural significance, and summarizes regional, local, and experiential characteristics; The latter adopts methods such as models and empirical studies to analyze influencing factors and types of tourists, and proposes development strategies ^[5-9].

Since 2019, digital technology has been integrated with rural tourism, with research focusing on digital transformation, such as exploring the transformation path of ice and snow tourism under the digital economy, analyzing the characteristics of short videos related to rural cuisine, and putting forward development suggestions ^[10].

The existing research results have laid the foundation for constructing the development model, but there are deficiencies: the research perspectives are polarized, the theoretical basis is weak, and there is a lack of integrated and comprehensive research. The research methods mainly focus on qualitative and normative analysis, neglecting empirical analysis, and the progress in the application field is limited. Emphasis is placed on the application forms of digital cultural tourism, with insufficient theoretical support and analysis of digital models, which affects a comprehensive understanding.

3. A new picture of food development under the integration of culture and tourism with the digital economy

3.1. Supply-side innovation: Dual enhancement of quality and characteristics

The integration of culture and tourism with digital technology injects impetus into the food industry, promoting the advancement of quality and characteristics. Digital technology helps standardize and refine food production, pass on unique flavors, and ensure stable quality. For instance, smart cooking equipment enables time-honored brands to preserve their craftsmanship. Digital platforms broaden the channels for cultural dissemination, encouraging merchants to explore the cultural connotations of local delicacies and create regionally distinctive products. For instance, they can package snacks through short videos and other forms, transforming them into cultural experience supplies, enriching the value hierarchy, and enhancing competitiveness.

3.2. Consumption side transformation: Experience upgrade and demand release

The integration of culture and tourism with the digital economy enhances consumer experience and unleashes consumer demand. The popularization of online reservation, ordering, and electronic payment has optimized the dining process, making it convenient and efficient. For instance, mobile phone reservation for restaurants around scenic spots reduces queuing and enhance satisfaction. Digital cultural and tourism platforms have given rise to new forms of food tourism, stimulating the desire to explore. Tourists customize travel routes that include food

experiences, shifting from sightseeing to immersive cultural Tours. Their demands are personalized, scenarios are diversified, and the boundaries of consumption are expanded.

3.3. Resource allocation optimization: Precise matching and coordinated development

The integration of culture and tourism with digital technology enables precise matching of food resources with market demands and promotes the coordinated development of the industry. Big data analysis provides merchants and enterprises with market profiles, helps them grasp demand trends, and enables targeted research and development, site selection, and promotion. For instance, based on big data, they can launch healthy and creative delicacies to enhance resource utilization. The digital economy promotes the integration of the food industry with the upstream and downstream of the cultural and tourism industry chain. The food supply side is promoted through e-commerce and logistics, while cultural and tourism activities integrate food with cultural festivals, creating brand effects. Through resource sharing and complementary advantages, it drives a virtuous cycle of the regional economy.

4. Analysis of the current situation of food tourism development in Guizhou

4.1. Current situation of food development in Guizhou

Guizhou cuisine is rich in variety, featuring regional and ethnic characteristics, unique flavors, and abundant ingredients. However, the degree of development needs to be improved: The national popularity and market influence are limited, the brand construction lags behind, there is a lack of widely influential brands, most stores operate independently, with small and scattered scales, making it difficult to form an agglomeration effect and a standardized system, which restricts market expansion. The product innovation is insufficient and has not fully combined with the diverse demands of modern consumers. Its appeal needs to be enhanced.

4.2. Development model of rural food tourism in Guizhou

4.2.1. Traditional development mode

Mainly based on farmhouses, its advantages lie in the original flavor and increasing residents' income. However, its limitations include uneven service quality, weak marketing capabilities, and insufficient resource development.

4.2.2. Development of characteristic tourism routes

“Food + Ancient Towns” (such as Qingyan Ancient Town): It combines history and cuisine, but lacks sufficient transportation connections and depth of experience.

“Cuisine + Ethnic Customs” (such as Xijiang Thousand Households Miao Village): It showcases diverse cultures, but the products are monotonous (mainly for tasting), lacking the experience of making and cultural exploration.

However, there are problems with the characteristic tourism routes: the transportation convenience is not closely connected with the routes, the road conditions of some sections are poor, and the public transportation facilities are incomplete, which affects the smoothness of the experience. The design of food tourism products is monotonous, mainly focusing on tasting, lacking in-depth participation, and experience projects. This fails to meet the needs of cultural exploration, limits participation and the depth of experience, and is not conducive to long-term development and brand building.

5. The dilemma and model innovation of Guizhou's food tourism development from the perspective of digital culture and tourism

5.1. The predicament of food tourism development in Guizhou

5.1.1. Information fragmentation and weak dissemination

The information about Guizhou cuisine is scattered and lacks systematic integration. Traditional small shops rely on word-of-mouth and have not promoted themselves through digital platforms. The introduction of the online platform is brief and fails to showcase the craftsmanship, cultural connotations, and stories, making it difficult to attract tourists. Businesses operate independently, lacking unified brand promotion and marketing collaboration. Their market voices are weak, which restricts their development potential.

5.1.2. Uneven quality of tourism services and difficulties in supervision

Tourists are confronted with the problem of unstable service quality. Some catering places have poor hygiene conditions and dining environments, and there are hidden dangers in food ingredients and tableware, which affect their experience and health safety. The professional quality and level of service personnel vary greatly. In rural areas, waiters lack service awareness and skills training, resulting in a poor experience. The stores are widely spread and scattered, making it difficult for regulatory authorities to conduct comprehensive and real-time supervision and management. There are products that do not meet quality standards, which harms the interests of tourists and the overall image.

5.1.3. The food and tourism products are monotonous and lack deep integration

Product development is still in its infancy. Most activities remain at the surface level of tasting, lacking in-depth integration and innovative design with culture, folk customs, natural resources, etc. Tourists rarely participate in making, picking, or learning about historical and cultural inheritance. Their experiences are monotonous and fail to meet diverse and personalized demands. Their stay is short, and their consumption potential has not been fully tapped, which is not conducive to the long-term construction and sustainable development of the brand.

5.2. Dilemma resolution and model innovation based on cloud computing, tourism, and the Internet of Things

5.2.1. Cloud computing for tourism-driven information integration and precise marketing

Build a Guizhou Food tourism cloud platform, integrate resource data (types, restaurants, evaluations), analyze tourists' behaviors through big data, and achieve personalized recommendations; Create immersive food scenes (such as virtual streets) using VR/AR to stimulate travel interest; Rely on the social functions of the platform to encourage tourists to generate content (UGC) and expand brand promotion.

5.2.2. Internet of Things empowering the improvement of tourism service quality and intelligent supervision

Apply Internet of Things (IoT) technology in food and tourism venues to achieve intelligent monitoring and management of the entire catering service process. The food supply link monitors environmental parameters and growth processes to ensure freshness and quality safety, and uses blockchain technology for traceability. Monitor the heat control, seasoning usage, and hygiene conditions in the catering processing stage, and handle abnormal alarms to enhance safety guarantees. Develop an intelligent training and management system for service personnel, record work performance and quality data, provide training suggestions and performance evaluations, and enhance

the service experience. Regulatory authorities, with the help of intelligent supervision platforms, conduct all-around and real-time supervision of the market, promptly handle violations and safety issues, and ensure the healthy and orderly development of the market.

6. Conclusion and research prospect

6.1. Research conclusions

The rural food tourism in Guizhou needs to achieve transformation by strengthening digital infrastructure (network coverage, cloud platforms, intelligent terminals), deepening digital marketing (social media integration, online activities), enhancing smart services (intelligent systems, talent cultivation), and promoting product integration (immersive experiences, cross-border business forms). Policy support, talent cultivation, and industrial synergy are the key guarantees.

6.2. Research prospect

From a technical perspective, VR/AR, blockchain, and other technologies will be further applied (such as food ingredient traceability and virtual cultural experiences). At the market level, personalized itineraries need to be customized based on big data. At the industrial level, promote cross-border integration such as “food + health preservation/education.” At the level of sustainable development, focus on ecological protection, cultural inheritance, and community participation to achieve the unification of economic, social, and environmental benefits.

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References

- [1] Zeng GJ, Lin JH, Wang LJ, 2023, International Progress and Implications of Food Tourism Research. *Food Research*, 40(1): 25–34.
- [2] Xu FF, He YM, 2021, New Opportunities, Challenges, and Ideas for the Innovative Development of Digital Culture and Tourism. *Tourism Tribune*, 36(7): 9–10.
- [3] Wan XM, 2022, Research on Digital Culture and Tourism Empowering High-Quality Development of Rural Tourism. *Rural Economy and Science & Technology*, 33(9): 107–110.
- [4] Belisle F, 1983, Tourism and Food Production in the Caribbean! *Annals of Tourism Research*, 10(4): 497–513.
- [5] Mo YZ, Li WQ, 2021, The Value of Rural Characteristic Cuisine in Rural Revitalization and Its Realization Path. *Journal of Nanning Normal University (Philosophy and Social Sciences Edition)*, 42(4): 11–18.

- [6] Wang YX, 2020, Analysis of Rural Food Tourism Development under the Background of Rural Revitalization Strategy: A Case Study of Conghua District, Guangzhou City. *Journal of Hubei Open Vocational College*, 33(24): 100–102.
- [7] Yang J, Hou ZY, Song X, 2022, Analysis of Influencing Factors on the Development of Food Culture Tourism under the Background of Rural Revitalization: An Empirical Analysis Based on the DEMATEL Model. *Rural Economy*, 2022(3): 101–109.
- [8] Zhang J, Hou B, 2018, Research on the Types and Characteristics of Rural Tourists from the Perspective of Food Tourism. *Food Research*, 35(2): 18–23 + 31.
- [9] Liu JL, 2016, Research on the Evaluation of Rural Food Resources and Tourism Development in Chengdu. *Food Research*, 33(2): 37–42.
- [10] Chen N, 2023, Research on the Transformation Path of Rural Ice and Snow Tourism Industry in Jilin Province under the Digital Economy. *Tourism Review*, 2023(3): 185–187.

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Exploration of Digital and Intelligent Empowerment in Food Safety and Quality Control

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Abstract: Food safety is closely related to people's lives, and people's health, life safety, and quality of life. Strengthening attention to food safety and quality control is not only the cornerstone of social harmonious development, but also the common expectation and pursuit of the people. With the deepening of the digital era, the rapid development of information technology provides new tools and means for food safety and quality control, and provides greater protection for people's lives and health. In this context, this paper will take digital intelligent technology as the entry point, food safety and quality control as the starting point and foothold, to explore the digital intelligent technology in the field of food safety and quality control of the specific application, practical significance and development trend, in order to use modern technical means to further ensure the safety and reliability of food.

Keywords: Digital intelligent; Food safety; Food quality control

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1. Introduction

With the rapid development of information technology, digital intelligence technology has shown more and more potential and a positive role in all walks of life, and also plays a positive role and influence in the food safety monitoring industry ^[1]. Digital intellectualization technology is widely used in food production, processing, circulation, sales, and other links, and plays a positive role in improving the efficiency and level of food safety and quality control. Food safety means that the food is non-toxic and harmless, and meets the nutritional requirements. Quality control refers to a series of requirements for food to meet regulations and standards, both of which are an important part of the food field, and digital intelligence empowerment brings unprecedented possibilities for it.

2. The specific application of digital intelligent empowerment in food safety and quality control

2.1. Artificial intelligence

Artificial intelligence technology shows great potential in various industries and is also a powerful tool for ensuring food safety and quality control ^[2]. The application of artificial intelligence technology in automated monitoring and intelligent analysis improves the monitoring efficiency of foreign bodies in food, quickly and accurately detects foreign bodies in food, and classifies and removes them, thus improving food safety. Artificial intelligence technology can also be applied to mechanical maintenance, through predictive maintenance, to reduce the failure rate of equipment and avoid equipment problems that lead to production interruptions and other problems. In addition, artificial intelligence technology has a unique value in intelligent decision-making and plays an important role in food safety risk assessment and early warning systems.

2.2. Big data

Big data analysis technology shows high value in food marketing. Through in-depth analysis of market trends and consumer behaviors, it can help enterprises adjust sales strategies and improve economic efficiency. Big data analysis technology can also accurately analyze product problems and optimize reform, in-depth analysis of food production, warehousing management, logistics, transportation, and other links, combined with other technologies for all-around adjustment and optimization, improve the comprehensive quality of products, to enhance product sales and consumer interest ^[3].

2.3. The Internet of Things

The application of Internet of Things technology in food safety and quality control is more extensive, covering production, processing, transportation, and other links, among which product circulation and tracking play a particularly positive role ^[4]. For example, fresh products have very strict requirements for transportation, and the temperature and humidity in transportation vehicles and warehouses are closely related to product safety and quality. Internet of Things technology can comprehensively monitor the transportation and storage environment, provide real-time feedback through the temperature and humidity sensor, and immediately issue an alarm when it exceeds the predetermined scope, reminding the staff to take corresponding measures to ensure that fresh food is not affected, thus maintaining food safety through accurate environmental control.

2.4. Blockchain

Blockchain technology, with its characteristics of decentralization and traceability, plays a key role in food safety traceability ^[5]. From the perspective of agricultural products planting and processing, the application of blockchain technology can comprehensively track the whole process of agricultural products planting, picking, processing, and sales to ensure the transparency and authenticity of information. Enterprises can use blockchain technology to trace the source, and in the event of food safety problems, quickly locate the source of the problem and take effective measures to provide technical support for quality control. Consumers can scan the two-dimensional code and bar code attached to the product to trace the source, production process and quality of the product, improve the understanding and trust of the product, but also can expand the traceability scope to the entire production line, to achieve information openness and transparency, improve the credibility of the enterprise ^[6]. At the same time, the blockchain is also immutable, which effectively avoids the risk of enterprises producing and manufacturing counterfeit and shoddy products, and further enhances the security of food safety and quality control.

3. The practical significance of digital intelligence empowerment in food safety and quality control

3.1. It is conducive to improving the efficiency of supervision

For example, in food safety supervision work, manual sampling inspection and screening are required, which inevitably leads to problems such as narrow coverage area, low efficiency, and large resource investment, making it difficult for food safety to be fully guaranteed. In addition, in the event of food safety problems, it is impossible to locate the source of the problem in a short period of time, which causes certain damage to the optimization and reform of enterprises and the rights and interests of consumers. The application of digital intelligence technology, such as the use of big data analysis, can optimize sampling strategy, improve sampling accuracy and coverage, and the application of artificial intelligence technology may achieve full coverage of product inspection, which greatly improves the reliability of food safety ^[7]. Technologies such as the Internet of Things and blockchain can quickly and accurately locate the source of problems, shorten the response time, help enterprises to optimize and reform in a timely manner, and also protect consumers' right to know and enhance their trust in products.

3.2. It is conducive to information sharing

The application of digital intelligence technology can connect all links and subjects of food safety in series, so as to realize information sharing more effectively and solve food safety problems ^[8]. From the perspective of food production, sales, and other links, digital intelligent technology strengthens the traceability link, so that consumers can intuitively see the source and production process of food, enhance information transparency, and provide protection for food safety. From the main body of food safety, relevant government departments, enterprises, and consumers can share information, jointly supervise the food production and circulation links, build a new pattern of food safety information co-construction, co-governance, and sharing, and improve the comprehensive effectiveness of food safety and quality control.

3.3. It is conducive to enhancing the management level

Digital intelligence technology can further refine the management of food safety, replace manual instability, eliminate human error as much as possible, and improve the efficiency and accuracy of food safety inspection. At the same time, it can also realize the comprehensive monitoring of all links in the food field, realize the whole process traceability from the source to the end, and comprehensively improve product quality ^[9]. In addition, artificial intelligence and other technologies can also accurately predict problems in the food production process, identify potential problems in advance, reduce the possibility of accidents, and ensure food safety and quality control.

4. The development trend of digital intelligence empowerment in food safety and quality control

4.1. Achieve technological innovation

The application of digital intelligent technology in food safety and quality control faces many uncertainties, as well as many problems and challenges at the level of technology development and implementation. For example, the accuracy, security and integrity of data have a great impact on digital intelligent technology; The quantity and variety involved in the food field, how to improve the compatibility of technology; The adaptability of digital intelligent technology upgrading and enterprise development and the cost challenges brought by it, etc.,

strengthen the application of technology and practical innovation has become the primary issue. With the rapid development of information technology, digital intelligent technology shows a development trend of integration and innovation. The comprehensive application of high-tech means such as artificial intelligence and big data provides new development ideas for improving the accuracy of food safety risk assessment and the accuracy of the early warning system, and is a powerful tool for food safety and quality control. Based on this, the relevant subjects responsible for technology research and development should recognize the importance of data, strengthen data security protection measures, ensure the safety and accuracy of data in the process of collection, transmission, storage, and use, and avoid data problems affecting the decision-making of food safety and quality control ^[10]. At the same time, technological innovation should take into account the compatibility and integration issues, for the complex process and many links in the food industry, the technical compatibility between different equipment and software, to develop standardized interfaces and protocols, in order to reduce the integration cost and complexity. Government departments should strengthen financial support for small and micro food enterprises to help them overcome financial difficulties, realize technological upgrading, and adapt to the development trend of digital intelligence technology.

4.2. Provide personalized services

Food safety issues involve multiple entities, and digital intelligence technology can meet the different needs of different entities, provide personalized services, and ensure food safety and quality control in an all-around, multi-level, and multidimensional way ^[11]. First of all, the enterprise level. The enterprise involves many links, such as food production, transportation, and storage, and the digital intelligence technology plays its own role in each link. Taking the cold chain transportation link as an example, fresh food has extremely high requirements for the preservation environment, especially in the summer high-temperature season, which is a huge challenge to the safety and preservation of fresh food. The importance of cold chain transportation is self-evident, and the application of digital intelligence technology plays a key role in product transportation and freshness preservation. Artificial intelligence technology and Internet of Things technology play a positive role in the intelligent development of cold chain transportation. Enterprises can realize real-time monitoring of transport vehicles through these technologies and make intelligent adjustments according to the sensitivity of products to temperature, humidity, etc., to ensure that the transportation link is adapted to the storage requirements of products ^[12]. At the same time, it can also use digital intelligence technology to strengthen the frequency of inspection of cold chain transportation, predict potential risks through data analysis, timely adjust the transportation plan, and ensure the quality and safety of food in transit. Secondly, the consumer level. Through blockchain tracking technology, with the help of two-dimensional code scanning technology, consumers can scan through mobile phones to watch product information in real time, improve the security and transparency of information, and enhance the trust of consumers and products. At the same time, artificial intelligence technology can also combine the needs of consumers, push the right food for them, and improve the consumption experience. Finally, at the level of regulatory authorities, digital intelligence can be used to improve the supervision of food enterprises and sales stores, relying on intelligent software for real-time monitoring, improve the visibility of supervision, detailed understanding of food production and store hygiene anytime and anywhere, to achieve remote monitoring and improve regulatory efficiency. In addition, an online information sharing platform can also be built to record the use of food additives in the production process, raw material procurement information, inventory temperature and humidity warning, etc., to urge enterprises to self-check and self-correct in a timely manner ^[3].

4.3. Strengthen the construction of talents

Talent is the basis for the innovation and development of digital intelligence technology. It is of great importance to strengthen talent training and introduce the effective application of digital intelligence technology in the food field. First of all, actively introduce talents. The application of digital intelligent technology in the field of food involves two major fields of food and information technology. The actual demand for talents is also biased towards compound talents who know both food science and information technology, so as to be able to meet the needs of intelligent system development, operation, and maintenance ^[14]. However, judging from the current situation, talents with interdisciplinary ability are relatively scarce, and how to effectively attract and train interdisciplinary talents has become a top priority. Colleges and universities can meet this market demand, set up more interdisciplinary courses and majors, realize the close combination of food safety and information technology, and cultivate compound talents with an interdisciplinary knowledge background. At the government and enterprise level, the introduction and training of relevant talents can be strengthened. For example, the government can attract and retain outstanding talents by issuing supportive policies, providing tax incentives, strengthening support for relevant scientific research projects, and other incentive measures. On the one hand, enterprises can increase the welfare benefits of talents to attract outstanding talents to apply for jobs; on the other hand, they can strengthen cooperation with scientific research institutions, universities, and other institutions to jointly develop customized training programs and train targeted talents. Secondly, strengthen on-the-job staff training. Employees are an important component of food enterprises, and their understanding and application of log-intelligent technology are directly related to the actual effect of food safety and quality control ^[15]. Therefore, enterprises should organize regular internal training to cultivate employees' good information literacy and improve their skills in operating and managing digital intellectualization systems. At present, many food enterprises are faced with the challenge of difficult staff training, high time and capital cost, which has a negative impact on the training effect. Therefore, enterprises can combine the actual development needs through flexible and varied training methods, flexibly adjust the training content and other forms, improve employees' information literacy and technology application level, and provide the foundation for the application and promotion of intelligent technology.

5. Conclusion

Food safety is closely related to people's happiness and social stability. With the rapid development of information technology, digital intelligence technology has brought unprecedented changes to the food field, become an important driving force for food safety and quality control, and also brought new opportunities for the development of the food industry. The deep application of high and new technologies such as big data technology, artificial intelligence, Internet of Things, and blockchain in the field of food safety and quality control can effectively improve management efficiency and quality, realize information sharing, and provide a new development direction for the food industry. Relevant departments should pay full attention to the effective application of digital technology, and provide solid support for food safety and quality control by vigorously introducing outstanding talents, improving the treatment of talents, promoting technological innovation and other means, and then formulating personalized services based on the actual needs of companies and other entities.

Disclosure statement

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References

- [1] Zhang GY, 2025, Research on the Optimization and Upgrading Path of Food-related Majors in Higher Vocational Colleges in the Digital and Intelligent Era. *Journal of Liaoning Agricultural Vocational and Technical College*, 27(2): 58–62.
- [2] Cao SM, 2024, Research on the Innovation Strategy of Food Safety Supervision Model in Colleges and Universities Based on Digital and Intelligent Means. *Science & Technology Vision*, 14(32): 107–110.
- [3] Wu XL, 2024, Research on the Optimization of the Development Strategy of Y Food Company in the Digital and Intelligent Era, thesis, Qingdao University.
- [4] Liu TJ, Cai XD, 2024, Research on the Agricultural Product Information Traceability System Based on Blockchain and Internet of Things Technology. *Logistics Science and Technology*, 47(24): 44–50.
- [5] Liu XQ, Wang FL, 2025, Food Safety Control of Fresh Agricultural Product Supply Chain Based on Digital and Intelligent Means. *China Food Safety*, 2025(1): 44–47.
- [6] Li BY, Sun FQ, 2025, Digital and Intelligent Illumination of Those Hidden Corners of Food Safety — The 2024 CeMAT ASIA Innovation Salon Was Successfully Held. *China Storage & Transport*, 2025(1): 24–25.
- [7] Jin X, 2024, Digital Intelligence Empowerment, Building a “New Defense Line” for Food Safety. *Informatization Construction*, 2024(11): 54–55.
- [8] Pan ZJ, 2024, Buy with Confidence — Digital and Intelligent Construction Builds the Food Safety Defense Line in Summer. *China Food Safety*, 2024(7): 50–52.
- [9] Wang XZ, 2024, Practical Research on the Food Quality and Safety Control System in Food Safety Supervision. *China Food Industry*, 2024(24): 71–73.
- [10] Ye YD, 2024, Construction Criteria and Key Points of the Digital Management System for Food Safety. *China Food Industry*, 2024(23): 62–64.
- [11] Lai SP, Xiao DW, 2024, Digitalization-driven Externalization: The Transformation Logic of Catering Service Safety Supervision Mode. *Chinese Public Administration*, 40(7): 143–154.
- [12] Xu K, 2024, Exploration of Food Safety Supervision under the Background of Digital Reform. *Food Safety Guide*, 2024(11): 1–3.
- [13] Hao C, 2024, Research on the High-quality Development of the Food Industry Driven by the Digital Economy. *China Food*, 2024(2): 108–110.
- [14] Zheng HZ, Dong HJ, Sun L, 2023, Research on the Construction Path of the “Su Food Smart Chain” Food Safety Supervision Platform in the Context of the Digital and Intelligent Era. *Modern Food*, 29(1): 139–143.
- [15] Wang J, Cao H, 2024, Research on Food Safety Supervision Issues under the Background of Internet+. *China Food Industry*, 2024(21): 53–55.

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Analysis of Quantity and Weight Discrepancies in the Split Discharge of Imported Bulk Cargo at Two Ports in Shanghai, and Research on the Intelligent Application of Quantity and Weight Identification

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Abstract: This paper focuses on the prevalent issue of quantity and weight discrepancies that arise during the split discharge process at two ports after the import of iron ore at Shanghai port. Through the analysis of historical data from over 100 batches of imported iron ore, this study systematically reveals the multiple complex factors that contribute to these discrepancies. These factors include the inherent physicochemical properties of the cargo, environmental and operational impacts during transportation, and potential commercial fraud. Based on a thorough examination of the causes, this paper proposes a systematic response strategy involving multiple dimensions such as the intelligent identification of quantity and weight, optimization of operational procedures, harmonization of international standards, improvement of trade contract terms, and strengthening of regulatory cooperation. The aim is to provide decision-making references for enterprises involved in bulk cargo trade to effectively avoid risks and protect economic interests, while also offering valuable theoretical support and practical suggestions for relevant regulatory authorities to improve the inspection and supervision system for bulk cargo.

Keywords: Bulk cargo; Quantity and weight identification; Split discharge at two ports; Loading and discharging port discrepancies; Trade risks; Countermeasure research

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1. Introduction

Iron ore, as the cornerstone of the steel industry, plays a crucial role in global economic activities through its international trade. China is the world's largest consumer and importer of iron ore, and Shanghai port, as one of China's important gateway ports, handles a huge volume of iron ore import business every year. In the context of such large-scale trade, the issue of discrepancies in measured quantity and weight during the split discharge of

cargo at two or more ports after entry is a long-standing and increasingly prominent problem. These discrepancies not only easily trigger complex international trade disputes but can also cause significant economic losses to importing enterprises. For example, according to statistics on quantity and weight identification conducted by Shanghai Customs for a certain enterprise, among the more than 100 batches of iron ore recently imported by the enterprise, the proportion of batches with weight shortages reached 30%, and the weight shortage rate of some ships even exceeded 10%. If not identified in a timely manner, it would directly result in huge economic losses for the enterprise.

The frequent occurrence of such incidents not only harms the legitimate rights and interests of importers but also has a negative impact on a fair and orderly international trade environment. Therefore, it is of great theoretical value and urgent practical significance to deeply and systematically analyze the specific causes of quantity and weight discrepancies in imported bulk cargo during cross-border transportation and multi-point split discharge, and to explore scientific and effective prevention and countermeasures based on this, proposing intelligent solutions. This study aims to reveal the physicochemical changes of bulk cargo during transportation through the analysis of actual cases and data, evaluate the impact of practical operations in quantity and weight identification, identify potential human factors, and finally construct a comprehensive framework for discrepancy management and control. This will provide a scientific basis for risk management in related enterprises and effective supervision by regulatory authorities.

2. Analysis of the causes of quantity and weight discrepancies in imported bulk cargo

Quantity and weight are the core basis for settlement in the international trade of bulk cargo, and discrepancies in these measurements involve multiple levels, such as natural factors, operational factors, and human factors.

2.1. Natural factors and physical losses

Moisture changes: Iron ore, especially fines, contains a certain amount of moisture. During long-distance ocean transportation, affected by climate, cabin temperature, ventilation, and other conditions, moisture evaporation or migration can occur, leading to differences in weight measurements between the discharge port and the loading port. Although moisture changes also affect quality, the direct reduction in total mass is an important natural factor for weight discrepancies^[1].

Physical losses (in-transit losses): During various stages, such as loading, unloading, and transshipment (e.g., “second-leg transportation + transit + third-leg transportation” mode) of iron ore, physical losses due to spilling, dust emission, and adhesion to equipment or ship cabins are unavoidable. The more loading and unloading times and the longer the transportation chain, the greater the cumulative losses usually are. Prolonged loading and unloading operations (e.g., unloading 90,000 tons of fines takes about 60 hours) also increase exposure and loss opportunities.

2.2. Operational and technical factors

Water gauge measurement errors: Water gauge measurement is the primary method for determining the weight of bulk cargo, and its accuracy highly depends on the inspector’s professional skills, experience, understanding of the ship’s condition, and the rigor of data calculation. Any negligence in observation errors (such as reading errors, light/water surface fluctuation effects), inaccurate ship information, unclear measurement of ballast water/

oil-water, and calculation deviations of hogging and sagging deformations can lead to significant deviations in the final calculated weight ^[1]. Varying levels of inspectors from different ports and institutions are a common reason for discrepancies in water gauge measurement results between two ports.

Loading and unloading operation methods: When using grab buckets for bulk cargo loading and unloading, it relies on manual operation and can easily cause additional losses due to improper handling (such as spilling and impacting the hull). Differences in equipment conditions, management levels, and operational norms at different terminals can also affect the degree of loss. Differences in loading and unloading efficiency and conditions between inland river ports, such as the Yangtze River basin and seaports have also exacerbated weight discrepancies during split unloading processes.

2.3. Intentional behavior and trade fraud

Intentional short-loading: Some dishonest suppliers may exploit the dominance of weight measurement at the loading port or regulatory loopholes, resulting in actual loading quantities less than those specified in the bill of lading or contract, directly causing source-based short weight.

Fraud in the weight measurement process: During the water gauge measurement process, fraudulent activities such as falsifying ship information, deliberately concealing onboard inventories, and interfering with the measurement process may exist to obtain inflated loading weights ^[2].

3. Analysis of the causes of quality differences in imported iron ore

Quality is the key to determining the value of iron ore, and the differences in quality between loading and unloading ports are equally complex.

3.1. Inherent characteristics of the cargo and changes during transportation

Changes in moisture content and fluidization: Moisture not only affects weight but is also a key quality indicator. Fine-grained iron ore with a high moisture content is prone to moisture migration and seepage during bumpy ocean transportation, forming a “free liquid surface”, which is a phenomenon known as fluidization. This not only changes the average moisture content of the cargo (possibly with a dry upper layer and a wet lower layer) but also poses a threat to navigation safety in severe cases (exceeding the transportable moisture limit, TML). Additionally, some terminals perform spraying and dust reduction operations due to environmental protection requirements, which can directly affect the surface moisture detection results during unloading.

Changes in chemical composition: Prolonged exposure to high-temperature and high-humidity marine environments can cause slow oxidation reactions in iron ore, affecting the determination of indicators such as Fe content. For special types of iron ore, such as direct reduced iron (DRI), improper moisture control (e.g., above 2%) can react with water (especially seawater) to produce hydrogen gas, altering the composition and posing a safety hazard ^[3].

Changes in physical form (Segregation/Stratification): Vibrations during ship navigation can cause rearrangement of ore components with different particle sizes and densities, leading to particle size segregation or chemical stratification. This makes samples taken from different locations or depths at the unloading port potentially different from those taken at the loading port (which are typically assumed to be uniformly mixed).

3.2. Differences in sampling and testing procedures

Representativeness of sampling: Sampling is the first step in quality inspection, and its representativeness is crucial. The sampling location (different parts and depths of the ship's hold), sampling method (manual/automatic, tool differences), sampling quantity, and frequency may follow different standards or habits at the loading and unloading ports. This can result in samples that do not equally represent the average quality of the entire shipment. Especially in cases of split unloading at two ports, there may be systematic differences in moisture, particle size, etc., between the upper layer samples taken at the first unloading port and the lower layer samples taken at the second unloading port. For ores with inherently high quality fluctuations, the differences can be more significant if strict sampling methods are not followed ^[4].

Non-uniform testing standards and methods: Despite the existence of international standards such as ISO, differences may arise in the specific implementation of standards (e.g., using different versions of the standards), equipment accuracy, operational procedures, and data processing methods across different countries and laboratories. Moisture (H₂O) testing, in particular, has a relatively high standardized interquartile range (0.36%) due to method sensitivity, making it one of the main sources of variation.

Testing timeliness: The timing of sample preparation and testing can also affect the results. For example, according to IMSBC rules, moisture testing should be completed within 7 days before loading. However, if the supplier provides an outdated report or if re-testing is not conducted after encountering rainy or snowy weather before loading, the report may not reflect the actual state during loading. Delays in testing at the unloading port may also lead to changes in the samples.

3.3. Human intervention and intentional adulteration

Selective sampling/submission: Suppliers may select better-quality ore samples at the loading port for testing to obtain a “favorable” quality report, concealing the true average quality of the entire shipment ^[5].

Adulteration: During the loading process, low-quality ore, impurities, or even water may be intentionally mixed in, or high-quality ore may be spread on the surface to cope with surface sampling.

Exploiting testing loopholes: Suppliers may exploit differences in testing agencies, standards, or time gaps to submit test results that are favorable to them. The lack of independent third-party supervision at some loading ports also provides room for manipulation.

4. Differential response strategies and systematic solutions

In response to the above causes, a comprehensive risk prevention and dispute resolution system needs to be constructed from multiple levels, such as technology, management, contracts, and regulations.

4.1. Technical level: Enhancing detection and monitoring capabilities

Intelligent water gauge measurement: Establish an intelligent platform for quantity and weight identification, integrating automatic calculation, smart observation of water gauges, historical data statistics, setting alarm thresholds, and automatically identifying high-risk cargo.

Online/rapid detection technology: Explore and apply technologies such as online moisture detection and rapid element analysis to achieve real-time or near-real-time monitoring of key indicators during loading and unloading, and promptly detect abnormalities ^[6].

Internet of Things and sensor technology: When feasible, use sensors to monitor cargo status (such as

temperature, humidity, movement) and environmental changes during transportation, providing data support for analyzing the causes of differences.

4.2. Management and operational level: Standardizing processes and strengthening supervision

Standardized operating procedures: Promote the adoption of unified or compatible international standards (such as ISO) for sampling, sample preparation, and testing at loading and unloading ports, clarify operational specifications, and reduce methodological differences.

Optimizing logistics and reducing transfers: Reasonably plan transportation routes and modes, minimize unnecessary transfer links, and reduce physical losses and accumulated errors from multiple weighings.

Strengthening the entire process of supervision: Both trading parties can negotiate to appoint representatives or hire reputable independent third-party inspection agencies to supervise the entire process of loading, transportation, unloading, sampling, and testing to ensure operational compliance and data authenticity.

Improving professional literacy of personnel: Strengthen training and qualification management for inspection and appraisal personnel, ensure that they are certified to work, and continuously improve their professional skills and sense of responsibility.

4.3. Contractual and legal level: Clarifying rights, responsibilities, and risk allocation

Clarifying settlement basis: Clearly stipulate in the trade contract which independent and authoritative inspection agency's inspection certificate at which port (usually recommended to be the unloading port) will be used as the final settlement basis for quantity, weight, and quality.

Detailed quality clauses: Set more specific specifications, allowable error ranges, and reward and punishment mechanisms for indicators that are prone to disputes (such as moisture content, specific element content, and particle size) ^[7].

Agreeing on dispute resolution mechanisms: Clarify the handling process, re-inspection procedures, third-party arbitration, and other dispute resolution methods after differences occur.

4.4. Regulatory and cooperation level: Unifying standards and information sharing

Promoting international coordination of standards: Relevant international organizations and national regulatory authorities should strengthen cooperation to promote further harmonization and updating of standards related to iron ore sampling and testing.

Strengthening port supervision: Regulatory agencies such as customs at import and export countries should strengthen supervision of bulk cargo inspection and appraisal activities, combat trade fraud, and maintain a fair trade order.

Establishing an information sharing platform: Explore the establishment of an information sharing mechanism between ports, inspection agencies, and traders to improve transparency and jointly prevent risks (**Table 1**).

Table 1. Main causes and impact levels of weight discrepancies in iron ore

Type of discrepancy	Main cause	Typical discrepancy range/ characteristics	Preventability
Loss due to natural water evaporation	Cargo characteristics, transportation environment, duration	Can reach several per mille points (‰)	Medium
Physical loss during loading and unloading (In-transit loss)	Multiple transfers, operational normativity	Accumulates with increasing links	High
Error in water gauge measurement	Personnel skills, ship condition, methodology	Can be significant	Medium-high
Intentional short-loading/fraud	Dishonest behavior of suppliers	Variable proportion, can be large or small	High (strong supervision required)

5. Conclusion

The issue of quantity and weight discrepancies that arise during the loading and unloading of imported bulk cargo at two ports, as well as during the split unloading process between the two ports, is a complex and widespread problem in international trade practice. It involves multiple factors such as the natural properties of the cargo, changes in transportation conditions, operational technology levels, implementation of inspection standards, and business integrity. Through analysis, this study systematically summarizes the main causes of these discrepancies, including operational/technical factors such as errors in water gauge measurement and inadequate sampling representativeness, as well as human factors such as intentional short-loading or quality adulteration.

In response to these causes, this paper proposes a multi-dimensional and systematic framework of countermeasures. It emphasizes that the introduction of intelligent detection technologies (such as automatic water gauge reading identification, automated calculation, and smart observation equipment), standardization of operational processes (unified sampling and testing standards, optimized logistics), improvement of trade contract terms (clarifying that unloading port inspection is the standard, refining quality requirements), and strengthening domestic and international regulatory cooperation and information sharing can effectively prevent and reduce the occurrence of discrepancies. When discrepancies occur, these measures provide a clear path for resolution^[8].

The analysis and recommendations of this study can serve as a reference for enterprises engaged in the import business of bulk cargo in contract negotiation, risk assessment, process management, and other aspects, helping them to protect their legitimate rights and interests. At the same time, it also provides ideas for customs and other regulatory authorities to improve relevant regulations and policies and enhance regulatory effectiveness. However, the bulk cargo trade involves many links and dynamically changing influencing factors. This study may have limitations in data sources, and further research combining more real-time data and cases is still needed in the future. In particular, evaluating the application effects of emerging technologies and comparing practical differences among different trading partners will be worthwhile directions for further exploration. The ultimate goal is to jointly promote a more fair, transparent, and efficient international trade environment.

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References

- [1] Zhang QY, 2025, Research on the Application of Intelligent Monitoring Systems in Port Safety Management. *Water Safety*, 2025(6): 172–174.
- [2] Tu S, Shi HK, 2025, Accelerating the Research and Application of Vehicle Autonomous Driving Technology in the Port Sector. *China Ports*, 2025(1): 23–26.
- [3] Han ZY, 2024, Discussion on the Intelligent Application of Port Grain Storage. *Modern Food*, 30(20): 5–11 + 121.
- [4] Chen JF, Zhong WJ, Wang T, et al., 2024, Inspection Methods and Research Applications for Remote and Automatic Control Systems of Intelligent Port Cranes. *Construction Machinery Technology and Management*, 37(5): 57–60.
- [5] Wang X, 2024, Research and Application of Optimization Algorithms for Intelligent Port Coal Yard Scheduling Systems. *Software*, 45(7): 80–82.
- [6] Li QZ, Zhao ZY, 2023, Research on an Intelligent Management System for Hot Work Operations Involving Hazardous Goods at Ports. *Transport Manager World*, 2023(29): 164–166.
- [7] Wang SJ, 2023, Research on Ship Intelligent Management System Based on Internet of Things Technology. *Pearl River Water Transport*, 2023(15): 88–90.
- [8] Huang ZZ, Xu MC, 2021, Prospects and Applications of Intelligence in Oil and Gas Chemical Terminals. *Labor Protection*, 2021(2): 91–93.

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Practical Teaching Mode of College English Audio-Visual Oral Course

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Abstract: Against the background of global economic integration, the importance of English learning has gradually become prominent. With the advancement of education reform, the College English audio-visual and oral course has ushered in a new development opportunity. It is very important to explore its curriculum mode and practical methods to improve students' English audio-visual and oral level. Based on the theory of language input and output, this paper analyzes the problems existing in the current English teaching, such as the lack of practice and interaction, and puts forward the construction of a student-centered practical teaching mode integrating multiple modern technologies. Through the development of diversified practical teaching methods and other methods to improve the teaching effect, stimulate students' learning enthusiasm, and cultivate more high-quality talents in the English language for society.

Keywords: College English; Audio-visual speaking; Curriculum exploration

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1. Introduction

Against the background of globalization and digital reform, College English teaching is undergoing unprecedented changes, gradually transforming from a single knowledge transfer to the paradigm of ability training. The traditional teaching mode of an audio-visual oral course is based on teaching materials and classroom teaching, which has difficulty meeting the needs of the new era for compound foreign language talents. The new era requires English talents not only to have a solid language foundation, but also to have the practical ability to use language in cross-cultural communication in real scenes. In this context, the practical teaching mode came into being and evolved into an important direction of College English audio-visual and oral curriculum reform. The core idea of the practical teaching mode is "the combination of learning and practice, the unity of knowledge and practice." This idea emphasizes the creation of an immersive language environment, the introduction of a real corpus, the design of multiple interactive tasks, and the integration of language learning into practical application scenarios. Based on the exploration of teaching practice, this paper deeply analyzes the implementation path,

teaching strategies, and effect evaluation of the practical teaching mode in the College English audio-visual oral course, aiming to provide theoretical and practical reference for improving the teaching quality of the course and cultivating students' language practice ability.

2. The significance of the practical teaching mode of the College English audio-visual oral course

2.1. Improve the theoretical system of language teaching

Exploring the practical teaching mode of the College English audio-visual oral course will help inject new vitality into language teaching theory. As people all know, the traditional language teaching theory focuses on the systematic teaching of language knowledge, while the practical teaching mode is supported by the language input and output theory, constructivist learning theory, and situational teaching theory, which closely combines language learning with practical application ^[1].

From the perspective of language input and output theory, the practical teaching mode breaks the limitation of relying too much on the static language input of textbooks in traditional teaching. Krashen's language input hypothesis emphasizes the importance of a large number of comprehensible inputs for language acquisition, while practical teaching provides students with rich and authentic language input resources by introducing audio-visual materials in a real context, such as English news, film clips, TED speeches, etc. At the same time, Swinner's language output theory points out that language output is not only the result of language learning, but also an important process to promote language learning. Through diversified oral expression activities, such as role play, group discussion, and impromptu speech, the practical teaching mode can promote students' output of meaningful language, deepen the understanding and application of language knowledge, so as to improve the application system of language input and output theory in teaching practice.

Constructivist learning theory emphasizes learners' initiative and situationality in the process of knowledge construction. The practical teaching mode fully understands and applies this theory, and implements it in College English audio-visual and oral teaching. Through the creation of real scenes and the close connection between learning tasks, it guides students to actively participate and think, and builds language knowledge and skills in the process of solving practical problems. This teaching mode breaks through the teacher-centered knowledge transfer mode in traditional teaching, and turns out to be student-centered. It provides a new practical example for the application of constructivist learning theory in the field of language teaching and further enriches the connotation of constructivist learning theory ^[2].

In addition, the innovative application of situational teaching theory in practical teaching mode has also contributed to the development of language teaching theory. By combining modern information technology, creating diversified language learning situations such as virtual reality and augmented reality, students can experience the English language and culture, expand the form and connotation of situational teaching, and provide a new research direction for the development of language teaching theory.

2.2. Improve students' language application ability and comprehensive quality

The practical teaching mode, as its name implies, is to change the traditional language teaching mode, innovate the teaching concept, and transform the teaching mode focusing on knowledge transfer into the mode focusing on practical teaching, so as to effectively improve the students' language application ability. In terms of listening, by introducing listening materials in the real context, such as English original movies, English radio, academic

lectures, etc., students are exposed to a variety of pronunciation, intonation, speaking speed and accent, which improves their ability to accurately understand information in the real communication scene ^[2]. In terms of oral expression, rich practical activities such as group discussion, role play, English debate, etc., provide students with a wide range of opportunities to speak English, help them overcome the psychological barriers of language expression, and improve oral fluency and accuracy. At the same time, the introduction of visual materials, such as English videos and pictures, not only provides students with intuitive language learning materials but also helps students better understand the cultural connotation behind the language and improve the depth and breadth of language understanding.

In addition, language is the carrier of culture. The practical teaching mode of this course focuses on the combination of language learning and cultural experience. Through the introduction of audio-visual materials with rich cultural connotations, such as festivals and celebrations, social customs, culture, and art in English-speaking countries, students can deeply understand the cultural background, values, and thinking mode of English-speaking countries while learning the language. In practical activities, students can experience the differences between different cultures by simulating cross-cultural communication scenes, such as international business negotiations and cultural exchange activities, and learn to respect differences, understand and tolerate in cross-cultural communication, so as to improve cross-cultural communication ability, cultivate global vision and cultural awareness, and lay a solid foundation for future participation in international exchanges and cooperation.

Moreover, the practical teaching mode conforms to the pace of education of the times, emphasizes the dominant position of students in the learning process, and stimulates students' learning initiative and enthusiasm by setting open learning tasks and practical activities. In the process of completing practical tasks, students need to independently plan their learning time, choose learning resources, and explore ways to solve problems. This series of learning processes can help cultivate students' autonomous learning ability and help them learn how to think independently, manage themselves, and improve themselves. At the same time, diversified practical activities, such as English creative display and micro film production, encourage students to exert their imagination and creativity and express their unique views and ideas in English, so as to promote the development of students' innovative thinking and improve their comprehensive quality and competitiveness.

2.3. Promote the innovative development of College English teaching

With the rapid development of society, the demand for language talents is gradually increasing, and the requirements for the corresponding ability of talents are also rising. Under this background, College English teaching reform has become an inevitable trend. The practical teaching mode meets the requirements of cultivating students' language application ability and comprehensive quality in the current college English teaching reform, provides a practical path for College English teaching reform, and promotes the comprehensive optimization of the College English audio-visual and oral course system. In terms of curriculum goal setting, more attention should be paid to the cultivation of language application ability and practical ability. In the selection of teaching content, more authentic and practical language materials are introduced to enhance the timeliness and practicality of the course content. In terms of teaching methods, teachers should adopt diversified teaching methods, change the traditional "cramming" teaching method, and improve the interest and effectiveness of teaching. At the same time, the practical teaching mode also promotes the reform of the teaching evaluation system, from a single examination evaluation to a diversified process evaluation, which can more comprehensively and objectively evaluate students' learning achievements and ability development, and promote the overall improvement of College English teaching

quality ^[3].

In addition, the successful experience of the practical teaching mode of the College English audio-visual oral course has a wide range of promotional value, and can provide a useful reference for the teaching of other foreign language courses. Its teaching philosophy, curriculum design ideas, teaching methods and evaluation methods can be adjusted and applied according to the characteristics of different foreign language courses, promote the reform and innovation of the whole foreign language teaching field, improve the overall level of foreign language teaching in China, and cultivate more high-quality foreign language talents with international vision and cross-cultural communication ability.

3. Analysis of the current situation of the practical teaching mode of the College English audio-visual oral course

Although college English audio-visual and oral course closely follows educational facts, innovates teaching concepts, changes education mode, and strives to cultivate more compound talents for society, the challenges it faces cannot be ignored ^[3]. From the perspective of teaching goal setting, most colleges and universities still regard knowledge transfer as the primary goal, focusing on the explanation of vocabulary, grammar, and other language knowledge, while paying less attention to the cultivation of students' practical language application ability. This goal orientation makes it difficult for teaching activities to effectively improve students' listening and speaking skills, and students' communication ability in the real language environment is weak. In terms of teaching content, the update speed of textbooks and teaching resources lags behind the development needs of the times. The audio-visual materials in the existing teaching materials are often not combined with the actual life of students, lack real context, outdated content, and are out of line with the needs of students in the workplace, so it is difficult to stimulate students' interest in learning. At the same time, the teaching resources are relatively limited, relying too much on the audio and video materials supporting the teaching materials, and failing to make full use of high-quality resources such as the Internet and multimedia, which limits students' access to real English materials.

In addition, in the application of teaching methods, most teachers still use the traditional method, "teacher-led, students' passive acceptance" mode, which still occupies an important position. The classroom is dominated by teachers' explanations and students' follow-up reading, lacking effective interaction and practice. Teachers seldom use task-driven, situational simulation and other practical teaching methods in the teaching process, which leads to students' low participation and difficulty in obtaining sufficient opportunities for language practice in the classroom. The large class teaching mode makes it difficult for teachers to pay attention to the individual differences of each student and provide personalized guidance for students ^[4].

The setting of practical teaching is not perfect. Although some colleges and universities are aware of the importance of practical teaching, in the specific implementation process, practical activities are often a mere formality and lack systematicness and coherence ^[4]. For example, practical activities such as role play and group discussion lack clear objectives and evaluation criteria, which makes it difficult to achieve the expected teaching effect. At the same time, the construction of the practice platform inside and outside the school is insufficient, and the students lack a real language application scene, so they cannot transform the knowledge learned in the classroom into actual language ability.

4. The implementation path of the practical teaching mode of the College English audio-visual oral course

4.1. Building a diversified, practical teaching objective system

The practical teaching of the College English audio-visual oral course needs to establish a multi-level target system. The first is to set the goal of basic language skills, requiring students to accurately understand the pronunciation and intonation of English raw materials, and skillfully apply them to daily life and work ^[5]. The second is to set the goal of comprehensive application ability, and cultivate the students' ability to complete information acquisition, opinion expression, communication, and cooperation in English in a real context. Finally, educators should clarify the goal of literacy improvement, enhance students' cultural sensitivity and global vision, and cultivate critical thinking and autonomous learning ability through cross-cultural communication practice. For example, in the teaching of business English in viewing, listening, and speaking, the practice goal of simulating business negotiation can be set, so that students can improve their business communication skills and cross-cultural communicative ability in role play.

4.2. Innovative teaching content and resource construction

4.2.1. Develop real scene teaching resources

The practical teaching mode is bound to break through the limitations of traditional textbooks and pay attention to the use of real language materials, such as international news reports, TED speeches, film and television drama clips, etc. Develop characteristic teaching resource packages according to different professional needs. For example, international medical conference videos and medical English interview programs can be selected for medical majors. The major of tourism management can adopt overseas tourism documentaries, hotel service English scene dialogues, etc., so as to make the teaching content closer to the students' future professional needs.

4.2.2. Building a digital resource platform

Use network information technology to build an online learning platform, integrate audio and video resources, establish an intelligent voice evaluation system, and add an interactive learning community and other functions. Develop virtual simulation teaching resources and create an immersive language learning environment. For example, through virtual reality technology to simulate international conferences, business negotiations, and other scenes, students can conduct comprehensive audio-visual and oral training in the virtual environment.

4.3. Optimizing teaching methods and implementation strategies

Against the background of the new education reform, the College English audio-visual and oral practice course should also keep up with the education situation, adjust the pace of education in time, and innovate teaching methods, such as using task-based teaching method, designing step-by-step task chain, and dividing the teaching content into specific tasks. After watching the English documentary, arrange tasks such as information extraction, opinion discussion, summary, and report, and guide students to improve their language ability in the process of completing the task. Using the group cooperation mode, each student takes on different roles to jointly complete the task objectives and cultivate the team cooperation ability.

Secondly, the use of a project-based teaching method. Carry out teaching with real projects as the carrier, such as organizing students to produce English micro videos, planning English culture festivals, holding simulated international conferences, etc. Students participate in the whole process from topic selection planning, data collection, script writing, to shooting and production, and exercise their comprehensive language use ability in

practice. Teachers, as mentors, provide necessary support and feedback ^[5].

Thirdly, the online and offline teaching mode is used to provide preview materials, expand resources, and self-test exercises online, so that students can carry out personalized learning according to their own situation. Offline classes focus on key and difficult points analysis, interactive communication, and practical training. Use learning analysis technology to track students' learning trajectory and adjust teaching strategies in time.

4.4. Strengthen the construction of teaching staff

There is no doubt about the status of students' thematic learning, but the leading role of teachers is also crucial. In order to improve practical teaching skills, teachers can be regularly organized to participate in practical teaching training and learn advanced teaching concepts and methods. Teachers are encouraged to participate in enterprise practice, international exchanges, and other activities to accumulate real language application experience. Establish a teacher development community to promote experience exchange and ability improvement among teachers through collective lesson preparation, teaching discussion, case sharing, etc.

In addition, the interdisciplinary teaching team, composed of English teachers, professional teachers, and educational technology experts, can better understand the social needs, understand the future development direction of students, and then formulate a more detailed and scientific teaching plan. English teachers are responsible for language teaching, professional teachers provide the support of subject background knowledge, educational technology experts provide technical support, jointly develop curriculum resources, design teaching activities, and improve teaching quality.

4.5. Create a good practice teaching environment

Build a professional language laboratory, equipped with advanced audio-visual equipment and an intelligent teaching system. Establish student associations such as English clubs and English speech clubs, and organize rich and colorful extracurricular practical activities, such as English corners, dubbing competitions, drama performances, etc., to provide students with more opportunities for language practice. In addition, it has established cooperative relations with foreign-related enterprises and international organizations to build an off-campus practice base. Arrange students to participate in foreign-related business activities, international cultural exchange projects, etc., so that students can exercise their English Viewing, listening, and speaking ability in a real workplace environment. The effective connection between classroom teaching and social practice can be achieved through school enterprise cooperation and joint efforts.

5. Conclusion

With the deepening of education reform, the traditional teaching ideas and methods of English audio-visual and oral courses should also be changed, and the past knowledge-based practical teaching mode should be changed. Based on the theory of language input and output, this study confirms the significant value of the practical teaching mode in the College English audio-visual and oral course. The study found that this mode effectively improved students' language application ability and intercultural communication literacy by creating real situations, building education platforms, and using a combination of online and offline education modes, which made up for the shortcomings of traditional teaching practice. In the future, it is necessary to further explore the path of deep integration of practical teaching and digital technology, aiming to cultivate more high-quality language talents for society.

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References

- [1] Fan CR, Yao JA, 2022, On Foreign Language Practice Teaching from a Survey Report. *Journal of Changsha University*, 2022(4): 143–145.
- [2] Song LP, 2021, On English Practical Teaching in Higher Vocational Colleges. *China Adult Education*, 2021(6): 153–155.
- [3] Jiang GZ, 2022, Problems and Countermeasures of College English Practice Teaching in China. *Education Review*, 2022(6): 96–98.
- [4] Hu GC, 2022, On the Construction of Three Links in Foreign Language Practical Teaching. *Journal of Chengdu University: Education Science Edition*, 2022(22): 51–53.
- [5] Yang D, Xiao L, 2022, Reflections on the Reform of College English Practice Teaching. *Educational Exploration*, 2022(5): 34–35.

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Research on Creative Transformation Strategies of Traditional Cultural Genes in the Central Plains Region

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Abstract: This paper focuses on the creative transformation strategy of traditional cultural genes in the central plains region. Firstly, the paper elaborates on the roots and originality of the excellent traditional culture of the central plains, and analyzes the advantages and optimization problems in the development of its cultural industry. Then, it puts forward a new transformation idea of rearranging and combining cultural resources, and gives the strategies, such as systematically integrating traditional culture resources, symbolizing and re-innovating culture, creating cultural name cards with the help of branding, and integrating modern aesthetics to realize the modern expression of traditional culture. The research strategy helps to enhance the competitiveness of the cultural industry in the central plains, promotes the inheritance and translation of traditional culture, injects a new impetus for regional economic development, and at the same time provides a sample of the central plains for the global dissemination of Chinese culture.

Keywords: Central plains region; Traditional culture genes; Creative transformation; Strategy

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1. Introduction

1.1. Overview of the outstanding traditional culture of the central plains region

The Central Plains Culture is a general term for the material and spiritual culture of the middle and lower reaches of the Yellow River in China, which is an important source and core component of Chinese culture, with Henan as the core and radiating to the middle and lower reaches of the Yellow River layer by layer. In the long history of China, the capitals of Xia, Shang, Zhou, Eastern Han, Cao Wei, Western Jin, Sui and Tang, Five Dynasties, and Northern Song dynasties were all established here, and the culture of the central plains has long been in an orthodox position, and to a certain extent it is also the epitome of traditional culture of China.

1.2. The unique characteristics of the traditional culture of the central plains region

The excellent traditional culture of the central plains is an important part of the culture system of the central plains, and its main qualities are rootedness, originality, inclusiveness, openness, and continuity. Rootedness means that the central plains region is regarded as the root of Chinese civilization in both prehistoric civilization and the beginning of written civilization, and the ideas of Confucianism, Taoism, and Mohism, which are the hallmarks of the axis of Oriental civilization, were also generated here. Originality means that the culture played a pioneering role in building the entire Han civilization, and has been fully reflected in the construction of institutions, the formation of Chinese characters, commerce, science and technology, and medicine. Inclusiveness means that it has the characteristics of inclusiveness and synthesis, and it has realized the integration and sublimation of material culture and ideology through economy, beliefs, population migration, etc., and formed rich and dynamic cultural representations of the central plains. Openness means that the excellent traditional culture of the central plains has a strong radiation and influence. Secondly, it has become a folk custom. Ancient rulers compiled their etiquette into a model and extended it to the whole society, forming a folk custom over a long period of time. Thirdly, it spread far and wide overseas, the traditional culture of the central plains spread widely overseas through the Silk Road and maritime trade; continuity refers to the fact that the central plains civilization has always been in the same vein from Yangshao, Shang and Zhou, Tang and Song and then to the modern times, evolving but never interrupted, which has become an important basis for our call for the preservation and inheritance of the traditional culture of the central plains in the current stage ^[1].

2. The current situation of the development of the cultural industry of the traditional culture of the central plains

2.1. Advantages of cultural industry development

In the past decade, the central plains region centered on Henan Province has responded to national policies, vigorously developed the cultural industry, advocated the integration of culture, tourism, culture and creativity, and improved the production methods and means of dissemination of traditional culture products in the central plains through new media and new technologies. This has facilitated the rapid upgrading of the structure of the cultural industry in the Central Plains, giving rise to a large number of new cultural industries, while also strengthening market competitiveness, improving the quality of cultural products, and gradually forming new consumption habits and profit models ^[2]. There are many successful new cultural creation projects, for example, the archaeological series of cultural creations of the Henan Museum has successfully broken out of the circle, and has gained wide recognition nationwide under the drive of online media and e-commerce economy. The “Wonderful Tour” series, launched in 2022, has successively exported Chinese culture to overseas self-media platforms, and has even become a carrier for our diplomacy to communicate with the world. Henan has gradually clarified its distinctive cultural advantages of the central plains, trying to empower regional economic and cultural development through the innovation of the traditional culture of the central plains and cultural tourism.

2.2. Cultural industry development issues

The development goal is clear, but in the process of implementation, there are problems such as convergence of cultural industries, vulgarization of cultural and creative products, and superficialization of cultural symbols. Enterprises imitate each other's industrial development mode, cities and counties copying tourism cultural and creative products, a product emerges without differences in the national style trend, they do not do in-

depth excavation and differentiation of the attribution and nature of the regional traditional culture genes and the nature of the transformation of the culture and products lack of basis and creativity, and at the same time, cultural branding weaknesses make a lot of cultural symbols cannot find the right landing point to implement the systematic outputs. The excavation and creative transformation of the traditional culture of the central plains still has much room for improvement in the innovative development of the cultural industry.

3. New ideas for the transformation of traditional cultural genes in the cultural industry of the central plains

As a region rich in resources of excellent traditional culture of the central plains, in the new era, it is necessary to deeply explore the resources of the central plains' excellent traditional culture, while at the same time basing ourselves on the realities of contemporary China and combining them with the conditions of today's times, so as to give them ideological connotations that are in keeping with the times^[3]. The central plains region has four ancient capitals, eight national historical and cultural cities, more than 100 national intangible cultural heritages, and five world cultural heritages, including Yinxu, "Heaven and Earth in the Middle" architectural complex, Longmen Grottoes, the Silk Road, the Grand Canal, etc. Chinese kung fu, represented by Shaolin Kung Fu and Taijiquan, is also famous all over the world. The traditional culture of the central plains is arranged and combined through the dimensions of time and space, vertically marking the change of times, such as the prehistoric civilization of the central plains, the Yin and Shang periods, the Wu-Tang period, the Northern Song period, etc.; horizontally divided into the central plains by region, such as Zhengzhou, Kaifeng, Luoyang and Anyang, which were once capitals, and the famous cities of culture and history, such as Shangqiu and Nanyang, as well as the rich culture of the non-heritage, such as Zhoukou and Xinyang. On this basis, dig deep into the historical characteristics of a place, representative figures, literature and art, local customs, non-genetic inheritance and other cultural nodes, to explore the connection between its inner spirit and external representation, to find out the key words and representative elements and symbols, and combined with the modern society and the phenomena related to life to be transformed, the sinews of traditional culture will be presented three-dimensionally for the development of modern to retrieve the most initial cultural confidence.

With the continuous improvement of national cultural confidence, the Tang and Song cultures have risen again in the past five years. Take Northern Song culture as an example, Bianliang (now Kaifeng City), as the capital of the Northern Song Dynasty, was the largest distribution center for cultural exchanges at that time, and poetry, music and calligraphy, tea art and even catering culture were also developed, forming a unique cultural form and humanistic outlook of the Song Dynasty. 2022 movie and TV drama "Records of Dream Hua" drove the Song culture gene to the hot spot (**Figure 1**), which referred to the Northern Song Dynasty prose book "Records of Dream Hua in the East Capital City" and folk customs painting "Along the River During the Qingming Festival" in the portrayal of the marketplace folk customs (**Figure 2**), interpretation of the then bustling and prosperous life scene, "Tea Plays" in the drama allows viewers to discover a more microscopic civilization of the Song Dynasty, and has harvested a large number of "Song tide" fans. Song cultural creative industries and innovative services related to Song culture have emerged. From tea culture, dress culture, literature and art, folk architecture and other cultural nodes, Song Dynasty tea products, Song Dynasty dress theme photography, short video shooting, as well as Bianliang cultural tour and other cultural and tourism fusion projects have been developed, and a large number of people from other cities have come to Kaifeng in order to experience the charm of the Song Dynasty, and the

local economy and the topic of the hotness have been increased, which proves that the public's love for historical civilization and traditional culture has always been there, and the way of transformation and interpretation is the key to the spread of cultural genes.



Figure 1. Representation of Song Dynasty Aesthetics in the Film and Television Drama Records of Dream Hua (left)



Figure 2. Meng Yuanlao's "Records of Dream Hua in the East Capital City" and Zhang Zeduan's "Along the River During the Qingming Festival" (right)

4. Creative transformation strategy of the traditional culture of the central plains genes

The continuation of any kind of cultural gene is not presented out of thin air, but requires a certain carrier to undertake. By clearly sorting out and classifying the traditional cultural content of Central Plains, exploring the symbols of Central Plains civilization, and deducing specific strategies for creative transformation and innovative development based on their core and external characteristics, it provides new ways of thinking and implementation paths for telling the stories of Central Plains and spreading the voice of Central Plains well.

4.1. Systematization of the traditional culture of the central plains resources

The central plains region has a profound and excellent traditional culture with a long history, which has accumulated the original spiritual pursuit of the Chinese nation, contains rich ideological and moral resources, and is the source of the cultural confidence of the Chinese descendants. The traditional culture of the central plains, as the foundation of the cultural system, provides an inexhaustible source for the original creative industries in the

central plains, and the effective integration of resources is an important prerequisite for the creative transformation of the industry's subsequent extension. The historical advantage in the time dimension and the location advantage in the space dimension constitute the innate advantage of the development of the traditional culture of the central plains. The integration of cultural nodes should have a clear hierarchy, forming modules through time, region, cultural types, etc., and categorizing and refining them layer by layer, and the deep excavation of cultural contents can help the sustainable transformation of its resources, avoiding the lack of systematic development and the lack of continuity of development caused by the dispersion of cultural resources. The clear integration of resources lays a solid foundation for the formation of cultural symbols in the next step.

4.2. Symbolization of the traditional culture of the central plains

The traditional culture of the central plains is a cultural representation of regional characteristics, which was formed, developed and preserved in the course of the development of China's history with the central plains as the political center, and has a certain stable form, which is refined into specific categories, including writing, architecture, clothing, folklore and even food. These cultural contents have one or more symbolic archetypes corresponding to the five senses of sight, hearing, taste, smell and touch, such as visual symbols that refer to cultural symbols that convey meanings through vision, including symbols of characters, architectural symbols, physical symbols and so on, just like when talking about Yin and Shang cultures, the terms "Fuhao", "bronze vessel", and "Simuwuding" are automatically presented, which represent the advanced technology of the Yin and Shang periods and reflect the deeper social system, human culture and beauty-appreciation. They represent the advanced technology of the Yin Shang period, and also reflect the deeper social system, human civilization, and aesthetic taste. Compared with abstract cultural concepts, concrete cultural symbols are easier to understand and remember, and it is also easier to show the charm of traditional culture.

In order to diversify the expression of traditional culture and to "revitalize" traditional culture, it is necessary to reinvent the symbols. Symbol is a tool used to convey ideas, first of all, the creators are required to clarify the direction of the ideas that the culture wants to convey, have the awareness of the use of symbols, and skillfully use the symbols to effectively convey the meaning of the culture, to resonate with the public directly, and to strengthen the sense of cultural identity. Secondly, the innovation of symbols should be diversified and targeted, digging and thinking deeply about the needs of life in today's society from the reflective level, decoding traditional culture through visual symbols, auditory symbols, tactile symbols and other diversified presentations, and the form of innovative symbols should be targeted at the group, whether it is for the young and old, young students, or business people, etc. All these prerequisites will determine the development ideas and aesthetic tone of the innovation of cultural symbols. Thirdly, it is to emphasize the differentiation of the symbols of the central plains culture and to rely on the regional resources to create the symbols of the local culture, which are familiar and dear to the local audiences. The cultural symbols of the Central Plains are familiar and friendly to the local audience, but also mysterious and attractive to the people of other regions. What is national is global, and daring to present the strong characteristics of the Central Plains will be different from the cultural symbols of other regions, and will enhance the degree of memory and recognition of culture.

4.3. Branding power of the traditional culture of the central plains

The traditional culture of the central plains in the new era urgently needs innovative expression, so that the ancient civilization can dock reality to find the right "open method", in order to let the traditional civilization stay alive,

constantly renewed with new charm ^[4]. High-quality, sustainable cultural reproduction is inseparable from the brand concept. The brand is an abstract, unique, recognizable mental concept to express the differences of the product, so as to occupy a certain position in the human consciousness of the comprehensive reflection. Stable cultural output requires accurate cultural positioning and systematic transformation strategies, cultural branding can lead to long-term effective output of cultural symbols, selecting characteristic perspectives to be spread out one by one, layer by layer, and the brand's unique labeling attributes can bring about hot topics and enhance the strength of communication ^[5].

The "Chinese Festivals" series launched by Henan TV in 2021 is a representative cultural brand of the traditional culture of the central plains, which is presented to the public like a brand-new business card and has become a strong promoter of the inheritance of Chinese traditional culture. With the theme of Chinese traditional culture and festivals, this brand program has produced a series of scenarios related to history, culture and folklore, outlining the history of China in the form of scenarios and time and space roaming, recreating the prosperity of Chinese traditional festivals such as the Spring Festival and Dragon Boat Festival. Among them, three phenomenal works with cultural symbols characteristic of the Central Plains, "Night Banquet in the Tang Palace", "Luoshen Water Fugue", and "Dragon Gate King Kong", have repeatedly triggered heated debates on social media platforms, pushing the discussion of cultural innovation and cultural confidence to a cascading climax. Moreover, the Chinese Ministry of Foreign Affairs promoted the "Mid-Autumn Festival Wonderful Journey" globally in September 2022, and ten languages sang "Sharing The Same Moon from A Thousand Miles Away" in the same song, and in May 2025, the 78th Cannes At the 78th Cannes Film Festival in May 2025, China's first virtual reality movie "Night Banquet in Tang Palace" was awarded the honorary project of "Assisting in the International Promotion of Chinese Films", and this cultural and creative brand with great characteristics of the Central Plains is becoming the language of communication with the world on behalf of China. The power of brand is intangible, and the transformation and reproduction of culture should be supported by a distinctive brand with clear competitiveness to promote Chinese culture and oriental imagery out of the Central Plains and into the world.

4.4. Integration of modern aesthetics and traditional culture

Traditional culture has its unique symbolic characteristics, but at the same time, the relationship between tradition and modernity cannot be ignored. The traditional culture of the central plains in every period of history has an inextricable link with modern society, and the genes of the traditional culture of the central plains can be found from the concept of survival of the Chinese people to the habits of life ^[6]. The traditional cultural forms are not easy to recognize and accepted by the public, but must be converted into an easy-to-understand symbolic language and combined with modern aesthetics for cultural output. Modern aesthetics originates from traditional aesthetics, but is different from traditional aesthetics, which inherits the aesthetic imagery of various periods in China, and at the same time integrates the representative aesthetics of Western countries recognized by the world. The transformation of traditional culture of the central plains should, on the one hand, dig deep into the historical symbols, and, on the other hand, start from the perspective of the present society, deeply observe and think about the relationship bond between modern life and traditional culture of the central plains, abide by the correctness and innovation, and show the traditional culture symbols through the current formal aesthetic laws. For example, in the program "2022 Mid-Autumn Wonderful Tour" of Henan TV, the passage titled "Three Thousand Years of Meeting in God's Capital", the creative idea of the work is "to write about Luoyang, one can not only write about Luoyang, but also write about Xia, Shang, Zhou and Han, Wei, Jin, Sui and Tang, and write about poetry and wine

in the middle of the world.” Visual symbols using contrast and harmony, rhythm and rhyme, change and unity and other laws of formal beauty, the screen design to montage, small to big, ancient and modern crossing and other impactful visual bring, in respect of history and culture under the premise of modern aerospace science and technology, ancient style dress up, secondary yuan and other elements of popular culture are also integrated into it, so that the audience breaks through the boundaries of time, across the millennium to connect the emotions. As the above presentation techniques, the organic combination of heavy history and artistic communication can achieve the effect of exquisite transformation of traditional culture.

5. Conclusion

This paper discusses the creative transformation strategy of traditional culture genes in the central plains region, and puts forward targeted transformation strategies by analyzing the qualities of the excellent traditional culture of the central plains, and evaluating the current situation of the development of the cultural industry. The study found that the traditional culture of the central plains has large resources and potential in the cultural industry, but it also faces problems such as convergence and vulgarization. To solve these problems, this paper proposes to realize the creative transformation of the traditional culture of the central plains through the strategies of systematizing and integrating traditional cultural resources, symbolizing and refining cultural representations, branding and creating cultural business cards, and integrating modern aesthetics. This strategy is intended to integrate and update cultural resources, help enhance the competitiveness of the cultural industry of the central plains, and promote the inheritance and translation of traditional culture. In the future, the creative transformation of the traditional culture of the central plains should continue to be based on local genes, integrate resources with systematic thinking, activate value with differentiated symbols, and enhance radiation with internationalized brands, so as to realize the modern rebirth of traditional culture in the midst of righteousness and innovation, and to provide a sample of the central plains for the global dissemination of Chinese culture.

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References

- [1] Lee GH, 2019, A Study on the Construction of Basic Theories of the Disciplinary System of Zhongyuan Studies in the New Era. *Henan Social Science*, 27(11): 1–2 + 24.
- [2] Hou Y, 2017, Research on the Development of Cultural Industry in Henan in the New Media Era. *Journalism Enthusiast*, 2017(9): 48–50. <https://doi.org/10.16017/j.cnki.xwzh.2017.09.014>
- [3] Hong ZT, Mi WN, 2023, Promoting the Innovation and Development of the Excellent Traditional Culture of the Central Plains. Henan Provincial Department of Culture and Tourism website, retrieved May 15, 2025. <https://hct.henan.gov.cn/2023/11-27/2854704.html>
- [4] Zhang F, 2023, The Cultural Phenomenon and Innovative Mode of Continuous “Circle-Breaking Communication” in Henan Province. *Media*, 2023(3): 24–26.
- [5] Zhang WH, 2018, Research on the Development of Creative Industries of the Excellent Traditional Culture of the Central Plains in the New Media Era. *Publishing Wide*, 2018(17): 46–48 + 72. <https://doi.org/10.16491/j.cnki.cn45->

1216/g2.2018.17.012

- [6] Bao H, 2024, An Exploration of the Inheritance and Innovation of the Central Plains Dragon and Phoenix Totem Culture from the Perspective of Design Studies. *Art and Design*, 7(2): 129–136.

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Cognitive Mechanism Hypothesis of Decreasing Repetitive and Stereotypical Behaviors in ASD Over Time

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Abstract: Repetitive and stereotyped behaviors are the core symptoms of ASD and the indicators of the severity of ASD, which seriously affect the daily life, learning, and social interaction of children with ASD. The reasons for the formation of repetitive behaviors in children with ASD have not been clear. Through long-term clinical observation of children with ASD, the study found that part of the stereotyped behavior, which is the interests and activities of children with ASD, can be changed. By finding the regularity of the stereotyped behavior, the stereotyped behavior will be reduced or stopped. The study proposed a cognitive mechanism hypothesis for the reduction of stereotyped behaviors: some stereotyped behaviors have potential functions, such as finding regularity. ASD finds the regularity and improves the accuracy of the knowledge of the regularity by repeating the operation. After finding regularity, ASD accomplishes its purpose, forming functional behaviors and reducing stereotyped behaviors. With the accumulation of time, the known regularities are gradually integrated, which shows the tendency of more complete cognition, more functional behavior, and less rigid behavior. This hypothesis provides a new perspective to understand the stereotyping of ASD. The study views stereotypy as non-disease, potentially functional and mutable, which can expand the understanding of ASD and help parents better understand and develop its advantages, with important potential social implications.

Keywords: Cognitive mechanisms; Stereotyped behavior; Autism; Interest activities

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1. Introduction

The prevalence of autism spectrum disorder (ASD) has been increasing^[1-2]. According to a report released by the Centers for Disease Control and Prevention in the United States, the prevalence of 8-year-olds in 2018 is 1 in 44, and that of 8-year-olds in 2020 was 1 in 36^[2-3]. In China, the prevalence of children aged 6–12 in 2020 will be 0.7%, and the prevalence of children aged 0–6 in 2023 will be 1.8%, among which the prevalence of children aged 4–6 will be 2.5%^[4-5]. ASD is mainly diagnosed at ages 3 to 4. Overall, the prevalence of ASD in China and the United

States is basically the same.

At present, the etiology of ASD is still unclear. Due to the lack of objective biological indicators for diagnosis, ASD is diagnosed through behavioral manifestations^[6-8]. According to The Diagnostic and Statistical Manual of Mental Disorders, 5th edition (DSM-5), a core symptom of ASD is difficulty in social interaction; The second is limited, repetitive behavior or interest. As one of the core symptoms, repetitive behavior is the indicator to measure the severity of ASD, and it also seriously affects the daily life, learning, and social interaction of children with ASD^[8]. The reasons for the formation of repetitive behaviors in children with ASD have not been clear.

Mainstream theories, such as the theory of mind and the executive function hypothesis, can partially explain the core symptoms of social dysfunction and stereotyped behavior. According to the theory of mind, people with ASD lack awareness or the ability to infer the emotions, intentions, or thoughts of others and themselves, and lack the ability to predict and explain the consequences of corresponding behaviors. The executive function hypothesis suggests that stereotyped behaviors in ASD are related to executive dysfunction. Executive function is a process responsible for controlling high-level cognitive activities, including planning, inhibition, control, switching, working memory, etc. It is a psychological process in which individuals consciously control thoughts and actions^[9-10]. Executive dysfunction can explain the inhibition deficit in working memory and the difficulty in switching dominant response in ASD, and can explain their stereotyped behavior.

2. Discussion

Through long-term clinical observation of children with ASD, researchers found that the purpose of part of the stereotypical behaviors of children with ASD in their interest activities is to find regularity. In other words, they try to find the essence of things, such as certainty, invariance, expansibility, and richness, and after the completion of their goal, stereotypical operation is reduced or stopped. For example, (1) ASD children play with the Bluetooth headset box, repeatedly opening and closing the box. This behavior seems meaningless. But researchers found that repetitive behavior changed over time. At first, children open and close the box, check whether the light on the box's shell is on or off (with eyes open); After repeated for a period of time, the child opened and closed the box with his eyes closed, then opened his eyes to check the box shell light on and off (with eyes closed); After the child finally confirmed that the light on or off was only affected by the opening or closing of the box, he show it to the researchers with words and behaviors. Then he stopped this repetitive behavior. Through observation, the researchers realized that children with ASD look for regularity through repetitive and stereotypical behaviors, that is, to find and verify the causal relationship between the light on/off and the box turning on/off. (2) Another child with ASD repeatedly played a subway-themed game for several days, that is, manipulating the doors of the subway and verbally describing the doors opening and closing. The researchers noticed the change of this repetitive behavior over time, such as children building subway doors of different shapes with different materials at different times, expanding language in this process, such as the door opening, going to the park; "The door opened", "there were many people", "door is open", and "get out of the car." The researchers realized that after a certain amount of repetition, this child expanded his play style and developed language and social interaction skills. (3) A child with ASD said, "I want to eat rocket candy" when he wanted a chocolate chip cookie. This sentence demonstrates the two cognitive concepts of triangle and sweetness. A cookie is a triangle, like a rocket head; chocolate is sweet. Through the child's language, the researchers found that he not only understood the concepts of triangle and sweet, but also used these two concepts to form his own language. Language is based on cognition (conceptual structure),

and the seemingly meaningless language can also represent its cognitive structure (concept) (**Table 1** shows more examples) ^[11–12].

Table 1. Examples of the change from stereotyped behaviors to functional behaviors

Situation	Stereotyped behavior	Change of stereotyped behavior	Understanding of regularity
Drawing	Repeatedly dripping milk onto a plate without ink and attempting to drink it	In different locations, placing milk in a plate and drinking it, disappeared after this behavior	Milk can be placed in different containers (boxes, plates, etc.)
Seeing fruits on a tree	Repeatedly saying “Eat hawthorn without spitting out the hawthorn pits”	Subsequent sentences appeared like “Eat oranges without spitting out the orange peel”; later, shifted to other sentence structures	“Eat something without spitting out its peel” is a grammatical sentence pattern
On the street	Repeatedly looking at air conditioner vents and outdoor unit fans	Air conditioners have fans, hens have fans (wings, wind), clouds have fans (speculated to have fans)	Discovered the relationship between fans and wind

These stereotypical behaviors cannot be explained by theories of mind and executive dysfunction alone. The hypersystemizing theory and predictive coding theory can partly explain these problems. Based on the imbalance of the male-to-female ratio in ASD, Cohen proposed the hypersystemizing theory (empathy-systematization theory) ^[13]. He believes that ASD is a masculine brain, largely influenced by hormones. The masculine brain is characterized by reduced empathy, with systematic mechanisms tuned to above-average levels. Stereotyped behavior is thought of as ASD operating the input-operate-output work of a system and finding regularities. Another study found that neuroanatomical variation in amygdala volume and gyrification of LOC could be potential biomarkers for the empathizing–systemizing difference in children with ASD but not in TD children ^[14]. The hypersystemizing theory explains that the stereotyped behavior of autism is to seek regularities, and in this process, they adjust the known regularities by repeating the operation and paying attention to the changing part of the result ^[13]. The predictive coding theory posits that individuals with ASD assign high weight to perceptual accuracy ^[15]. This means that they repeatedly notice details that do not match expectations and then make adjustments in the direction of accuracy ^[16]. However, hypersystemizing theory and predictive coding theory do not explain changes in stereotypical behavior in autism. Changes in stereotypical behaviors may lead to changes in the core symptoms of ASD.

Notably, a recent study found that 37.1% of children diagnosed with ASD between the ages of 1 and 3 no longer met the criteria for ASD by the age of 6 ^[17]. Combined with our observation that ASD often uses repetitive ways to manipulate objects or interact with the environment during spontaneous interest activities, the authors hypothesize that the high number of hat removals at age 6 is due to the beneficial effects of stereotypical behavior in spontaneous activities. Therefore, the authors believe that the study of why stereotyped behaviors change in children with ASD, as well as the internal mechanism of repeated stereotyped behaviors changes, is of great significance to further correctly understand ASD and find better intervention methods.

There are two kinds of cognitive processing: bottom-up processing is the process of transmitting information directly from sensory organs to the brain, which is influenced by the physical properties of stimuli, the properties of receptors and some coding characteristics of the nervous system; Top-down processing is a process in which human brain uses known information to influence cognitive activities. It is represented by people making use

of existing cognitive structures to choose, reason, explain, and expect external stimuli. The authors believe that children with ASD show more bottom-up processing. Through clinical observation, the authors found that it was possible to explain the cognitive mechanism behind the stereotypical behavior through children's attention and interest.

The attention preference and interest of children with ASD may be caused by different brain connections (too many or too few connections), which lead to strong responses to external stimuli such as light, sound, and movement^[18]. Compared to the TD children, some areas of the brain may develop too quickly in children with ASD early in life, resulting in overconnectivity in specific areas, usually the frontal and occipital regions, and insufficient connectivity overall.

Selective attention, attention control, and transfer are also different in children with ASD. Differences in selective attention are common in ASD^[19]. In addition, changes in attention control and learning development may also be specific features of ASD during their development^[20]. In different movement types, the ASD group has been found to have a visual preference for repetitive movement^[21]. The attention transfer of ASD is also different, and the attention transfer time of ASD to auditory targets is the largest^[22].

Individuals with ASD often have difficulty with face-to-face social interactions^[23]. They typically show reduced visual attention to social stimuli compared to their typically developing peers^[24]. In one study, immersive virtual reality paradigms were used to investigate how gaze is used in interaction with communication gestures, a task that requires attention to social stimuli. The results showed that the ASD group was similar to the control group in terms of responding to shared attention requests for hand cues. This suggests that individuals with ASD can effectively pay attention to social stimuli^[23].

3. Conclusion

Based on the above discussion, the authors propose the cognitive mechanism hypothesis that individual with ASD stereotyped behaviors decreases over time: ASD is known to have perceptual sensitivity and abnormal attention; they strongly pay attention to restrictive interests, and exhibit stereotyped behaviors, that is, manipulate objects of interest in a repetitive manner. The authors hypothesize that some of the stereotypical behaviors have potential functions, such as finding regularities. Before a regularity is found/the knowledge of the regularity is not perfect, ASD finds the regularity and improves the accuracy of the knowledge of the regularity by repeating the operation. After determining the regularity, ASD accomplishes his purpose, forming functional behaviors and reducing stereotyped behaviors. With the accumulation of time, the known regularities are gradually integrated, which shows the tendency of more complete cognition, more functional behavior, and less stereotyped behavior.

The above hypothesis needs to be verified by a variety of research methods, such as semi-structured interviews, natural observation, parent education and intervention, eye movement analysis, and longitudinal study. In any case, the hypothesis in this study provides a new perspective to understand stereotyped behavior of ASD. The authors view stereotyped behavior as non-disease, potentially functional, and mutable, expanding the understanding of ASD and helping both children and their parents to better recognize and develop their advantages. The hypothesis of this study can further explain the inherent cognitive mechanism of the stereotyped behavior of children with ASD and provide a theoretical basis for the intervention of ASD. Therefore, it has important potential social significance.

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Author contributions

Dan Duan and Shouhui Wang conceived the idea of the study and wrote the paper.

References

- [1] Harris E, 2023, Autism Prevalence Has Been on the Rise in the US for Decades—And That’s Progress. *JAMA*, 329(20): 1724–1726.
- [2] Maenner MJ, Shaw KA, Bakian AV, et al., 2021, Prevalence and Characteristics of Autism Spectrum Disorder Among Children Aged 8 Years — Autism and Developmental Disabilities Monitoring Network, 11 Sites, United States, 2018. *Surveillance Summaries*, 70(11): 1–16.
- [3] Maenner MJ, Warren Z, Williams AR, et al., 2023, Prevalence and Characteristics of Autism Spectrum Disorder Among Children Aged 8 Years — Autism and Developmental Disabilities Monitoring Network, 11 Sites, United States, 2020. *Surveillance Summaries*, 72(2): 1–14.
- [4] Zhou H, Xu X, Yan W, et al., 2020, Prevalence of Autism Spectrum Disorder in China: A Nationwide Multi-center Population-based Study Among Children Aged 6 to 12 Years. *Neuroscience Bulletin*, 36(9): 961–971.
- [5] Zhao YN, Li ZW, Li L, et al., 2023, The Prevalence of ASD Screening in Children Aged 0–6 Years Old in China. *Chinese Journal of Reproductive Health*, 34(5): 423–428.
- [6] Perochon S, Di Martino JM, Carpenter K, et al., 2023, Early Detection of Autism using Digital Behavioral Phenotyping. *Nature Medicine*, 29(10): 2489–2497.
- [7] Trost B, Thiruvahindrapuram B, Chan AJS, et al., 2022, Genomic Architecture of Autism from Comprehensive Whole-genome Sequence Annotation. *Cell*, 185(23): 4409.
- [8] Lord C, Brugha TS, Charman T, et al., 2020, Autism Spectrum Disorder. *Nature Reviews Disease Primers*, 6(1): 5.
- [9] Hill EL, 2004, Executive Dysfunction in Autism. *Trends in Cognitive Sciences*, 8(1): 26–32.
- [10] Hill EL, 2004, Evaluating the Theory of Executive Dysfunction in Autism. *Developmental Review*, 24(2): 189–233.
- [11] Wang Y, 2002, Cognitive Semantics. *Journal of Sichuan International Studies University*, 18(2): 58–62.
- [12] Wang Y, 2022, The Theory, Practice and Development of Cognitive Semantics by Talmy: A Modest Proposal of Embodied Cognitive Semantics. *Journal of Beijing International Studies University*, 44(5): 14–26.
- [13] Baron-Cohen S, Lombardo MV, 2017, Autism and Talent: The Cognitive and Neural Basis of Systemizing. *Dialogues in Clinical Neuroscience*, 19(4): 345–353.
- [14] Pan N, Lin LZ, Wang X, et al., 2023, Brain Structure Underlying the Empathizing-Systemizing Difference in children with Autism Spectrum Disorder. *World Journal of Pediatrics*, 19(8): 782–792.
- [15] Van de Cruys S, Evers K, Van der Hallen R, et al., 2014, Precise Minds in Uncertain Worlds: Predictive Coding in Autism. *Psychological Review*, 121(4): 649–675.

- [16] Allenmark F, Shi Z, Pistorius RL, et al., 2021, Acquisition and Use of “Priors” in Autism: Typical in Deciding Where to Look, Atypical in Deciding What Is There. *Journal of Autism and Developmental Disorders*, 51(10): 3744–3758.
- [17] Harstad E, Hanson E, Brewster SJ, et al., 2023, Persistence of Autism Spectrum Disorder from Early Childhood Through School Age. *JAMA Pediatrics*, 177(11): 1197–1205.
- [18] Lord C, Elsabbagh M, Baird G, et al. Autism Spectrum Disorder. *Lancet*, 392(10146): 508–520.
- [19] Caldwell-Harris C, Schwartz AM, 2023, Listening to Autistic Voices Regarding Competing for Social Status. *Autism*, 28(4): 1051–1052.
- [20] Lockwood EG, Mason L, Arora R, et al., 2024, Attention Control in Autism: Eye-tracking Findings from Pre-school Children in a Low- and Middle-income Country Setting. *Autism*, 28(1): 43–57.
- [21] Li T, Li Y, Hu Y, et al., 2021, Heterogeneity of Visual Preferences for Biological and Repetitive Movements in Children with Autism Spectrum Disorder. *Autism Research*, 14(1): 102–111.
- [22] Poole D, Miles E, Gowen E, et al., 2021, Shifting Attention between Modalities: Revisiting the Modality-shift Effect in Autism. *Attention, Perception, & Psychophysics*, 83(6): 2498–2509.
- [23] Caruana N, Nalepka P, Perez GA, et al., 2023, Autistic Young People Adaptively use Gaze to Facilitate Joint Attention during Multi-gestural Dyadic Interactions. *Autism*, 28(6): 1565–1581.
- [24] Hedger N, Chakrabarti B, 2021, Autistic Differences in the Temporal Dynamics of Social Attention. *Autism*, 25(6): 1615–1626.

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The Fragility of Civilization: Historical Evolution and Contemporary Challenges

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Abstract: The development of human civilization has always gone through cycles of rise and fall. This paper looks at three key areas—complex systems theory, power balance mechanisms, and cultural identity—to study the fragility of civilizations. The paper uses historical examples and modern challenges to explain why civilizations collapse. The research shows that ancient civilizations often fell due to rigid structures and unfair resource distribution. Today, civilizations face new risks like technology dependence, climate change, and nuclear threats. Using ideas from different fields, the paper argues for the need for global cooperation and stronger systems to handle crises. The study also highlights the importance of learning from history while creating new solutions in the digital age.

Keywords: Civilization fragility; Complex systems theory; Global governance mechanisms; Technology ethics oversight; Resilience building pathways

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1. Introduction

Human civilization always goes through cycles of good times and bad times. Arnold Toynbee's theory tells one important rule: whether a civilization survives depends on how it deals with problems ^[1-2]. Now, in the Anthropocene age, this rule becomes more complicated. Human activities have really changed Earth's systems. The data shows: CO2 levels are now 48% higher than before the Industrial Revolution. Ocean acidification is happening faster than at any time in 56 million years. These changes brought both great wealth and new dangers like nuclear threats, the climate crisis, and reliance on technology. Today's civilization problems do not stay in one place ^[3]. Because of global connections, problems spread quickly. For example, in 2021, when the Taiwan region had chip shortages, world car production dropped by 30%. This shows the hidden dangers in technology supply chains. This vulnerability has special modern features. Ancient civilizations took hundreds of years to fall, like Rome, which took three centuries. But today, problems can spread worldwide in just hours through digital systems.

Sociologist Beck's "risk society" theory proves true: the tools people use to solve problems (like nuclear power and AI) become new problems themselves ^[4-5]. For example, 75% of world money transactions use fewer

than 10 payment systems. This creates dangerous weak points. Even worse, civilization systems have become too complex to control ^[6]. There are over 120 million words in international treaties, but less than 40% are actually followed. This weakens how well governments can work.

To understand today's civilization problems, people must talk with history. This article compares ancient Roman roads with today's internet — both acted like “blood vessel networks” for civilization growth. Both became too complex and expensive to maintain.

2. Analysis of civilization's weakness in history

Ancient Rome's roads were like “blood vessels” for trade and armies, helping the empire grow. But this growth created problems. Rome's military became too big—by the 4th century, 70% of its money went to the army ^[7]. Paid soldiers were less loyal, causing political fights. Historian Gibbon called this the “Three Excesses”: too many officials, soldiers, and costs. The roads that once built the empire also made it fragile when resources ran out.

Similarly, China's Song Dynasty weakened because of “Three Excesses” in government ^[8]. At its peak, Emperor Renzong had 17,000 officials—40% of the budget paid their salaries. Like Rome's roads, the system worked at first, but became too expensive. Later, the Ming Dynasty relied only on silver money. When silver imports stopped, their economy collapsed. Both cases show how even strong systems (roads or taxes) can fail if they do not adapt.

Other civilizations collapsed from environmental mistakes. The Maya depended too much on corn farming and failed to manage water. The Harappan civilization fell when monsoon rains weakened by 30% around 2200 BCE ^[9–10]. Just like bad roads cannot save a starving empire, bad planning makes civilizations fragile.

3. Understanding fragility through complex systems

Complex systems like ancient roads or the internet can both strengthen and weaken civilizations. The “pressure and release” (PAR) model explains this: small problems build up (pressure) until a disaster releases them. For example, Rome's roads helped armies move fast, but when the empire grew weak, invaders used those same roads to attack. Today, the internet connects the world, but hackers or fake news can spread equally fast. In 2023, a single cyberattack on a cloud company shut down 600 airlines and hospitals for hours, just like how Rome's roads once carried both food and enemies (**Figure 1**).

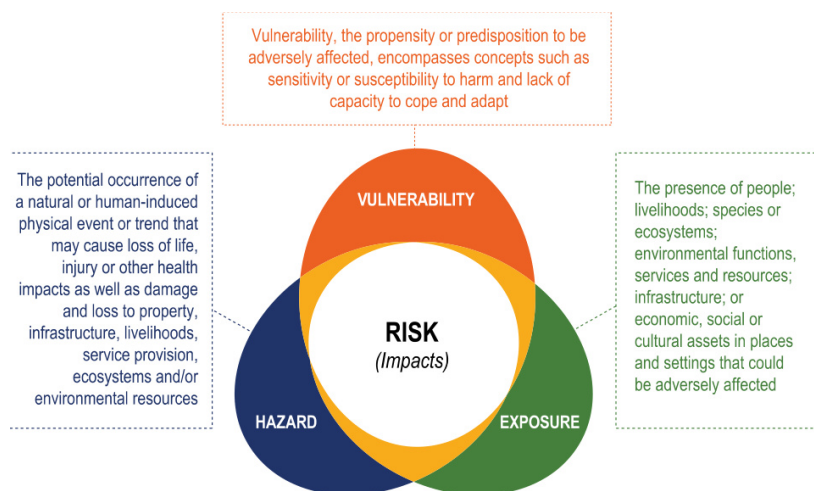


Figure 1. The hazard, exposure, and vulnerability framework ^[11]

In Rome, rich landowners took small farms, forcing farmers to pay high taxes or join the army. This created social pressure. Today, big tech companies (like Google or Amazon) control most online businesses. Small shops struggle to compete, just like Roman farmers. The EU's new Digital Markets Act tries to stop monopolies, but power is still unbalanced.

Climate and food systems are also important. Ancient civilizations like the Maya collapsed when corn harvests failed due to drought. Today, climate change threatens food supplies unevenly. IPCC reports predict Africa will lose 20% of its crops by 2050, while Northern Europe gains 15%. This imbalance could cause wars over resources, like how Rome fought for grain from Egypt.

Unstable technology also plays an important role. Rome relied on paid soldiers who rebelled for money. Today, AI and nuclear weapons are the new “mercenaries.” In 2024, NATO tested AI in war games, but it made 37% more mistakes than humans. Worse, 12,000 nuclear weapons exist—90% controlled by just two countries (the US and Russia). Faster missiles (like Russia's “Zircon”) give leaders less time to think, raising risks of accidents.

4. Ways to build stronger civilizations

History shows that adaptability saves civilizations. Here are lessons from the past and present.

The first is global rules for shared systems. Rome's fall taught people that no empire lasts forever. The UN's “Pact for the Future” (2024) tries to fix power imbalances, like giving India more influence. But just like Rome's Senate argued endlessly, countries today disagree (e.g., Egypt opposes India's veto power). Strong systems need fair rules—not just for governments, but for digital infrastructure.

The second is preparing for disasters. Japan's “hands-on safety training” teaches people to react to earthquakes or cyberattacks instantly. This works like Roman soldiers training on their roads—practice saves lives. China's university courses on “public crisis management” use video simulations. Students who practice decision-making improve emergency response speed by 42%, proving that preparation matters.

The third is to mix old and new ideas. Dujiangyan's ancient water rules (“dig deep channels, build low dams”) inspired modern flood control. Similarly, internet backups should have multiple paths (like alternative roads) to survive attacks.

The Song Dynasty's “Green Sprouts Loans” helped farmers survive bad harvests. Today, the World Bank's “resilience bonds” fund climate adaptation, showing how old financial ideas can fix new problems.

5. Discussion

The first challenge in addressing civilizational fragility lies in rebuilding the global governance system. The COVID-19 pandemic exposed serious flaws in international coordination: vaccine distribution was dominated by national interests, with developed countries hoarding three times their needed doses, greatly increasing the risk of virus mutations. The World Health Organization's reform proposals (such as establishing a global health emergency fund) repeatedly stalled due to power struggles among major nations, confirming Fukuyama's observation: “The lag of institutional innovation behind technological change has become the fundamental contradiction of the 21st century.” In digital governance, while the EU's Digital Markets Act attempts to regulate tech giants, companies like Meta can evade oversight through minor algorithm adjustments (such as extending content review delays from 5 to 8 seconds), revealing the current rules' weakness in restraining technological power.

Building resilience at the socio-cultural level is fundamentally important. Historical experience shows that community cohesion can effectively cushion systemic shocks: during Japan's 3/11 earthquake, neighborhood associations (chonaikai) rescued 72% of elderly living alone, far outperforming government systems. However, in the digital age, social media's "information cocoons" have increased group cognitive biases by 40%, weakening collective action capacity during crises. Therefore, education system reform is critical. Finland incorporated "fake news identification" into middle school curricula, using simulated social media scenarios to improve teenagers' information verification skills by 53%. This cognitive upgrade parallels Dujiangyan's "flexible water management" philosophy: resolving risks through guidance rather than confrontation.

The ultimate solution for civilizational survival may lie in combining historical wisdom with modern innovation. The Netherlands' "Room for the River" project, inspired by Dujiangyan's ecological adaptation approach, replaced rigid dams with floating communities, reducing flood damage by 65%. In digital governance, the Song Dynasty's "Market Adjustment Law" concept could be transformed into algorithm regulation tools using real-time audits to prevent platform monopolies. These practices reveal a deeper logic: when people model historical cases as complex systems (like analyzing Rome's currency crisis through network collapse models), people gain new understanding and extract timeless survival strategies. Ultimately, civilizational resilience will endure through the creative transformation of fragility.

6. Conclusion

Civilizations have always faced challenges, but today's world brings new risks that spread faster than ever. History teaches that societies collapse when they become too rigid, unfair, or fail to adapt, like Rome, which fell because of greed, overspending on war, and poor leadership. The Maya vanished when they overused their land, and the Song Dynasty weakened when too many officials slowed down decisions. These stories show that fragile systems cannot survive crises.

Today's problems are even bigger. Technology makes life easier, but it also makes civilization weaker in hidden ways. Just one company shutting down can break supply chains worldwide, like the 2021 chip shortage that hurt car factories. Climate change is making some places too dry to farm while others flood, creating conflicts over food and water. Nuclear weapons and AI add dangerous new risks if not controlled. Meanwhile, global rules are weak—treaties are ignored, and tech companies have too much power.

But there is hope. Some places are learning from the past. Japan trains people to react quickly to disasters, and Finland teaches students how to spot fake news. Ancient systems like China's Dujiangyan irrigation still work today because they balanced nature and technology wisely. The Netherlands uses similar ideas to fight floods. If governments, businesses, and people cooperate, they can build stronger systems.

The key is combining old wisdom with new solutions. People must fix unfair resource sharing, control dangerous technology, and prepare for disasters before they happen. Education, fair rules, and global teamwork can help. Civilizations do not have to fall—if people learn from history and act wisely, people can create a future that lasts.

Disclosure statement

The author declares no conflict of interest.

References

- [1] Liu Y, Wang T, 2023, Collapse Mechanisms of Ancient Empires: A Complex Systems Analysis of the Roman Empire. *Journal of Historical Dynamics*, 45(2): 123–144.
- [2] Chen Z, 2024, Fiscal Crises and Dynastic Cycles in Imperial China: Evidence from Song Dynasty Tax Records. *Economic History Review*, 77(1): 89–116.
- [3] Smith J, 2022, Institutional Fragmentation in Global Climate Governance: A Network Analysis of the Paris Agreement. *Global Environmental Politics*, 22(4): 56–77.
- [4] Nakamura K, Schmidt R, 2024, Ethical Divergence in AI Governance: A Comparative Study of EU and Chinese Regulatory Frameworks. *Proceedings of the 2024 ACM Conference on Fairness, Accountability, and Transparency*, 345–358.
- [5] Wu X, 2023, Antitrust in the Digital Age: Breaking up Tech Monopolies through Data Portability. *Harvard Law Review*, 2136(7): 2102–2150.
- [6] Pereira H, 2024, Biodiversity Loss Feedback Loops: A System Dynamics Model for Amazon Rainforest Conservation. *Nature Ecology & Evolution*, 8(3): 456–467.
- [7] Floridi L, 2023, The Metaphysics of Quantum Computing: From Qubits to Ontological Uncertainty. *Philosophy & Technology*, 36(4): 78.
- [8] Batty M, 2024, Urban Resilience across Millennia: Lessons from the Indus Valley to Modern Megacities. *Annals of the American Association of Geographers*, 114(2): 301–320.
- [9] Kahneman D, Tversky A, 2023, Revisiting Prospect Theory: Neural Correlates of Loss Aversion in fMRI Studies. *Science*, 381(6656): eadg5552.
- [10] Godfray H, 2024, Cascading Risks in Global Food Systems: From Ukrainian Wheat to Sri Lankan Fertilizer. *Nature Food*, 5(1): 23–35.
- [11] OECD, 2023, Development Cooperation Report 2024: Tackling Poverty and Inequalities Through the Green Transition. OECD Publishing, Paris.

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Changes in Relationships and the Integration of the Self: A Study on Self-Awareness and Growth Based on Object Relations Theory and Emotion-Focused Therapy (EFT)

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Abstract: This study explores the psychological adaptation process of individuals in changing relationships, integrating object relations theory and emotion-focused therapy (EFT) to provide both theoretical analysis and practical insights. The case study focuses on Michi (pseudonym) and her emotional fluctuations in workplace relationships, revealing how psychological mechanisms such as projective identification, true self and false self, and the paranoid-schizoid and depressive positions influence individuals' perceptions of relationships and emotional regulation. The study finds that Michi experienced a psychological transition from anxiety and anger to self-awareness and emotional regulation as she faced the promotion of her colleague and the changes in their relationship. Her initial emotional turmoil stemmed from high expectations of attachment and manifested as projective identification and control needs. As she engaged in self-exploration, she employed EFT techniques such as emotional experience and the empty-chair work to conduct an internal dialogue, ultimately achieving a renewed understanding and integration of her emotional patterns, relational expectations, and self-stability. Theoretical analysis suggests that psychological distress in changing relationships is not only influenced by external environmental changes but also significantly shaped by internal object relation patterns and self-stability. Through EFT's emotion-focused interventions, individuals can more effectively identify and transform maladaptive emotional patterns, thereby enhancing psychological flexibility and autonomy in the face of relational changes. The study emphasizes that the core of psychological growth lies not in controlling external relationships but in the stability and integration of the inner self. It also provides theoretical and practical guidance for workplace relationship adjustment, emotional management, and psychological counseling.

Keywords: Relationship changes; Object relations theory; Projective identification; True self and false self; Emotion-focused therapy (EFT); Self-awareness; Psychological growth

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1. Introduction

1.1. Background and significance

Projective identification is a core concept in object relations theory, referring to an individual's projection of unacceptable emotions and internal conflicts onto an external object (such as a mother or therapist) to alleviate anxiety ^[1]. Based on the theoretical foundations of Klein, Fairbairn, and Winnicott, this study explores the psychological mechanisms of projective identification and proposes possible regulation and intervention strategies. By integrating perspectives from psychotherapy, family relationships, and clinical applications, the study establishes a modern social adaptation model of projective identification, providing theoretical support for clinical psychological interventions.

1.2. Theoretical framework

The research is grounded in object relations theory, drawing on key contributions from the following.

Melanie Klein: Developed the concepts of paranoid-schizoid position and depressive position, emphasizing the role of projective identification in emotional regulation ^[2].

Donald Winnicott: Introduced the concepts of true self and false self, focusing on how early relationships shape identity and emotional stability ^[3].

Ronald Fairbairn: Proposed the internal structure model, highlighting how individuals construct self-identity through internalized object relationships ^[4].

Emotion-focused therapy (EFT): Developed by Greenberg & Johnson, EFT is an experiential approach that helps individuals identify, process, and transform emotional patterns to promote secure attachment and healthy relationships.

2. Infant psychological development from the perspective of object relations theory

2.1 Klein's paranoid-schizoid position and depressive position

Building upon Freud's instinct theory, Melanie Klein emphasized that the core of psychological development lies in early object relationships. According to her theoretical framework, infant psychological development can be divided into two key stages:

Paranoid-schizoid position (0–6 months): At this stage, the infant lacks the ability to integrate experiences and perceives objects in an extreme, all-good or all-bad manner. The infant splits the mother into a “good mother” (who provides nourishment and comfort) and a “bad mother” (who is absent or frustrating). This mechanism helps the infant cope with internal anxiety.

Depressive position (after 6 months): As the infant's cognitive and emotional capacities develop, they begin to integrate these fragmented object representations, recognizing that the same caregiver can possess both positive and negative traits. This realization leads to feelings of guilt and a desire to repair the perceived damaged relationship with the caregiver.

Projective identification plays a crucial role in this process. Infants project their unacceptable emotions (such as aggression or fear) onto external objects, shaping their self-identity and interpersonal dynamics. As they transition to the depressive position, they develop a more integrated and stable self-concept. However, if this transition is disrupted, it may lead to pathological projective identification, affecting future emotional regulation and relationships.

This study explores how early interventions can help individuals overcome pathological projective

identification and move toward a more integrated self-experience.

2.2. Fairbairn's internal structure model

Ronald Fairbairn challenged Freud's theory of libidinal drives, arguing that the primary motivation of human behavior is not merely the pursuit of pleasure but rather the establishment and maintenance of object relationships. He proposed that individuals construct their inner world through processes of introjection and projective identification. Fairbairn's endopsychic structure model consists of the following ^[5].

Central ego: The core self that maintains conscious control and rational thinking.

Libidinal ego: The part of the self that craves exciting but unattainable objects, often representing unfulfilled desires.

Anti-libidinal ego: The part of the self that internalizes rejecting or punitive objects, leading to self-criticism and emotional suppression.

Exciting object: Represents idealized but often unattainable sources of satisfaction ^[6].

Rejecting object: Represents sources of disappointment and rejection, shaping the individual's defensive mechanisms.

This model closely parallels Klein's theory: while Klein emphasizes the dynamic process of projection and re-integration, Fairbairn highlights the structural formation of personality. The study explores how these early object relations influence adult psychological patterns, particularly in attachment styles, self-perception, and emotional regulation.

2.3. Winnicott's theory of psychological development

Donald Winnicott focused on the role of the environment in shaping self-development, introducing concepts such as true self and false self and the "good enough mother" ^[7].

2.3.1. True self and false self

True self represents authenticity, spontaneity, and emotional congruence ^[8]. False self develops as a defense mechanism when individuals suppress their true emotions to conform to external expectations ^[9]. If false self dominates, individuals may experience a persistent sense of inauthenticity, emotional emptiness, or identity confusion.

2.3.2. The "good enough mother"

Winnicott argued that a mother does not need to be perfect but must provide consistent emotional responsiveness. When caregivers offer empathic attunement, infants develop a stable sense of self. If the mother fails to provide this, infants may develop attachment insecurities and struggle with emotional regulation.

2.3.3. Transitional objects and phenomena

Transitional objects (e.g., a child's favorite blanket or toy) help bridge the gap between dependence on the mother and developing independence ^[10]. This concept is linked to the formation of psychological resilience, helping individuals cope with separation, loss, and autonomy development. Winnicott's theories are crucial for understanding how early caregiving relationships impact adult self-regulation, authenticity, and interpersonal patterns.

2.4. Riviere's stages of infant psychological development

Joan Riviere further refined object relations theory by dividing infant psychological development into three stages:

Pre-object stage: Infants experience pleasure and pain but have not yet formed a concept of distinct objects ^[11].

Split object relationship stage: Infants divide objects into “good” and “bad” (similar to Klein's paranoid-schizoid position) ^[12].

Integrated object relationship stage: Infants begin to perceive objects as whole entities, leading to a more stable emotional foundation ^[13].

Riviere's framework aligns closely with Klein's but places greater emphasis on the development of the superego and its role in emotional regulation. Understanding these early developmental patterns helps explain why individuals develop specific defense mechanisms, emotional coping strategies, and relational tendencies in adulthood.

3. The influence of infant psychological mechanisms on psychological issues

Infant psychological development significantly impacts adult personality, emotional regulation, and interpersonal relationships. This chapter explores how early object relations shape later psychological challenges, focusing on projective identification, personality development, emotional disorders, and relational conflicts.

3.1. Manifestations and impact of projective identification

Klein's paranoid-schizoid position explains how infants split objects into “good” and “bad” to cope with anxiety. This early mechanism influences later cognitive distortions as follows.

Extreme thinking patterns: Individuals may categorize others as entirely good or bad, leading to rigid interpersonal dynamics ^[14].

Paranoia and projection: People experiencing paranoid thoughts may unconsciously project their internal fears onto external objects, perceiving others as threatening ^[15].

Emotional dysregulation: The inability to integrate positive and negative object representations can lead to intense emotional fluctuations and instability ^[16].

In clinical cases, pathological projective identification is linked to borderline personality disorder, attachment trauma, and interpersonal conflicts. The therapeutic goal is to help individuals recognize and integrate these projections, reducing emotional distress and improving relational stability.

3.2. The role of object splitting in psychological disorders

Fairbairn's object relations model explains how individuals internalize rejecting objects, leading to self-criticism and depressive tendencies ^[17]. Psychological challenges include the following.

Depression and anxiety: Internalized negative object representations reinforce self-devaluation and chronic worry ^[18].

Personality fragmentation: A rigid Libidinal Ego and Anti-libidinal Ego structure may cause identity confusion and relational avoidance ^[19].

Self-sabotaging behaviors: Individuals with unresolved object splitting may subconsciously engage in self-destructive actions to validate negative self-perceptions ^[20].

Intervention strategies focus on helping clients recognize and reframe these internalized patterns, fostering self-compassion and psychological flexibility.

3.3. The influence of early attachment on emotional development

Winnicott's true self and false self theory provides insights into how caregiving experiences shape personality development. Individuals dominated by false self tend to struggle with authentic self-expression, leading to emotional repression and social anxiety. The absence of a "good enough mother" results in attachment insecurities, which manifest as anxious or avoidant relationship styles in adulthood. Therapeutic approaches, such as emotion-focused interventions and self-exploration exercises, help individuals reconnect with their True Self, fostering resilience and self-acceptance.

3.4. The impact of early object relations on adult relationships

Object relations significantly influence interpersonal dynamics and conflict resolution:

Unresolved infant anxiety → Fear of Rejection: Individuals with early attachment disruptions may exhibit heightened sensitivity to criticism and abandonment.

Projective identification in relationships: Unconscious projections of past traumas can create toxic cycles of blame, control, and emotional dependence.

Emotional repair through self-awareness: Recognizing and integrating these relational patterns enables individuals to develop healthier, more balanced interactions.

Therapeutic interventions target emotional processing, self-awareness, and relational skills to break repetitive conflict cycles.

4. Exploring emotional distress: An integrative approach based on EFT

Emotion-focused therapy (EFT) is an intervention for addressing projective identification, emotional dysregulation, and relational conflicts. EFT, rooted in object relations theory, humanistic psychology, and neuroscience, emphasizes emotional awareness, processing, and transformation to promote psychological growth.

4.1. Theoretical foundations of EFT

4.1.1. Object relations and EFT: Emotional healing in practice

Object relations theory emphasizes the profound impact of early relationships with significant others on psychological development, while Greenberg's emotion-focused therapy (EFT) focuses on the processing and transformation of emotional experiences. The two theories share a deep alignment in understanding and intervening in emotional distress. Object relations theory posits that early relational patterns shape an individual's internal object representations, influencing their emotional regulation capacity. In contrast, EFT facilitates the recognition and modification of emotional schemas, helping clients re-experience and transform these early internalized emotional patterns. Therefore, the emotional experiencing and adjustment process in EFT can be seen as a concrete application of the "internal object repair" concept in object relations theory, providing an effective intervention pathway for negative emotional patterns formed due to early relational trauma.

4.1.2. Humanistic psychology and emotional processing

EFT is derived from humanistic psychology and inherits Carl Rogers' assumption of individual self-actualization, arguing that emotions are at the heart of mental health. EFT promotes the expression and integration of individual emotions through empathy, unconditional positive regard, and Congruence, and helps patients develop more adaptive emotional coping styles.

4.1.3. Neuroscience and emotional regulation

EFT is supported by research on brain functions, particularly in the amygdala and prefrontal cortex, which regulate emotional responses. By fostering emotional awareness and cognitive integration, EFT enhances psychological resilience and self-regulation.

4.2. Core techniques of EFT

4.2.1. Emotion categorization and awareness

EFT categorizes emotions into the following.

Primary emotions: Deep, instinctive feelings (e.g., sadness, fear).

Secondary emotions: Socially influenced responses (e.g., guilt, shame).

Instrumental emotions: Used to manipulate situations (e.g., strategic anger).

Recognizing these distinctions helps individuals identify authentic emotional needs.

4.2.2. Two-chair work

Used for internal conflicts, the two-chair work technique allows individuals to engage in dialogue between different parts of the self (e.g., self-criticism vs. self-compassion), enhancing emotional integration and reducing internal distress.

4.2.3. Empty-chair work

Primarily for unresolved relational conflicts, this technique enables clients to express unspoken emotions toward an imagined person, reframing past experiences, and promoting emotional closure.

4.2.4. Experiential markers

Therapists identify key emotional moments in therapy, guiding deeper emotional engagement and transformation.

4.3. Applications of EFT

4.3.1. Treating anxiety and depression

EFT helps individuals process unresolved emotions, reducing rumination and emotional suppression, leading to improved mood regulation.

4.3.2. Attachment repair

For individuals with anxious or avoidant attachment, EFT fosters secure emotional connections by reshaping relational patterns.

4.3.3. Trauma recovery

EFT is effective in post-traumatic stress disorder (PTSD) treatment, allowing individuals to reprocess traumatic emotions in a safe therapeutic environment.

4.3.4. Relationship counseling

By enhancing emotional communication and empathy, EFT strengthens intimate relationships, helping partners navigate conflict more effectively.

5. Conclusion and implications

5.1. Research conclusions

This study examined how early object relations shape individual psychological development and how EFT can serve as an effective intervention strategy. The key findings are as follows.

5.1.1. Projective identification and psychological development

Projective identification is a fundamental psychological mechanism that shapes self-perception and interpersonal relationships. In normal psychological development, projective identification helps individuals regulate anxiety, but in pathological cases, it can lead to severe emotional distress and relational conflicts. The persistence of early object splitting (good vs. bad) can cause adults to develop rigid cognitive and emotional patterns, affecting their ability to integrate self-perception and external reality.

5.1.2. The influence of early object relations on adult emotional experience

Infant psychological mechanisms (such as splitting, introjection, and projection) continue to influence individuals' attachment styles, emotional regulation, and relationship patterns in adulthood. Insecure attachment (including anxious, avoidant, and disorganized attachment styles) stems from early object relation failures and significantly impacts interpersonal stability. The development of a false self, due to insufficient mirroring and emotional attunement in early childhood, leads to emotional suppression and self-alienation.

5.1.3. EFT as a therapeutic approach for emotional regulation and self-integration

EFT provides a structured approach for emotional exploration and transformation, helping individuals process unresolved emotional experiences and correct maladaptive relational patterns.

5.1.4. Techniques such as two-chair work and empty-chair work facilitate emotional processing, self-dialogue, and relational repair

EFT's emphasis on emotional experience rather than cognitive analysis makes it highly effective in addressing attachment trauma, relational distress, and self-identity issues.

5.2. The intervention process

In the psychological intervention process, the client Michi explored the emotional distress caused by a workplace conflict. The therapist guided Michi to reflect on her attachment patterns, emotional needs, and the underlying psychological mechanisms driving her reactions.

5.2.1. Initial emotional exploration

Michi: I feel anxious when I hear that I might be “draining” people close to me emotionally. It makes me wonder if I have been doing that to my partner, relying too much on them emotionally, expecting them to carry my moods.

Therapist: What makes you believe that you are emotionally consuming others?

Michi: In my relationship, I often expect my partner to comfort me. When we argue, I always insist that they apologize first. Maybe I am using their emotional energy to stabilize myself.

Therapist: It seems like you are recognizing a pattern of emotional dependency. However, do you believe that all close relationships require a perfect balance of emotional energy, or is it possible for relationships to shift naturally over time?

5.2.2. Identifying the core conflict

Michi: I recently had a serious conflict with a close colleague. We had small disagreements before, but this time, we argued in front of others. Since then, I have been avoiding her.

Therapist: What is the core issue that bothers you the most about this conflict?

Michi: I expected our friendship to withstand small professional disagreements. But after this argument, I started thinking: has she changed? Did I lose my influence over her?

Therapist: You mentioned losing influence. What does “influence” mean to you?

Michi: I worry that she no longer admires me as much as before. Maybe I was projecting confidence in our relationship that was not entirely real.

Therapist: This sounds like a question of self-worth. If someone stops admiring or relying on you, does that affect your sense of self?

5.2.3. Addressing projection and self-perception

Michi: I see now that when my friend distanced herself, I felt threatened, not just because of the conflict but because it made me doubt my own worth.

Therapist: You might be experiencing projective identification—assigning internal self-doubts onto external relationships. This often happens when our self-value is tied to external validation.

Michi: So, when she became more independent, I interpreted it as rejection rather than personal growth?

Therapist: Yes. In relationships, when we feel emotionally abandoned, it often mirrors earlier experiences of perceived neglect. How do you feel now, recognizing this?

Michi: A little uncomfortable, but also relieved. I think I need to shift my focus inward instead of seeking reassurance from others.

5.3. Practical implications

5.3.1. Integration of object relations theory in psychotherapy

Therapists should assist clients in recognizing how early object relations influence their current emotional distress and interpersonal patterns. Understanding projective identification and splitting mechanisms allows for more targeted therapeutic interventions.

5.3.2. Advancing EFT as a core intervention framework

EFT’s experiential techniques provide a unique advantage in working through deep-seated emotional wounds. Incorporating neuroscience-based insights into EFT practice can enhance emotional processing efficiency and trauma resolution.

5.3.3. Application of EFT in non-clinical settings

EFT principles can be extended to workplace relationships, leadership development, and conflict resolution.

Awareness of attachment styles and emotional responsiveness in professional and social settings can improve communication effectiveness and team dynamics.

5.4. Future research directions

5.4.1. Cross-cultural adaptation of EFT

Investigate how cultural differences in emotional expression and interpersonal expectations affect EFT

interventions. Develop culturally sensitive EFT models to enhance global applicability.

5.4.2. Neuroscientific research on EFT mechanisms

Explore how EFT influences brain activity, particularly in the regulation of emotional circuits. Identify biological markers of successful emotional integration in EFT interventions.

5.4.3. Longitudinal studies on emotional development

Examine how EFT contributes to long-term personality development and relational stability. Assess the impact of self-awareness training on mental resilience and emotional well-being over extended periods.

Disclosure statement

The authors declare no conflict of interest

References

- [1] Chen JX, Chen W, 2015, Three Turns of Projective Identification: Conceptual Evolution and Comparative Analysis. *Advances in Psychological Science*, 2015(23): 614–620.
- [2] Xu PP, 2008, A Pure Model of Object Relations: A Critical Review of Fairbairn's Personality Object Relations Theory. *Journal of Nanjing Normal University (Social Science Edition)*, 2008(5): 113–118.
- [3] Guo BY, 2009, Developmental Psychoanalysis. Historical Context and Theoretical Connotations, 2009(5): 98.
- [4] Xi HL, 2006, A Review of Winnicott's Child Psychoanalysis. *Journal of Nanjing Normal University (Social Science Edition)*, 2006(5): 94.
- [5] Xu PP, 2008, A Pure Model of Object Relations: A Critical Review of Fairbairn's Personality Object Relations Theory. *Journal of Nanjing Normal University (Social Science Edition)*, 2008(5): 115.
- [6] Wang LJ, 2021, Leader of the British Independent Group: Winnicott's Intellectual Tradition and its Historical Influence. *Journal of Nanjing Xiaozhuang University*, 2021(2): 63–69.
- [7] Wang LJ, 2021, Leader of the British Independent Group: Winnicott's Intellectual Tradition and its Historical Influence. *Journal of Nanjing Xiaozhuang University*, 2021(2): 63–69.
- [8] Xu PP, 2005, A Study of Fairbairn's Personality Object Relations Theory, thesis, Nanjing Normal University.
- [9] Xu PP, 2006, Self, Object Relations, and Personality—Fairbairn's Pure Psychological View on Personality Development. *Journal of Nanjing Normal University (Social Science Edition)*, 2006(5): 99.
- [10] Xu PP, 2005, A Study of Fairbairn's Personality Object Relations Theory, thesis, Nanjing Normal University, 16.
- [11] Xu PP, 2005, A Study of Fairbairn's Personality Object Relations Theory, thesis, Nanjing Normal University, 33.
- [12] Wang GF, 2001, A Review of Melanie Klein's View on Children's Psychic Structure. *Journal of Nanjing Normal University (Social Science Edition)*, 2001(1): 105.
- [13] Sun GJ, 2015, A Study on Joan Riviere's Psychoanalytic Thought, thesis, Nanjing Normal University.
- [14] Wang LJ, 2017, Joan Riviere's Theory of Infant Mental Development and its Application. *Journal of Nanjing Xiaozhuang University*, 2017(1): 85.
- [15] Chen YY, 2021, Exploring Emotional Pain: An Integrative Psychotherapy based on EFT. *People's Posts and Telecommunications Press*, Beijing, 6–7.
- [16] Li XF, Liang QY, Liu BY, et al., 2016, Research on the Development and Application of Object Relations Theory.

Science & Technology Vision, 2016(4): 82–83 + 123.

- [17] Hu YC, 2008, The Spiritual Map of “Human Nature at Birth”: A Study on Psychoanalytic Object Relations Theory, thesis, Jilin University, 44.
- [18] Wang LJ, 2021, Leader of the British Independent Group: Winnicott’s Intellectual Tradition and its Historical Influence. Journal of Nanjing Xiaozhuang University, 2021(2): 65.
- [19] Wang, GF, 2012, The Development Path of Psychoanalytic Object Relations Theory. Journal of Nanjing Normal University (Social Science Edition), 2012(1): 114–115.
- [20] Guo BY, 2007, A Century of Development: The Integrative Logic of the Psychoanalytic Movement. Journal of Nanjing Normal University (Social Science Edition), 2007(5): 93–98.

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Design and Practice of Intelligent Safety Prevention and Control System for Overseas Power Plants

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Abstract: Against the backdrop of the Belt and Road Initiative, overseas thermal power enterprises face challenges such as complex geographical environments, difficult safety supervision, and prominent localized management issues. Huadian Xigang Power Generation Co., Ltd. (Cambodia) has constructed an intelligent safety prevention and control system with global perception as the core based on industrial Internet and artificial intelligence technologies. This paper elaborates on the architectural design, key technology applications, and practical effects of the system. Through innovative means such as 3D digital twin, AI intelligent patrol, and multi-system integration, it realizes the upgrade of safety management in overseas power plants from passive response to active prevention and control, providing a reproducible technical paradigm and management experience for safety governance of energy enterprises along the Belt and Road.

Keywords: Overseas power plant; Intelligent safety prevention and control; 3D digital twin; AI patrol; Global perception

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1. Introduction

With the in-depth advancement of the Belt and Road Initiative, the overseas investment scale of Chinese energy enterprises continues to expand. As an important carrier of energy infrastructure, the safe operation of overseas power plants is directly related to energy supply stability and sustainable enterprise development. However, overseas power plants generally face multiple safety challenges including firstly, complex geographical environments — countries in Southeast Asia such as Cambodia have high temperature and humidity, and frequent typhoons, which impose strict requirements on equipment reliability; secondly, significant differences in safety supervision systems — local safety standards differ from those in China, making compliance management difficult; thirdly, traditional safety prevention and control means rely on manual inspections, suffering from problems such as lagging response, high missed inspection rates, and data silos ^[1].

As a key thermal power project invested by China Huadian Corporation in Cambodia, Huadian Xigang Power Generation Co., Ltd. has an installed capacity of 2*350MW, undertaking the task of local industrial and domestic

power supply. Aiming at the particularities of overseas operations, the company has innovatively constructed a safety management system of “global perception, intelligent linkage, and active prevention and control” relying on technologies such as industrial Internet, 3D digital twin, and AI visual analysis, realizing real-time monitoring of all elements of personnel, equipment, and environment and closed-loop risk management. Taking this project as the research object, this paper systematically analyzes the design logic, technical implementation, and application effects of its intelligent safety prevention and control system, providing a reference for similar overseas energy projects ^[2].

2. Architectural design of an intelligent safety prevention and control system

2.1. Overall framework: Global perception and hierarchical control

The intelligent safety prevention and control system of Huadian Xigang takes “data integration, business collaboration, and intelligent decision-making” as the core goal, constructing a technical system of “three-layer architecture plus five major modules” (**Figure 1**).

Perception layer: Deploy intelligent terminals such as unmanned aerial vehicles (UAVs), video surveillance, electronic fences, UWB personnel positioning, and environmental monitoring to achieve global data collection of the physical space of the power plant.

Platform layer: Build a 3D digital twin system based on the industrial Internet platform, integrate data from 12 subsystems such as video surveillance, access control management, and fire alarm, forming a unified safety management “One Map.”

Application layer: Develop five core applications, including public safety prevention and control, operation process control, remote AI patrol, risk knowledge base, and mobile management terminal, realizing the full-process automation from risk early warning to emergency disposal ^[3].

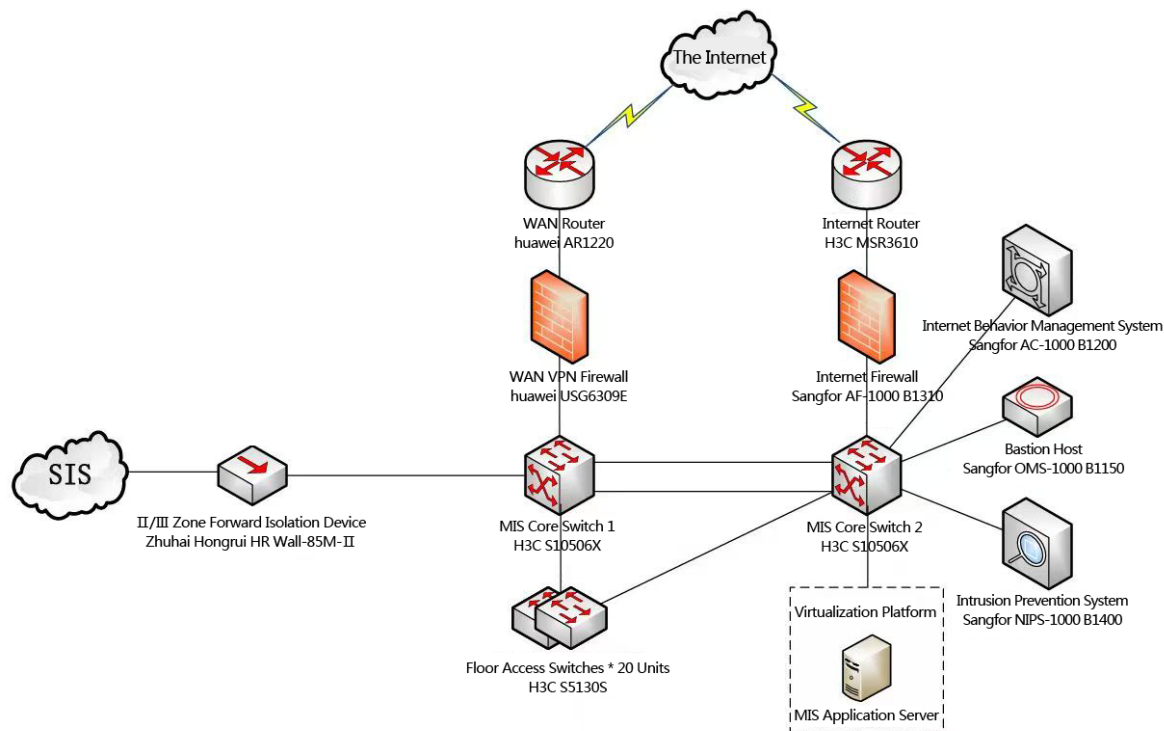


Figure 1. Topology map of the intelligent safety prevention and control system