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The Curvilinear Relationship between Telecommuting and Work Engagement: The Roles of Autonomous Motivation and Work Boundary Strength

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Abstract: This study explores the curvilinear relationship between telecommuting and work engagement based on self-determination theory, while examining the mediating role of autonomy motivation and the moderating effect of work boundary strength. Data were collected from 358 members of knowledge enterprises over three waves, each 10 days apart. Hierarchical regression analysis and PROCESS macros were employed to test the conceptual model. The findings reveal an inverted U-shaped relationship between telecommuting intensity and both work engagement and autonomy motivation. Autonomy motivation mediates the relationship between telecommuting intensity and work engagement. Work boundary strength moderates the inverted U-shaped relationship between telecommuting intensity and autonomy motivation. By investigating the inverted U-shaped relationship between telecommuting intensity and work engagement, this paper offers a new explanation for understanding the differences between telecommuting and work engagement. It also extends the interpretation of the “too much of a good thing” effect in the workplace and enriches research in the field of telecommuting.

Keywords: Telecommuting; Autonomy Motivation; Work Engagement; Work Boundary Strength; Self-determination Theory

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1.Introduction

The digital economy era has brought significant changes to the daily work and lifestyle of organizational members ^[1]. Telecommuting is gradually becoming the new norm, and many companies are adopting telecommuting and remote communication and collaboration to replace traditional on-site work patterns ^[2]. According to a 2020 global telecommuting survey conducted by YouGov in the UK, more than one-third of respondents are already using telecommuting, while another one-third expressed their willingness to adopt this work mode in the future. These findings highlight the increasingly normalized trend of telecommuting ^[3]. Therefore, it is important to address the impact of telecommuting on employees and businesses in the digital economy era in current management practices ^[4].

Telecommuting, a flexible work mode enabled by modern communication technologies, allows employees to work outside of traditional workspaces and is characterized by digitization, separation, and flexibility ^[5]. As telecommuting becomes increasingly prevalent, scholars have conducted numerous studies exploring its effectiveness ^[6-7]. Work engagement is one of the many effects of telecommuting and has been a controversial topic, with debates on whether employees engaged in telecommuting have higher work engagement ^[8]. While some studies have found that telecommuting improves work

engagement^[9], others have shown that it has a negative impact^[10]. The inconsistency of these research findings suggests that the relationship between telecommuting and work engagement is likely to be complex and nonlinear, rather than a simple linear one^[11].

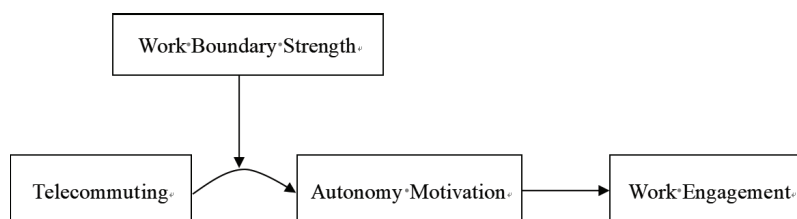
Moreover, as telecommuting has become a defining feature of contemporary work patterns, the knowledge about the impact of telecommuting accumulated by the academic community may lack relevance to the current work situation^[12]. This suggests that further exploration of whether and how telecommuting affects employees' work engagement in the context of the digital economy has significant theoretical and practical value^[13]. Therefore, this study aims to unveil the possible U-shaped curve relationship between telecommuting and employees' work engagement by integrating previous research findings. This approach overcomes the limitations of solely discussing simple linear relationships and offers a more comprehensive and precise explanation of the relationship between the two.

According to self-determination theory, creating a work environment that meets employees' psychological need for autonomy can promote their sense of autonomy in their work, enhance their autonomy motivation, and generate positive behavioral outcomes^[14]. Conversely, if employees' need for autonomy is suppressed, their sense of control in their work increases, and their autonomy motivation weakens, negatively affecting their work engagement^[15]. While telecommuting can provide employees with greater autonomy, allowing for better self-directed choices and enhancing their autonomy motivation^[8], an increase in the intensity of telecommuting may present significant work challenges, leading to weakened autonomy and self-control, suppressing their motivation for autonomy^[16]. Therefore, a nonlinear relationship may exist between telecommuting and employees' autonomy motivation. As a critical driver of employee engagement, high autonomy motivation makes employees more proactive and engaged in their work^[15]. Thus, analyzing the transmission of autonomy motivation through the lens of self-determination theory could be crucial in further uncovering the nonlinear impact of telecommuting on employee work engagement.

Additionally, the impact of telecommuting is often influenced by external environmental factors, such as work boundary intensity, which is an essential work environment factor that is rarely associated with telecommuting^[17]. Work boundary strength refers to the measures that organizations use to regulate the mutual penetration of employees' work and non-work areas^[18]. According to self-determination theory, supportive and controlling factors in the work environment can significantly affect employees' autonomy motivation^[19]. With telecommuting, there is a high degree of mutual penetration between employees' work and personal life. Thus, work boundary strength implemented by organizations can affect employees' perception of work autonomy and control^[20], ultimately having varying impacts on their autonomy motivation. Therefore, it is crucial to consider work boundary intensity as a contextual variable when studying the relationship between telecommuting and employees' autonomy motivation.

This study utilizes self-determination theory to develop a theoretical model (Figure1) aimed at exploring the impact of telecommuting on employee work engagement. Autonomy motivation serves as the mediator and work boundary strength as the moderator in the model. The study seeks to deepen our understanding of how telecommuting intensity affects employee work engagement in the digital economy context. Ultimately, the findings will offer scientifically sound recommendations on how enterprises can enhance employee work engagement through effective job design.

Figure1: Conceptual Model.



2.Theories and Hypotheses

2.1 Telecommuting and Work Engagement

Telecommuting is a flexible work arrangement that enables employees to work outside of a fixed office location using modern

information and communication technologies^[21]. The concept of telecommuting was first introduced by Nilles in the 1970s during the oil crisis, with the aim of demonstrating that telecommuting could help save oil by reducing commuting time^[22]. In the post-pandemic era, telecommuting has become a revolutionary and innovative work mode for enterprises to avoid major crises and market risks, and has thus attracted the attention of scholars^[23]. In comparison to telecommuting research, the concept of work engagement was proposed relatively later. It was first introduced by Kahn in 1990 and defined as a positive state where employees are fully invested in their work in terms of physical, cognitive, and emotional aspects^[24]. As work engagement is closely related to better performance and well-being, theoretical and practical circles have been devoted to exploring factors that can enhance work engagement^[25]. Against the backdrop of the rapid growth of telecommuting, there has been much discussion on the impact of telecommuting on employee work engagement^[13-26].

Currently, there are two different views in academia regarding the impact of telecommuting on employee work engagement. On one hand, some researchers suggest that telecommuting is a family-friendly work design and arrangement that is likely to enhance employee work engagement through social exchange^[27]. If employees feel that the organization cares about them and trusts that they can maintain work efficiency while telecommuting, they may reciprocate the organization with a positive work attitude and behavior. On the other hand, telecommuting's physical and psychological separation from the workplace may weaken employees' identification with the organization, leading to less social support and feedback and ultimately reducing employee work engagement^[13]. Additionally, a recent study suggests that there may be a nonlinear relationship between the intensity of telecommuting and work engagement^[28]. This study believes that, from the perspective of the "too much of a good thing" effect, as the intensity of telecommuting increases, employee work engagement will also increase. When the optimal intensity is reached, work engagement will be highest; however, after exceeding this threshold, telecommuting will have a negative impact on work engagement. In other words, as the intensity of telecommuting increases from low to high, it will have significantly different effects on employee work engagement.

Specifically, the impact of telecommuting on employee work engagement is determined by the varying levels of activation experienced by employees during telecommuting interactions. When the intensity of telecommuting is low, employees' activation level is also low, and they may feel bored and shift their attention from work activities to other activities, leading to a depletion of work emotional resources and lower work engagement^[29]. However, as the intensity of telecommuting increases, the activation level of employees also increases, enhancing their work engagement. At a moderate activation level, employees can obtain the best resources to maintain their vitality during telecommuting and have higher work engagement^[29]. Furthermore, when the optimal activation level is reached, employees are more confident in dealing with the pressure brought by telecommuting, can achieve personal valued work achievements, and experience the meaning of work during telecommuting^[30], resulting in higher work engagement.

However, excessive intensity of telecommuting has a negative impact on employee work engagement beyond a critical point due to the "too much of a good thing" effect. High-intensity telecommuting can lead to excessive activation levels, interfering with employees' emotions and cognition, causing higher role stress, resource depletion, and lower work engagement^[29-31]. Furthermore, studies indicate an inverted U-shaped relationship between the intensity of telecommuting and employee task performance and satisfaction, suggesting that moderate intensity telecommuting can enhance employee satisfaction and task performance^[32]. Based on this, we propose the following hypothesis:

H1: There is an inverted U-shaped curve relationship between telecommuting and work engagement.

2.2 Telecommuting and Autonomous Motivation

Autonomous motivation refers to the behavioral drive that employees generate from their genuine interest in an activity or personal recognition and value, which is a combination of highly internalized external and internal motivation^[33]. According to the self-determination theory, autonomous motivation can only be triggered when the support provided by the external environment satisfies the individual's three psychological needs of autonomy, relatedness, and competence, thus having a positive impact on employees' work attitudes and behavior^[14].

Telecommuting is an extremely flexible working mode that can meet the needs of both organizations and individual employees. It gives employees the power of self-management and stimulates work autonomy^[34]. Telecommuting allows

employees to choose their work location freely, enhancing their sense of control and flexibility in scheduling ^[8]. This work mode also provides autonomous support, enabling employees' basic psychological needs to be met, which is conducive to the formation of autonomous motivation ^[35]. However, the impact of telecommuting on employees' autonomous motivation may change as the intensity of telecommuting increases.

Firstly, when telecommuting intensity is low, employees can complete tasks without expending too much time and energy on their work ^[29]. Although telecommuting can satisfy employees' autonomy needs at this stage, it may not meet the needs of relatedness and competence, thus not effectively activating employees' autonomous motivation.

Secondly, under moderate telecommuting intensity, employees can control the pace of work arrangements and maintain communication and interaction with colleagues in the workplace, effectively dealing with work challenges to gain a sense of achievement ^[11]. Therefore, they are more likely to meet their basic psychological needs and show higher autonomous motivation.

Finally, as most employees choose to work from home in telecommuting, high telecommuting intensity can easily lead to employees facing higher role conflicts and work pressure, making it difficult for employees to balance their work and family life. It can also breed more negative emotions during telecommuting ^[21], thus weakening employees' sense of control over work and making it difficult for their basic psychological needs to be met, which is also not conducive to the formation of autonomous motivation. Based on the above, we propose the following hypothesis:

H2: There is an inverted U-shaped relationship between telecommuting and autonomous motivation.

2.3 The Mediating Role of Autonomous Motivation

According to the self-determination theory, employees with high levels of autonomy and competence are more likely to exhibit high levels of autonomous motivation towards their work ^[14]. This autonomous motivation can increase their work engagement through a sense of control and competence over the task at hand, as well as the enjoyment of challenging work experiences ^[29-35]. Empirical studies have also shown that autonomous motivation positively affects employees' work engagement ^[36]. Therefore, autonomous motivation can promote higher levels of work engagement by increasing employees' willingness and autonomy to engage in their work.

In essence, different levels of telecommuting intensity can impact employees' basic psychological needs in various ways, resulting in varying levels of autonomous motivation in telecommuting. Autonomous motivation is a crucial factor that promotes employees' proactive engagement in work and positively affects their work engagement. Therefore, we propose the following hypothesis:

H3: Autonomous motivation plays a mediating role in the inverted U-shaped relationship between telecommuting and work engagement.

2.4 The Moderating Role of Work Boundary Strength

The increasing popularity of telecommuting and telecommuting has resulted in more complex daily role relationships for employees, blurring the boundaries between work and non-work areas ^[37]. To regulate employee behavior and prevent excessive overlap between work and non-work activities, companies often establish work boundary policy ^[38]. Research has demonstrated that strong work boundary strength can make employees feel controlled since it prohibits any non-work behavior, while weak boundary strength allows more autonomy and flexibility in roles ^[39]. Therefore, work boundary strength could potentially moderate the inverted U-shaped relationship between telecommuting intensity and autonomous motivation.

On the one hand, as the intensity of telecommuting increases, employees with weak work boundary strength have more autonomy and flexibility in their work than those with strong work boundary strength, leading to an increase in autonomous motivation ^[40]. This flexible work boundary strength creates a supportive work environment in telecommuting, reflecting the organization's trust and support in employees, and largely satisfying employees' psychological needs ^[41]. Thus, weak work boundary strength can better enhance the positive effect of telecommuting on employees' autonomous motivation than strong work boundary strength.

On the other hand, strong work boundary strength may impose more restrictions on employees during telecommuting compared to weak work boundary strength, creating a controlled work environment that makes employees feel controlled

rather than supported by the organization^[39]. This control-type work boundary strength exacerbates employee resource depletion and role pressure, leading to emotional exhaustion and weakening employees' autonomous motivation^[42]. Therefore, in the stage of excessive telecommuting intensity, strong work boundary strength adopted by companies can exacerbate the negative effects of telecommuting intensity and be less conducive to the formation of employees' autonomous motivation.

To sum up, under the weak work boundary strength, the inverted U-shaped relationship between telecommuting and autonomous motivation may not be very obvious, while under the strong work boundary strength, the inverted U-shaped relationship between telecommuting and autonomous motivation will be more obvious. Therefore, we propose the following hypothesis:

H4: Work boundary strength moderates the inverted U-shaped relationship between telecommuting and autonomous motivation.

3. Method

3.1 Study Design and Procedure

The study utilized convenience sampling to collect data from knowledge workers in a large state-owned enterprise in Shenzhen. To minimize common method bias, the questionnaire was administered at three distinct time points. Participants were informed of the survey's anonymity and confidential nature for academic research purposes only. The first stage of the questionnaire focused on telecommuting intensity and demographic characteristics, the second stage assessed autonomous motivation and work boundary strength, and the third stage measured work engagement.

Out of 450 questionnaires distributed, 358 valid responses were obtained after eliminating invalid data with excessive missing information or regular response patterns, yielding an effective recovery rate of 79.56%. The majority of participants were male (57.82%), aged between 25-35 years (77.37%), with a bachelor's degree as their primary educational background (43.58%), unmarried (48.88%), and 70.11% working as ordinary employees.

3.2 Measures

Telecommuting intensity. The study assessed the level of telecommuting intensity among participants by asking them to report the number of hours they spent telecommuting in the past week due to the epidemic, following the approach of Golden and Veiga^[26]. To ensure measurement reliability, participants also indicated the proportion of their weekly working hours spent telecommuting. Results showed no significant difference between the reported proportion of telecommuting time and actual hours. The study presented the average weekly telecommuting time of the employees to clearly depict telecommuting intensity.

Autonomous motivation. Autonomous motivation was assessed using a 6-item scale developed by Gagné et al.^[33], with example items such as "My current work matches my values." The Cronbach's α value was 0.91.

Work engagement. Work engagement was measured using a 9-item scale developed by Schaufeli et al.^[24], with example items such as "I can feel myself bursting with energy at work." The Cronbach's α value was 0.91.

Work boundary strength. A 4-item scale developed by Hecht and Allen^[18] was used, with example items such as "The company requires complete focus on work-related issues during working hours." The Cronbach's α value was 0.89.

The study controlled for variables such as gender, age, education level, marital status, and job level based on prior research^[8-9]. Gender was coded as 1 for male and 2 for female. Age was coded as 1 for "21 years old and below," 2 for "22-30 years old," 3 for "31-40 years old," 4 for "41-50 years old," and 5 for "51 years old and above." Education was coded as 1 for high school (technical school) and below, 2 for junior college degree, 3 for bachelor's degree, and 4 for master's degree and above. Marital status was coded as 1 for married, 2 for unmarried, and 3 for other. Job level was coded as 1 for ordinary employees, 2 for grassroots managers, 3 for middle-level managers, and 4 for senior managers.

4. Results

4.1 Common Method Bias and Confirmatory Factor Analysis

The study employed programmatic control to mitigate the common method bias issue by collecting data at three different

time points. However, to further address the issue, post-hoc statistical control was carried out. Harman's single-factor analysis resulted in three factors, with the first factor accounting for less than 40% of the variance. Confirmatory factor analysis revealed that the single-factor model had poorer fit indices compared to other factor models (Table1). The method factor test was used, but adding a common method bias latent factor did not significantly improve the fit indices of the three-factor model. Based on the analysis, it can be concluded that common method bias has been somewhat effectively controlled.

Table1: Confirmatory Factor Analysis

Model	χ^2	df	χ^2/df	CFI	TLI	RMSEA	SRMR	$\Delta\chi^2$
Model 1 (AM+WE+WBE)	1819.72	152	11.97	0.56	0.50	0.18	0.15	1612.64***
Model 2 (AM, WE+WBE)	982.47	151	6.51	0.78	0.75	0.12	0.12	775.39***
Model 3 (AM, WE, WBE)	207.08	149	1.40	0.98	0.98	0.03	0.04	-
Model 4 (AM, WE, WBE, CMV)	229.86	148	1.55	0.98	0.97	0.04	0.05	-

Note(s): Autonomy motivation = AM; Work engagement = WE; Work boundary strength = WBE; CMV = Common Method Variance; + means to combine factors; *** $p < 0.001$.

4.2 Descriptive Statistics and Correlation Analysis

The means, standard deviations, and correlations between variables are shown in Table2. There is a significant positive correlation between telecommuting intensity and autonomy motivation ($r = 0.14$, $p < 0.01$); there is also a significant positive correlation between autonomy motivation and work engagement ($r = 0.49$, $p < 0.01$).

Table2: Descriptive Statistics and Inter-correlations of Variables

Variable	1	2	3	4	5	6	7	8	9
1. Gender	1								
2. Age	0.02	1							
3. Education	0.05	-0.07	1						
4. Marital status	-0.01	-0.10	0.01	1					
5. Occupational level	0.05	0.07	-0.04	-0.03	1				
6. Telecommuting intensity	-0.00	0.04	-0.01	-0.04	-0.01	1			
7. Autonomy motivation	0.08	-0.07	-0.03	0.03	-0.03	0.11*	1		
8. Work engagement	-0.02	-0.04	-0.01	0.03	0.05	0.03	0.49**	1	
9. Work boundary strength	0.03	-0.05	0.03	0.06	0.05	-0.08	-0.10	0.01	1
M	1.59	2.71	2.60	1.51	1.39	24.90	2.98	3.11	3.19
SD	0.49	0.89	0.75	0.50	0.64	9.11	0.84	0.73	0.94

Note(s): $N = 358$; * $p < 0.05$, ** $p < 0.01$ (two-tailed).

4.3 Hypothesis Testing

Prior to hypothesis testing, the variables of telecommuting intensity and work boundary strength were standardized. Table3 displays the results of the hierarchical regression analysis.

Table3: The Results of Hypotheses Testing

Variable	Work engagement			Autonomy motivation		
	M1	M2	M3	M4	M5	M6
Constant	3.28	3.39	2.15	3.10	3.07	3.08
Gender	-0.02	-0.04	-0.09	0.13	0.13	0.14
Age	-0.05	-0.05	-0.02	-0.07	-0.07	-0.07
Education	-0.03	-0.03	-0.02	-0.04	-0.03	-0.02
Marital status	0.02	0.04	0.02	0.06	0.07	0.03
Occupational level	0.05	0.07	0.07	-0.01	-0.00	-0.01
Telecommuting intensity	0.04	-0.08	-0.08 ⁺	-0.01	-0.02	-0.04
Telecommuting intensity squared		-0.12***	-0.08**	-0.11**	-0.12**	-0.13***
Autonomy motivation			0.40***			
Work boundary strength					-0.09 ⁺	0.02
Work boundary x Work boundary strength						-0.24***
Telecommuting intensity squared x Work boundary strength						-0.10**
R^2	0.01	0.05	0.26	0.05	0.06	0.11
ΔR^2		0.04***	0.21***		0.01	0.05***
F	0.53	2.59*	15.12***	2.74**	2.90**	4.51***

Note(s): ⁺ $p < 0.1$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

Hypothesis 1 stated that work engagement improves with increasing telecommuting intensity, but only up to a certain point after which it decreases. The results presented in Model 2 of Table3 supported this hypothesis, showing a significant negative effect of the telecommuting intensity squared term on work engagement ($b = -0.12$, $p < 0.001$), indicating an inverted U-shaped relationship between telecommuting intensity and work engagement. Thus, H1 was confirmed.

Hypothesis 2 proposed that as telecommuting intensity increased and reached a certain level, employees' autonomy motivation would start to decline. The results were presented in Model 4 of Table3, where the telecommuting intensity squared term had a significant negative impact on autonomy motivation ($b = -0.11$, $p < 0.01$), indicating an inverted U-shaped relationship between telecommuting intensity and autonomy motivation. Therefore, H2 was supported.

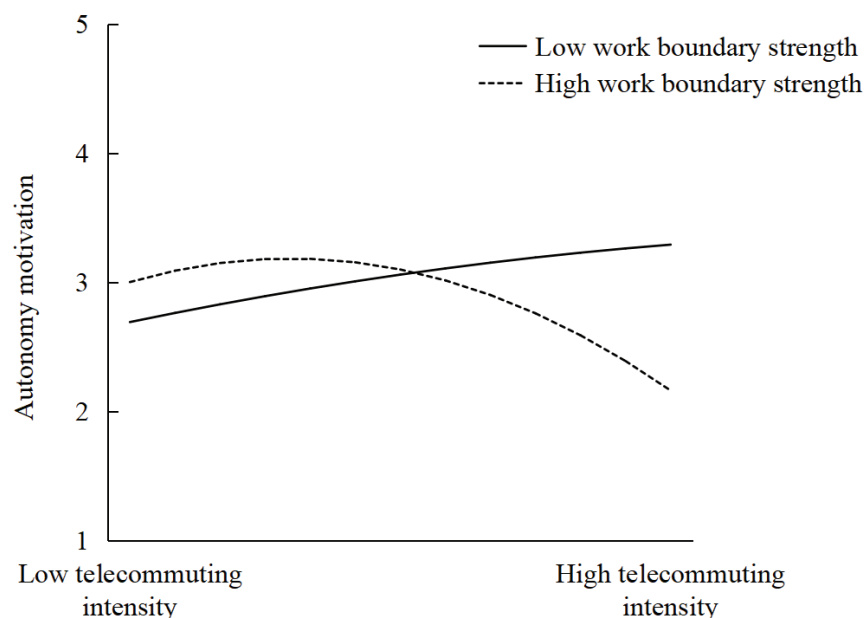
Hypothesis 3 suggested that as telecommuting intensity gradually increased, fluctuations in employees' autonomy motivation would correspondingly affect their work engagement. The results are presented in Model 3 of Table3. After adding autonomy motivation, the impact coefficient ($b = -0.08$, $p < 0.01$) of the telecommuting intensity squared term on work engagement decreased but remained significant, indicating that autonomy motivation partially mediated the nonlinear effect of telecommuting intensity on work engagement. Therefore, H3 was preliminarily validated.

To test the robustness of the curvilinear mediation effect of autonomy motivation, we used the MEDCURVE macro program in SPSS. The results showed that when telecommuting intensity was moderate, the instantaneous effect of autonomy motivation was 0.12 with a confidence interval of [0.06, 0.19]. However, when telecommuting intensity was low or high, the confidence intervals of the instantaneous effect of autonomy motivation included 0. This indicates that when telecommuting intensity was moderate, autonomy motivation played a significant mediating role in the curvilinear relationship between telecommuting intensity and work engagement, thus supporting H3.

Hypothesis 4 suggested that work boundary strength could moderate the nonlinear relationship between telecommuting intensity and autonomy motivation. The results were presented in Model 6 of Table3, which showed that the interaction term between the squared term of telecommuting intensity and work boundary strength had a significant negative effect on employees' autonomy motivation ($b = -0.10$, $p < 0.01$). This indicated that work boundary strength negatively moderated the inverted U-shaped relationship between telecommuting intensity and autonomy motivation, providing support for H4.

Additionally, to better illustrate the inverted U-shaped moderating effect of work boundary strength on telecommuting intensity and autonomy motivation, a moderation effect plot of job boundary strength was generated, as shown in Figure2. It can be observed that the inverted U-shaped relationship between telecommuting intensity and autonomy motivation is not significant when work boundary strength is weak. In contrast, when work boundary strength is strong, the inverted U-shaped relationship between telecommuting intensity and autonomy motivation is significant, further validating H4.

Figure2: Moderating effect of work boundary strength between telecommuting intensity and autonomy motivation



5. Discussion

This study aimed to investigate the impact of telecommuting on employee work engagement, focusing on the mediating role of autonomy motivation and the moderating role of work boundary strength. Drawing on self-determination theory, the study found that telecommuting intensity had an inverted U-shaped effect on work engagement, with moderate levels having a positive impact, and excessive levels having a negative impact. Additionally, there was an inverted U-shaped relationship between telecommuting intensity and autonomy motivation, with autonomy motivation mediating the effect of telecommuting intensity on work engagement. Finally, work boundary strength moderated the relationship between telecommuting intensity and work engagement, with strong work boundary strength amplifying the inverted U-shaped impact of telecommuting intensity on autonomy motivation compared to weak work boundary strength.

5.1 Theoretical Contribution

The main contribution of this study is to provide further clarification on the relationship between telecommuting and work engagement. With the prevalence of telecommuting in the digital economy, scholars have paid attention to its impact on

employee work engagement^[12-13]. By examining the dual attributes of telecommuting intensity, this study reveals that moderate telecommuting intensity can promote employee work engagement, while excessive telecommuting intensity has a negative impact beyond a certain threshold. These findings offer a new perspective on explaining the divergent relationship between telecommuting and work engagement, and enrich research in the field of telecommuting.

Moreover, this study emphasizes the significance of autonomy motivation as a crucial factor in comprehending the relationship between telecommuting intensity and work engagement, which has been neglected in prior research^[8-26]. Drawing on self-determination theory, this study incorporates autonomy motivation as a mediating variable in the association between telecommuting intensity and work engagement. These findings build upon the conclusion by Kuruzovich et al.^[7] on the nonlinear relationship between telecommuting intensity and work outcomes and illuminate the “black box” mechanism of how telecommuting intensity impacts employee work engagement.

Finally, this study sheds light on the moderating effect of work boundary strength on the relationship between telecommuting intensity and employee motivation, providing new insights into the boundary conditions of telecommuting intensity research. While previous research on telecommuting intensity has mainly focused on individual and external environmental factors^[26], this study addresses a gap in the literature by examining the moderating factors. The findings contribute to a deeper understanding of the mechanisms through which telecommuting intensity affects employee motivation^[4], and identifying the conditions under which telecommuting can be either beneficial or detrimental to employee outcomes.

5.2 Practical Implications

In today’s digital economy, telecommuting and on-site work are two primary working modes, and managing telecommuting has become a pressing concern in the industry. This study explores the relationship between telecommuting intensity and employee work engagement, providing valuable insights for relevant practices.

First, organizations should assess the degree of telecommuting. While telecommuting is a flexible work design, organizations should use it judiciously and be mindful of the potential risks of excessive telecommuting intensity. Moderate telecommuting intensity can enhance employees’ autonomy motivation and work engagement, but excessive telecommuting intensity can have adverse effects. Therefore, organizations should keep telecommuting intensity within a moderate range to avoid negative impacts on employees’ motivation, attitudes, and behavior.

Second, organizational managers should prioritize the positive effect of autonomy motivation in enhancing employees’ work engagement. Autonomy motivation is a crucial intrinsic factor for improving work engagement. Under telecommuting, organizational managers should reasonably set the difficulty and risk of tasks, create flexible work conditions, and provide a supportive work environment that meets employees’ basic psychological needs to stimulate autonomy motivation.

Third, when implementing telecommuting, organizational managers should set appropriate work boundary strength. While strong work boundary strength can play a supervisory role, it can also exacerbate the weakening effect of telecommuting intensity on autonomy motivation. Therefore, companies should flexibly formulate work boundary strength to maximize the effectiveness of telecommuting.

5.3 Limitations and Future Directions

First, this study used a sampling method that involved taking three measurements at 10-day intervals to establish the causal relationship between research variables. However, the short interval may have resulted in a memory effect among respondents. It is unclear whether the interval time effectively controlled for interference from other irrelevant factors or completely eliminated the memory effect of respondents. Future research could consider using multiple repeated measurements to further validate the relationship between variables.

Second, since all variables in this study were self-reported by enterprise employees, there may be a potential for common method bias to affect the relationship between variables. Although we have controlled and tested for this before, during, and after the study, future research can address this concern by using multi-source questionnaire surveys or experimental designs to further validate the findings.

Third, this study focused on the influence mechanism of telecommuting intensity on employees’ job engagement based on self-determination theory. Future studies could explore this influence mechanism more comprehensively by integrating other

perspectives and examining additional mediating and moderating variables.

6. Conclusion

Telecommuting has become an essential part of modern work and is considered a new paradigm of work in the 21st century. Although telecommuting can promote employees' autonomy motivation and work engagement to some extent, increased telecommuting intensity may negatively impact employees. Moreover, the effectiveness of telecommuting is also influenced by the boundary management strategy implemented by the organization.

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The Integrated Development of Rural Tourism and Culture in Rural Revitalization

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Abstract: In the context of the rural revitalization strategy, the integrated development of rural tourism and culture is of great significance. Through the analysis of relevant theories and practices, this study clarifies the crucial role of the integration of rural tourism and culture in promoting rural economic growth, inheriting rural culture, and enhancing rural social vitality, explores effective paths and strategies for integrated development, and provides theoretical support and practical references for rural revitalization.

Keywords: Rural Revitalization; Rural Tourism; Cultural Integration; Development Strategies

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1.Introduction

1.1 Research Background and Significance

1.1.1 The Importance of Rural Tourism Development in the Context of the Rural Revitalization Strategy

The rural revitalization strategy is an inevitable requirement for solving the principal contradictions in Chinese society in the new era, achieving the “Two Centenary Goals,” and realizing the Chinese Dream of the great rejuvenation of the Chinese nation. As an emerging force in rural industries, rural tourism is highly comprehensive and has a high degree of relevance. It can not only directly drive the development of related industries such as catering, accommodation, and transportation, create numerous job opportunities, absorb rural surplus labor, and increase farmers’ income, but also promote the improvement of rural infrastructure, such as road construction, hydropower renovation, and network coverage. At the same time, rural tourism pays attention to ecological environment protection, which is conducive to creating an ecologically livable rural environment and plays a leading role in rural industrial prosperity and a facilitating role in ecological livability in rural revitalization^[1]

1.1.2 The Value and Role of Culture in Rural Tourism

Culture is the core resource and unique identifier of rural tourism. Rural culture encompasses many aspects, such as folk customs, traditional crafts, historical sites, and farming wisdom. From a value perspective, it has historical value, witnessing the development and changes of rural areas; artistic value, with folk crafts, songs, dances, and operas showing unique artistic charm; and social value, maintaining the emotional identity and cultural inheritance of rural residents. In rural tourism, culture can enhance the connotation and quality of tourism products, enable tourists to obtain in - depth cultural experiences, and meet their spiritual and cultural needs. At the same time, the injection of culture can avoid the homogenization of rural tourism products, enhance the attractiveness and competitiveness of rural tourism, and achieve the sustainable development of rural tourism.^[2]

2.Theoretical Basis for the Integration of Rural Tourism and Culture

2.1 Definition of Relevant Concepts

2.1.1 The Concept and Connotation of Rural Tourism

Rural tourism is a tourism activity that attracts tourists to rest, sightsee, experience, and learn by taking the rural culture composed of rural regions, rural - related local conditions, customs, and landscapes as attractions. Its connotation includes rural natural landscapes, such as rural scenery and mountain - water scenery; rural production and living styles, such as farming experiences and rural handicraft making; and rural cultural customs, such as folk festivals and the inheritance of traditional crafts. Rural tourism emphasizes tourists' in - depth experience of rural life and focuses on the interaction between people and nature, as well as people and rural culture.

2.1.2 The Concept and Classification of Rural Culture

Rural culture is the sum of material and spiritual wealth created and accumulated by rural residents in long - term production and living practices. From a material level, it includes rural architecture, traditional farming tools, handicrafts, etc. From a spiritual level, it covers folk culture (such as traditional festivals, folk beliefs, and wedding and funeral customs), historical culture (the history of ancient villages, stories of famous people), and farming culture (farming solar terms, agricultural production knowledge), etc. According to forms of expression, it can be divided into material culture, institutional culture, and spiritual culture; according to functions, it can be divided into production culture, living culture, and belief culture.^[3]

2.2 Theoretical Basis

2.2.1 Industry Convergence Theory

The industry convergence theory holds that driven by factors such as technological innovation, regulatory relaxation, and market demand, different industries or different sectors within the same industry penetrate and intersect with each other, and finally merge into one to form a new industry form. In the integration of rural tourism and culture, technological innovation provides means for the integration, such as the use of digital technology for cultural display and tourism marketing; regulatory relaxation creates a policy environment for integration, reducing industry barriers; and market demand is the fundamental driving force for integration. Tourists' pursuit of cultural experiences and tourism quality promotes the integration of the tourism and cultural industries. Through industry convergence, the boundaries between rural tourism and the cultural industry are broken, giving birth to new forms of tourism such as folk culture tourism and historical - culture - themed tourism, and enhancing industry added value and competitiveness.

2.2.2 Cultural Economics Theory

The cultural economics theory emphasizes the economic attributes of culture and the cultural connotations of the economy. Rural culture has economic value and can be transformed into economic benefits through tourism development. At the same time, economic activities also carry cultural connotations. Integrating cultural elements into the development of rural tourism can enhance the cultural taste and economic value of tourism products. Cultural capital plays an important role in the integration of rural tourism and culture. Rural historical and cultural sites, folk cultural traditions, etc. are all important cultural capitals. Through rational development and operation, the appreciation of cultural capital can be realized, promoting rural economic development. In addition, cultural consumption is an important force driving the integration of rural tourism and culture. Tourists' consumption of rural cultural tourism products not only meets their spiritual and cultural needs but also drives the development of related industries^[4]

2.3 The Driving Mechanism for the Integration of Rural Tourism and Culture

2.3.1 Driven by Market Demand

With the improvement of people's living standards and the transformation of tourism consumption concepts, tourists' demands for tourism products have shifted from simple sightseeing to in - depth cultural experiences. The rich cultural resources in rural areas, such as unique folk customs, profound historical heritage, and traditional farming culture, can meet tourists' pursuit of differential and personalized tourism experiences. The strong market demand for rural cultural tourism products prompts tourism enterprises and practitioners to explore the cultural connotations of rural areas and develop related tourism products and projects, promoting the integration of rural tourism and culture. For example, urban residents' strong

interest in rural traditional festival activities and farming experience activities has given birth to integrated forms such as folk culture tourism festivals and rural complexes.

2.3.2 Guided by Government Policies

The government has issued a series of policies to support the integration of rural tourism and culture. In terms of industrial policies, rural tourism and the cultural industry are included in the category of key - supported industries, and financial subsidies, tax preferences, and other supports are provided. In terms of planning policies, rural tourism and culture integration development plans are formulated to guide the rational allocation of resources and the optimization of industrial layout. In terms of cultural protection policies, the protection and inheritance of rural cultural heritage are strengthened, providing a resource guarantee for the integration of rural tourism and culture. For example, traditional village protection projects and rural cultural museum construction projects implemented by local governments not only protect rural culture but also create conditions for the development of rural tourism. The guidance and support of government policies provide a strong guarantee and development direction for the integration of rural tourism and culture.^[5]

3. Analysis of the Current Situation of the Integrated Development of Rural Tourism and Culture

3.1 The Current Situation of Rural Tourism Development in China

China's rural tourism is rich and diverse in types, mainly including the farmhouse - based type, which provides rural catering and accommodation and conducts simple farming experience activities; the rural - scenery - sightseeing type, which relies on rural landscapes and agricultural parks for tourists to sightsee; the folk - culture - experience type, which features the display and experience of rural folk culture, such as traditional festivals and folk crafts; the rural - vacation type, which builds leisure and vacation facilities to provide services such as leisure and entertainment, health preservation, and elderly care; and the agricultural - science - popularization type, which combines agricultural production bases to carry out agricultural science education and parent - child experience activities. In terms of development models, there is the government - led type, where the government invests in infrastructure construction and tourism project planning; the enterprise - driven type, where tourism enterprises are introduced for large - scale development and operation; the community - participation type, where local residents are encouraged to participate in tourism development and share the development results; and the composite type, which integrates the advantages of multiple development models to achieve the diversified development of rural tourism.^[6]

3.2 The Current Situation of the Protection and Inheritance of Rural Culture in China

China's rural cultural resources are diverse and widely distributed. In terms of material cultural resources, there are ancient villages, ancient buildings (such as ancestral halls, temples, and ancient dwellings), ancient bridges, traditional production tools, etc., mainly distributed in rural areas with a long history, such as the ancient villages in southern Anhui and the courtyards in central Shanxi. Non - material cultural resources cover folk culture (such as paper - cutting, embroidery, New Year pictures, folk dances, and local operas), traditional crafts (such as handmade paper - making, brewing techniques, and wood - carving techniques), folk legends, farming solar terms, etc., which are distributed in rural areas across the country and have their own characteristics, such as Shaanxi paper - cutting, Suzhou embroidery, and Miao songs and dances in Guizhou. These rural cultural resources are precious heritage of rural history and culture and an important basis for the integration of rural tourism and culture.^[7]

4. Problems and Reasons for the Integrated Development of Rural Tourism and Culture

4.1 Existing Problems

1. Insufficient Exploration of Cultural Connotations: Currently, many rural tourism projects simply pile up cultural elements without deeply exploring the spiritual connotations and values behind the culture. For example, some folk - culture - tourism activities only stay at the performance level. Tourists can only watch and cannot truly understand the meaning of folk culture. In some historical - cultural - site tourism, the lack of in - depth explanations of historical backgrounds and cultural stories makes it difficult for tourists to resonate culturally.

2. Serious Homogenization of Tourism Products: The homogenization of rural tourism products in different regions is obvious.

Many rural tourism scenic spots mainly focus on projects such as farmhouses, picking gardens, and folk performances, lacking uniqueness and innovation. For example, the dishes and accommodation styles of farmhouses in different regions are almost the same, and the fruit varieties and picking models of picking gardens are also similar, making it difficult to meet the diversified and personalized tourism needs of tourists.

4.2 Reasons for Analysis

1. Inadequate Ideological Understanding: Some local governments and tourism practitioners do not fully understand the importance of the integrated development of rural tourism and culture. They do not regard culture as the core competitiveness of rural tourism, only focus on short-term economic benefits, and neglect the exploration of cultural connotations and the protection of cultural inheritance.

2. Insufficient Policy Support: Although the state has issued a series of policies to support the development of rural tourism, there are few special policies for the integration of rural tourism and culture. The existing policies are not effectively implemented in the implementation process. For example, policies such as financial support and tax preferences for the protection of rural cultural resources are difficult to truly benefit the grassroots level. At the same time, the policies lack systematicness and coordination, and the policies of different departments are difficult to effectively connect, affecting the promotion of the integrated development of rural tourism and culture.

5. Countermeasures and Suggestions for the Integrated Development of Rural Tourism and Culture

To better integrate rural tourism and culture and assist rural revitalization, we can address the existing problems from the following aspects.

Promote the differential development of tourism products. On the one hand, tourism products should be developed in combination with the cultural characteristics of rural areas. For example, if a rural area has a long-standing farming culture, farming-experience products that allow tourists to participate in sowing and harvesting can be developed. If there are ancient buildings and other historical and cultural sites, historical-culture-exploration tourism products can be developed. On the other hand, brand building and marketing should be strengthened. Create a unique brand for rural tourism and promote it through the Internet, social media, and other channels, so that more people know the characteristics of this rural tourism and are attracted to visit.

Coordinating the relationship between cultural protection and development is the key to ensuring the sustainable development of rural tourism. A scientific and reasonable protection and development plan should be formulated. When formulating the plan, both cultural protection and tourism development should be considered, and it should be clearly defined which areas need key protection and which areas can be moderately developed. Especially for historical and cultural sites, operations should be carried out in accordance with the principles of “protection first, rescue first, rational utilization, and inheritance and development.” In addition, it is essential to establish a long-term mechanism for cultural protection and development. By formulating relevant rules and regulations, strengthen the supervision of cultural protection; set up special funds to provide financial support for cultural protection.

Improving infrastructure and public services can enhance tourists' tourism experience. First, build infrastructure such as transportation and accommodation well. Build wider and flatter roads in rural areas to facilitate the entry and exit of tourists; build more accommodation places with different grades and styles to meet the diversified needs of tourists. Second, improve the level of public services. Strengthen the construction of rural sanitation facilities to make the rural environment cleaner and more tidy; improve tourism service facilities, such as building tourist service centers and setting up clear signboards, to provide tourists with a convenient and comfortable tourism environment.

6. Conclusion and Prospect

6.1 Research Conclusions

In response to the problems existing in the integrated development, such as serious homogenization of tourism products, prominent contradictions between cultural protection and development, and imperfect infrastructure and public services,

corresponding solutions have been proposed. For example, deeply explore the cultural characteristics of rural areas and innovate the display and experience methods, develop characteristic tourism products in combination with cultural characteristics and strengthen brand building and marketing, formulate scientific protection and development plans and establish long - term mechanisms, strengthen infrastructure construction and improve public service levels. Through these countermeasures, it is expected to solve the current problems, promote a deeper integration of rural tourism and culture, and promote the sustainable development of rural areas.^[8]

6.2 Research Prospects

First, conduct in - depth research on the models and paths of the integration of rural tourism and culture in different regions, and formulate more targeted and operable development strategies according to the actual situations of different regions. Second, strengthen the research on the cultural protection mechanism in the integrated development of rural tourism and culture, and explore how to better protect and inherit rural culture while developing tourism, so as to achieve the common development of culture and the economy. Third, pay attention to the impact of integrated development on the rural social structure and residents' lives, and study how to protect the rights and interests of local residents in the development process and promote the harmonious development of rural society. Through in - depth research on these aspects, stronger theoretical support and practical guidance can be provided for the integrated development of rural tourism and culture, and the smooth implementation of the rural revitalization strategy can be promoted.

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Application of Internet User Behavior Data in Library Big Data Analysis

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Abstract: This paper investigates the current state of data utilization in libraries, thoroughly analyzing the characteristics, collection methods, and processing techniques of internet user behavior data. In response to the service demands of libraries, it proposes application models such as user profiling, personalized recommendation services, and optimized collection decision-making. Furthermore, the paper offers suggestions for building a data governance system and an open knowledge service platform, aiming to enhance libraries' data-driven service capabilities. These strategies align with the central government's directive to "promote innovation in big data technology and industry development, build a digital economy driven by data, use big data to modernize national governance, improve public welfare, and safeguard national data security"^[1].

Keywords: Big Data Management; Intelligent Application; Library; Management Systems; User Behavior Data; Data Analysis

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1.Introduction

With the rapid advancement and widespread application of information technology, big data has emerged as a critical and strategic resource underpinning the sustainable development of modern society and the broader economy. As essential institutions for the provision of public cultural services and the dissemination of knowledge, libraries are increasingly being called upon to respond to the evolving digital landscape. One of the most pressing and complex challenges they currently face is how to effectively harness and integrate data derived from internet user behavior in order to enhance the scope, precision, and adaptability of their service delivery systems.

At present, there exist notable deficiencies in the data management practices of many libraries, particularly in the domain of user behavior analytics. Most libraries lack a systematic and comprehensive framework for collecting, analyzing, and utilizing behavioral data, which in turn constrains their ability to offer personalized and targeted services that meet the dynamic needs of their users. This gap significantly hampers efforts to modernize service models and respond proactively to shifts in user expectations and information consumption patterns.

In this context, conducting research on how to effectively consolidate and apply internet user behavior data within library operations becomes not only timely but also imperative. Such efforts aim to construct scientific, data-informed service models that can guide future innovations in library management. This line of inquiry carries substantial theoretical implications for the development of data-driven decision-making mechanisms, while also offering practical value for enhancing the relevance, efficiency, and user-centeredness of library services in the era of digital transformation.

2. Scoring Efficiency

2.1 Progress in Foreign Research

Academic and practical exploration into the application of big data in libraries began relatively early in Western countries. Leading institutions such as the Harvard University Library and the Yale University Library have taken the initiative to integrate user behavior data analytics into their operational frameworks. By analyzing patterns in user behavior—including search queries, resource access frequency, and navigation paths—these libraries have achieved notable advancements in the precision of resource allocation and the personalization of user services, thereby significantly enhancing overall user satisfaction ^[2].

The focal points of these studies and implementations have revolved around three main domains: data governance, optimization of resource configuration, and intelligent recommendation services. Over time, these institutions have developed relatively mature models of data governance, which not only support internal decision-making but also facilitate responsive and user-centered service innovation.

Specifically, the Harvard University Library launched an early-stage reader behavior analytics project grounded in big data methodologies. By collecting and analyzing extensive data on users' visit logs, keyword searches, and resource download behaviors, the library was able to accurately identify patterns of interest and user preferences. This insight directly informed decisions regarding collection development, spatial arrangement of resources, and acquisition strategies, leading to more data-driven and user-aligned resource planning ^[3].

The Yale University Library has similarly leveraged advanced data mining techniques and machine learning algorithms to extract actionable usage patterns from massive volumes of user behavior data. Based on these insights, the library developed a personalized resource recommendation system, which not only improved the efficiency of information retrieval but also substantially increased user satisfaction and engagement with library collections.

In addition, the Bodleian Libraries at the University of Oxford have adopted big data analytics to support the development of an intelligent book recommendation platform. By analyzing historical borrowing records and online interaction behaviors, the system is capable of making accurate predictions regarding users' informational needs and preferences. This has enabled more intelligent resource recommendation and configuration strategies, contributing to enhanced service precision and operational efficiency.

The National Library of Australia has employed a different but equally effective approach. By integrating data from social media platforms and the library's official website, and applying natural language processing (NLP) techniques, the library has been able to extract latent user demands and interest features from unstructured data sources. This has substantially improved the effectiveness of its digital collections and enhanced the user experience in a measurable way.

Moreover, a wide range of public libraries across Europe and North America have increasingly incorporated user behavior analytics into their routine service optimization processes. Through regular data mining and behavioral analysis, these institutions are able to detect evolving patterns in user needs. The results inform dynamic adjustments in collection development and procurement policies, ultimately leading to marked improvements in community user satisfaction ^[4].

2.2 Current Research Status and Existing Problems in China

In contrast to the relatively mature big data practices observed in libraries in Western countries, the development of big data applications in Chinese libraries remains predominantly at the stage of theoretical exploration, with practical implementation lagging significantly behind. Current efforts are hindered by a range of structural and technological barriers, including difficulties in data sharing, the widespread existence of data silos, and outdated data collection technologies. As a result, an effective data-driven service system has yet to take shape in most domestic libraries ^[5].

A closer examination of the situation reveals that research on big data in Chinese libraries is mainly focused on conceptual frameworks and preliminary technological trials, while systematic and replicable case studies remain scarce. On one hand, the issue of data silos is particularly severe. Information systems in many libraries continue to operate independently, with little to no integration between platforms. These systems often lack unified data standards and effective mechanisms for interoperability and data exchange, leading to significant data fragmentation. Such limitations seriously hinder the potential

for comprehensive cross-platform analysis and application, thus undermining the utility of data in enhancing library services. On the other hand, the technological infrastructure supporting data collection in domestic libraries remains underdeveloped. Many institutions have not yet established robust mechanisms for collecting and analyzing user behavior data—such as search histories, browsing patterns, and online social interactions. Consequently, the immense potential of internet user behavior data for driving service innovation and personalization has not been fully realized ^[6].

Moreover, there is an evident absence of a comprehensive data governance framework and supporting technical platforms across Chinese libraries. Key challenges include insufficient capabilities in data management and governance, low levels of data standardization, and inadequate development of data security systems. These weaknesses collectively constrain the effectiveness of data utilization and impede the advancement of innovative, data-driven services.

Given these circumstances, there is an urgent need to accelerate the construction of a robust and unified data governance system. This includes the formulation of standardized data protocols, the establishment of effective sharing mechanisms, and the adoption of advanced data collection and analytical technologies. By addressing these foundational issues, libraries in China can significantly enhance their capacity to provide responsive, intelligent, and user-centered services in the era of big data ^[7].

3. Analysis of Library Data Types and Current Application Status

3.1 Analysis of Library Data Types

Library data is characterized by its diversity and complexity, encompassing a wide range of data types including structured, unstructured, and semi-structured data. Structured data—such as bibliographic records, user borrowing histories, and electronic resource access logs—typically exhibits a well-defined organizational schema and is easily searchable. These features make structured data highly effective for supporting routine library operations, including catalog searching, circulation analysis, collection development, and user behavior profiling.

In contrast, unstructured data refers to information that lacks a fixed format, including images, audio files, video recordings, and scanned documents. Due to its varied forms and massive volume, unstructured data poses significant challenges in terms of storage, processing, and analysis. Nevertheless, it plays a vital role in the development of digital libraries, particularly in the management and utilization of multimedia resources. Tasks such as content indexing, semantic tagging, and media retrieval require advanced data processing capabilities to unlock the full value of these assets.

Between these two extremes lies semi-structured data, which includes formats such as webpages, HTML documents, XML files, and emails. These data types contain structural elements but do not conform to rigid relational models. In the context of libraries, semi-structured data is particularly valuable for tasks related to resource integration, user interaction analysis, and the enhancement of web-based services and communication platforms.

The growing variety and rapid expansion of these heterogeneous data types bring about new challenges for data governance, management, and effective utilization. Traditional data handling methods are increasingly inadequate in addressing the complexity, scalability, and performance demands posed by such data. Consequently, libraries must prioritize the enhancement of their data processing technologies, adopt advanced analytics frameworks, and strengthen their data governance capabilities in order to achieve efficient, secure, and value-driven data use in a rapidly evolving information environment.

3.2 Analysis of the Current Data Status and Problems of the National Library

The National Library of China operates multiple independent business management systems, including ALEPH, the Wenjin Search System, and others, which are responsible for various aspects of library operations. These systems generate substantial volumes of operational data, such as borrowing records, bibliographic and collection data, and reader profile information. However, due to the independent operation of each system, the overall level of data integration remains low, and data sharing across platforms is significantly limited, resulting in a highly fragmented data environment.

One of the critical challenges lies in the lack of standardized interfaces and data exchange protocols between systems. This absence of interoperability hinders seamless data flow and prevents the realization of cross-platform data integration, thereby limiting the potential for comprehensive analytics and coordinated resource management. As a result, valuable insights that

could be derived from correlating data across systems remain untapped.

Furthermore, the absence of a unified data governance framework has led to inconsistent data standards and uneven data quality. Discrepancies in data formats, naming conventions, and update cycles further complicate efforts to utilize the data effectively. The inefficiencies stemming from poor data quality and lack of standardization not only compromise the accuracy of analytical outcomes but also constrain the library's ability to make informed decisions and deliver high-quality, personalized services to its users.

Given these challenges, there is an urgent need for the National Library to establish a comprehensive and unified data governance system. This system should aim to standardize data formats, enforce quality control mechanisms, and create efficient channels for data exchange between systems. Promoting system-wide data fusion and intelligent utilization will be essential for unlocking the full potential of operational data, thereby enhancing the library's overall service capabilities, resource management efficiency, and strategic decision-making capacity in the digital age.

3.3 Analysis and Application of Tag Data

Tag data represents a crucial type of user-centered information that reflects individual interests, behaviors, and preferences. In the context of libraries, tag data can be broadly categorized into three types: static tags, such as age, occupation, and other demographic characteristics; dynamic tags, which capture evolving patterns of user interests and behaviors over time; and predictive tags, which aim to forecast future directions of user interest based on historical data and behavioral trends (Li, 2016). These tag types together serve as a foundational component in the development of personalized services and intelligent resource recommendation systems in modern library environments.

The application potential of tag data in libraries is considerable. By enabling fine-grained user profiling and facilitating targeted content delivery, tag-based systems can significantly enhance user satisfaction, engagement, and service relevance. However, despite its importance, the actual utilization of tag data in library practice remains limited by several critical issues related to data quality and system design.

First, data freshness remains a major challenge. Tag information is often not updated in a timely manner, which results in outdated or inaccurate user profiles. Second, the lack of standardized tag formats and classification rules across systems leads to inconsistency in how user attributes are labeled and interpreted. This lack of standardization not only impedes data interoperability but also undermines the reliability of personalized services across platforms. Third, the granularity and precision of tag content are frequently insufficient. Tags may be too generic or irrelevant to capture the nuanced preferences of users, thereby limiting the effectiveness of recommendation algorithms and weakening the accuracy of user portraits.

These limitations collectively restrict the development of data-driven service capabilities within libraries. To address these challenges, it is imperative to invest in the enhancement of tag data quality by increasing the frequency of updates, establishing uniform tagging standards, and improving semantic accuracy and contextual relevance. Only by advancing these aspects can libraries fully realize the value of tag data in enabling responsive, intelligent, and user-tailored services in the era of big data.

4.Characteristics and Analysis of Internet User Behavior Data

4.1 Dimensional Analysis of User Behavior Data Analysis and Application of Tag Data

Internet user behavior data encompasses a wide array of dimensions that collectively form the analytical foundation for user modeling and personalized service delivery. These dimensions are typically categorized into three core types: static attributes, interest-based dimensions, and social interaction dimensions. Together, they offer a multi-faceted representation of user behavior and preferences, serving as the basis for advanced data-driven decision-making in digital information environments such as libraries.

Static attributes refer to foundational demographic information, including variables such as gender, age, geographic location, educational background, and occupational category. These data elements form the structural core of a basic user profile, offering initial insights into user segmentation and group characteristics. While relatively stable, static attributes provide essential context for tailoring services to broad user categories and initiating preliminary filtering in recommendation systems. Interest-based dimensions, on the other hand, capture the dynamic and personalized behavioral patterns of users. These

include data on search queries, browsing habits, and historical purchasing behavior. By analyzing these elements, institutions can gain nuanced insights into individual users' actual preferences and latent needs. For instance, frequent search keywords and their recurrence patterns reveal the thematic interests of users, while metrics such as browsing duration and visit frequency offer clues about the depth of interest and engagement intensity. Additionally, purchasing history—when available—can offer concrete evidence of user intent and behavior, thus allowing for the construction of highly targeted service or content recommendations.

Social interaction data constitutes the third dimension and reflects the user's behavior within online communities and networks. This includes comments, likes, shares, reposts, and other interactive actions across social media platforms or within digital content environments. These social signals are valuable not only for understanding a user's attitude toward specific resources but also for analyzing interpersonal relationships, community influence, and content diffusion pathways. Using methods such as social network analysis (SNA), libraries and information service providers can explore the collective behavior of user groups, track the propagation of interests, and even identify opinion leaders within user communities.

Among these, the analysis of interest-based data is particularly crucial for achieving accurate user profiling and service personalization. For example, frequent analysis of user search terms and their occurrence frequency enables the identification of core interest themes. By further examining browsing duration, click-through behavior, and page revisit patterns, it becomes possible to infer interest intensity and preference orientation. Similarly, analysis of purchase records can yield rich insights into users' material needs and consumption behaviors, leading to more refined and predictive models of user demand.

In the realm of social data, interactive behavior on digital platforms adds another dimension to user analysis. Comments, reposts, and likes not only indicate users' preferences but also reflect their engagement levels and influence within a social network. By mapping out these behaviors through social network analytics, organizations can uncover the dynamics of interest diffusion, detect clusters of shared preferences, and design community-responsive service strategies.

In summary, the integration and analysis of static, interest-based, and social data dimensions are essential for constructing comprehensive user portraits. Such multidimensional profiling allows institutions to move beyond one-size-fits-all approaches and toward context-aware, personalized service ecosystems, enhancing user satisfaction, engagement, and service effectiveness in a data-rich digital age.

4.2 The Theory and Application of Folksonomy

Folksonomy reflects the characteristics of user-initiated tagging, with Douban's social tagging system being a typical application example. Through spontaneous user tagging and evaluation, accurate analysis of user interests and needs can be achieved, which is of significant reference value for the resource construction and service optimization of libraries. Specifically, folksonomy emphasizes user-initiated tagging, allowing users to flexibly express their needs and preferences through free and informal tagging forms^[9]. Unlike traditional professional classification methods, folksonomy is more timely and precise in reflecting users' real needs, capable of quickly capturing trends in user interests.

For instance, Douban's successful experience with its social tagging system is worth learning from libraries. Users tag resources autonomously, with tag content covering multidimensional information such as resource characteristics, personal feelings, evaluations, and points of need^[10]. These tags not only help users locate the resources they need more quickly but also provide valuable user interest data for libraries. Libraries can conduct data mining and analysis based on user-initiated tagging systems, accurately grasp the trends in user interests, optimize resource acquisition and service strategies, and enhance the personalization of library services^[11].

Moreover, by analyzing the relevance and trend changes of user tags, libraries can promptly identify resource hotspots and user needs trends, making precise resource recommendations and service arrangements. This folksonomy based on user-initiated tags effectively compensates for the shortcomings of traditional professional classification methods in personalized services, greatly enhancing the precision and applicability of library resource construction and services.

5. Internet User Behavior Data Collection and Processing Technology

5.1 Principles and Applications of Web Crawler Technology

Web crawler technology is an automated tool for internet data collection, which achieves rapid and efficient data acquisition

through specific programs. This article focuses on the advantages and application processes of focused crawlers in data collection within specific domains.

5.2 Practical Analysis of Data Collection Technology Examples

The Octopus Data Collection System is a powerful web data collection tool capable of efficiently scraping data from specific websites and web page structures, and is easy to operate. Taking the Octopus Data Collection System as an example, the strategies and specific operational steps for collecting internet user behavior data include:

- (1) Creating a collection task: First, the user creates a new task in the Octopus system and inputs the URL of the target website.
- (2) Setting collection rules: For instance, when collecting user review data from a book e-commerce platform (such as Dangdang), the user needs to select and set the target data fields through the system's built-in visual interface, including user name, review content, review time, rating, and other specific details.
- (3) Running the task for automatic collection: After setting the rules, the collection task is initiated, and the Octopus system automatically visits the website pages, extracts user review data according to the preset rules, and automatically flips through multiple pages to capture data.
- (4) Data export and processing/cleaning: After collection, the user exports the data into Excel, CSV, or database formats. Based on the exported raw data, the data quality is further improved through data cleaning steps, such as removing duplicate data, cleaning abnormal data, standardizing time formats, and rating criteria.

6. Construction of Library Application Models Based on Internet User Behavior Data

6.1 Construction of Reader and Resource Profiles

Reader profiles are constructed by analyzing internet behavior data of readers, such as browsing history, borrowing history, search keywords, and purchase records, to create a comprehensive and precise user demand model. For instance, by analyzing the frequency of search keywords, search preferences, and the fields of resources that users are interested in, the focus of user interests can be determined. Additionally, by examining the online reading duration and frequency, the intensity of interest in specific content can be assessed. Based on social dimension data, such as user comments, ratings, and resource sharing interactions, user emotional tendencies and social influence can be effectively identified, thereby further enriching the content of reader profiles ^[12].

Resource profiles are constructed by analyzing the tagged information, user evaluations, and access records of library resources to establish detailed feature tags for the resources. For example, for a specific book resource, combining reader comments and tag annotations can clarify its content characteristics and suitable reader demographics, achieving precise resource description and classification.

It is also noteworthy that during the actual construction process, a unified data standard and model specification should be established to ensure the precision and consistency of reader and resource profiles. Moreover, continuous updates to the profiles should be emphasized to maintain their real-time relevance and precision.

6.2 Personalized Recommendation Service System

The personalized recommendation service system is based on reader and resource profiles, achieving precise push services through intelligent matching algorithms. On one hand, it leverages the user interest preference data provided by reader profiles to accurately select resource content that highly matches user needs; on the other hand, it precisely identifies the user groups that resources are suitable for through the detailed descriptions of resource profiles, realizing a two-way precise match between resources and users.

For example, by analyzing reader historical browsing and borrowing records data, combined with the content attributes and tag features of resources, the intelligent recommendation system can automatically push books and electronic resources that align with reader preferences, significantly improving the efficiency of users obtaining information. At the same time, by continuously analyzing real-time dynamic user behavior data, the recommendation algorithm is constantly optimized, promptly capturing trends in user interest changes, and continuously enhancing the precision of the recommendation service.

As the main body, libraries should focus on introducing machine learning and artificial intelligence technologies when

building a personalized recommendation service system, training models through user behavior data, and developing precise and efficient recommendation systems, fully utilizing the value of user data in service innovation.

6.3 Collection Resource Decision Support System

The collection resource decision support system based on user behavior data is an important means to achieve precise optimization of collection resources. By analyzing user browsing, borrowing, favoriting, and evaluation behaviors in detail, libraries can accurately grasp the real needs and interest directions of readers, providing scientific decision-making bases for the acquisition and management of collection resources.

In practical work, by analyzing a large amount of user search data and resource utilization data, the types and trends of popular resources can be accurately predicted, and the acquisition plans and collection layout can be optimized in advance. At the same time, by evaluating user feedback on resources, the satisfaction of specific resources can be clarified, and the collection structure and configuration plans can be precisely adjusted to avoid resource waste and significantly improve the utilization efficiency of resources.

In addition, libraries should also establish real-time data analysis and decision support systems, by analyzing the changing trends and hot resource demands of user behavior data in real-time, to adjust collection resource strategies in a timely manner, ensuring the timeliness and effectiveness of resource acquisition and management decisions. At the same time, a unified data governance platform should be built to ensure that data analysis results can be quickly applied to actual collection management^[13].

7.Application Strategies and Suggestions

7.1 Construction of Data Governance System

In response to the current deficiencies in data governance within libraries, a comprehensive data governance system should be constructed, mainly including the following aspects: First, establish unified data standards, clarify specific standards for data collection, storage, processing, and application, to avoid data islands and difficulties in utilization due to inconsistent data standards. Second, strengthen data quality management, establish data quality monitoring and evaluation mechanisms, and ensure data accuracy and reliability through continuous data quality checks and optimization. Third, build a data governance platform to promote centralized data storage and unified management, eliminate data islands, and achieve cross-system data sharing and linkage. Fourth, strengthen data security management, establish data access permission management and data security monitoring mechanisms, to ensure the security of user privacy data and sensitive data.

In practice, libraries should first formulate a comprehensive data governance plan, clarify the data governance responsibilities of each business department, and determine detailed processes and standards for data collection, storage, and sharing. In addition, a data governance team should be established, with clear division of responsibilities, and individuals responsible for data quality monitoring, standard implementation, and data maintenance work, to ensure the efficient operation of the data governance system.

7.2 Construction of an Open and Integrated Knowledge Service Platform

To effectively promote data-driven service innovation in libraries, an open and integrated knowledge service platform should be established to achieve effective integration and application of library data with internet data. First, the platform needs to have a high degree of openness and compatibility, capable of seamless connection and data interaction with external internet data platforms; second, by providing API interfaces, it facilitates external developers and researchers to call and analyze data, achieving widespread data resource sharing and deep integration.

Specifically, libraries can build a unified data integration platform, connect and share data with internet platforms such as Douban, Amazon, Dangdang, etc., through data interfaces, and obtain external platform user behavior data in real-time for library service innovation. At the same time, a platform data analysis and visualization tool should be established to provide library staff with convenient data mining and analysis services, enhancing resource management and service decision-making efficiency. In addition, the platform can provide users with personalized resource retrieval and push services, improving the accuracy of user services.

By building an open knowledge service platform, libraries can continuously access external user data resources, form a

service environment with a high degree of integration of internal and external data, and effectively promote the in-depth implementation of data-driven services. In addition, it is important to note that the system platform should strengthen the real-time nature and security management of data, ensuring data utilization efficiency and security, establish unified user privacy protection standards, win user trust, and enhance the sustainability and competitiveness of the service platform.

8. Conclusion and Outlook

This article comprehensively analyzes the application value of internet user behavior data in library service innovation, clarifying its specific role in constructing reader profiles, optimizing collection resource allocation, and precise recommendation services. By analyzing internet user behavior data, libraries can gain an in-depth understanding of user needs and interest trends, thereby providing precise data support for resource acquisition, collection management, and service optimization. Specifically, this article proposes strategies such as building a data governance system and establishing an open knowledge service platform, effectively addressing current issues such as inconsistent data standards, data silos, and insufficient data security, and promoting the efficient integration and deep application of data.

In the future, with the further development of big data, artificial intelligence, and other technologies, libraries will face broader development opportunities in the utilization of internet user behavior data. First, libraries should further explore advanced data fusion technologies, open up channels for data integration within and outside the library, achieve cross-system integrated analysis of different data sources, and establish a more comprehensive and precise data service system. Second, they should actively introduce artificial intelligence and machine learning algorithms, strengthen data analysis capabilities, enhance the precision of reader profiles, the real-time nature of personalized recommendations, and the effectiveness of decision support.

It is worth noting that libraries should strengthen research on user privacy protection and data security, ensuring user privacy and data security during the data application process, and enhancing the compliance and transparency of data governance. By deeply mining user interests and needs trends, libraries can construct a more dynamic and intelligent knowledge service model, truly realizing the intelligent and precise transformation of library services.

In summary, the application of internet user behavior data brings new development opportunities and technological means to library service innovation. Future research needs to pay more attention to the technical implementation of data governance, the optimization of intelligent recommendation algorithms, user privacy protection, and in-depth discussions on data ethics issues, promoting the continuous development of library services towards a more intelligent, precise, and user-needs-oriented direction, comprehensively enhancing the competitiveness and service value of libraries in the digital economy era [14].

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Conflict of Interests

The author(s) declare(s) that there is no conflict of interest regarding the publication of this paper.

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High-Quality and Full Employment of Women in the Digital Economy Era: Challenges and Opportunities

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Abstract: With the rapid development of the digital economy, women are playing an increasingly significant role in the labor market, particularly in driving employment model transformation and fostering entrepreneurial innovation. While the digital economy offers women more flexible employment opportunities and platforms for self-employment, it also presents multiple challenges, including the gender digital divide, skill shortages, heavy family responsibilities, and the lack of rights protection in emerging forms of employment. To promote fuller and higher-quality employment for women, this paper begins by examining the concept of high-quality and full employment, and then explores the current opportunities and challenges women face through data analysis and policy evaluation. Based on the findings, it proposes comprehensive strategies aimed at eliminating gender bias, improving the employment environment, strengthening digital skills training for women, enhancing social security systems for flexible employment, and fostering a more equitable and inclusive digital economy.

Keywords: Digital Economy; High-Quality and Full Employment; Digital Divide; Women's Employment

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1.Introduction

1.1 Research Background and Importance

In recent years, the digital economy has become a key driver of global economic growth. The Chinese government places great importance on the development of the digital economy, actively promoting the deep integration of digital technologies with the real economy to facilitate the transformation and upgrading of traditional industries. As the digital economy continues to thrive, women's employment opportunities have significantly increased, and the concept of gender equality has been increasingly embedded in policy-making, organizational development, and social initiatives. These efforts aim to safeguard women's legitimate rights and interests, promote their equal participation in the digital economy, and ensure they equally benefit from its development^[7]. This is of great significance for the new journey toward building a modern socialist country, as it highlights the roles and contributions of women as builders, advocates, and strivers in the digital economy, while also fostering the establishment of relevant institutions and mechanisms.

1.2 Definition and Measurement of High Quality and Full Employment

In the context of the new era, high-quality and full employment emphasizes both the breadth of employment opportunities and the depth of employment quality, reflecting a coordinated unity of quantity and quality in employment efforts.

1.2.1 Macro Level: Overall Requirements of Fullness and High Quality

Fullness refers to ample employment opportunities and unobstructed channels for workers to find jobs. Specifically, it is

manifested by: maintaining the unemployment rate within a reasonable range; sustaining a steady rise in the labor-force participation rate; and achieving a basic balance between labor supply and demand, with both government and market working together to expand employment capacity.

High quality emphasizes workers' sense of gain and room for development. It requires creating a situation characterized by "a fair employment environment, an optimized employment structure, efficient person-post matching, and harmonious labor relations," namely: a rational employment structure in which the tertiary and other emerging sectors absorb an increasing share of high-end positions; stable labor relations supported by consultative mechanisms jointly managed by employers and employees; and full implementation of fairness, with significant reductions in discrimination based on gender, age, region, and other factors.

1.2.2 Micro Level: Workers' Subjective Satisfaction and Objective Security

High-quality employment underscores the unity of workers' subjective satisfaction and objective security. Subjective satisfaction: The work itself must stimulate personal value and a sense of achievement; career development prospects must be clear, with accessible promotion channels.

Objective security includes: first a reasonable income level that matches both job requirements and market value; Second, Comprehensive coverage of social insurance and occupational safety; Third, Institutional safeguards for rights under new work arrangements such as flexible employment and remote work.

1.3 Measurement Dimensions: Quantity, Structure, and Quality

High-quality and full employment can be distilled into three interrelated dimensions—employment quantity, employment structure, and employment quality—representing their organic unity^[8]:

Employment Quantity: Provide ample job opportunities, maintain a low unemployment rate and a high labor-force participation rate, ensuring "jobs for all, work that matters, and good performance."

Employment Structure: Emphasize optimization of the employment structure by promoting industrial upgrading and increasing the share of high-end jobs. This not only meets workers' diverse employment needs but also drives high-quality economic development.

Employment Quality: Enhance job stability, income levels, social protection, and occupational safety. This includes improving the social-security system to safeguard rights in flexible and emerging forms of employment, and cultivating a fair employment environment by eliminating discrimination based on gender, age, and other factors.

2. Impact of Digital Economy

In recent years, the digital economy has become a crucial engine of global economic growth. The Chinese government places great emphasis on its development, actively promoting the deep integration of digital technologies with the real economy to facilitate the transformation and upgrading of traditional industries. As the digital economy flourishes, women's employment opportunities have increased substantially, and the principle of gender equality has been progressively embedded in policymaking, organizational development, and social initiatives. These efforts safeguard women's lawful rights and interests, encourage their equal participation in the digital economy, and ensure they share equally in its benefits. This is of great significance for the new journey of building a modern socialist country, as it highlights women's roles, contributions, and influence as builders, advocates, and pioneers in the digital economy, while also fostering the establishment of relevant institutional mechanisms.

The high-quality development of the digital economy not only offers women more equitable, abundant, and high-quality opportunities for employment and entrepreneurship, but also provides new solutions for balancing family and work, and opens novel pathways to reduce imbalances and inadequacies in women's development across urban-rural, regional, and demographic lines. The following framework analyzes the mechanisms through which the digital economy influences women's employment and entrepreneurship.

2.1 Reduced women's disadvantages in the labor market

The emergence of the digital economy has broken traditional constraints on women's employment, such as those related to time and space^[4]. On one hand, it offers a wide range of jobs that can be completed from home. Women are now able to

balance caregiving responsibilities while engaging in online work, which not only increases their participation in the labor market and expands overall employment, but also provides opportunities for improving income levels. On the other hand, the digital economy has driven the rise of new employment forms organized by platforms, which allow women to enter or exit the workforce at will and arrange their schedules independently.

2.2 Enhanced women's value in the labor market

In the digital economy era, women's advantages in certain soft skills can be more effectively utilized. For example, women often excel in detailed-oriented skills such as attentiveness and sensitivity, interpersonal abilities like empathy and understanding, and traits like responsibility and loyalty. These soft skills, combined with women's heightened sensitivity to consumer needs and market trends, enable them to access more opportunities in digital economy-related fields. Additionally, the digital economy has improved conditions for professions requiring "emotional labor," such as online teaching and cloud-based customer service^[5]. With the support of platform-based organization, these professions have expanded in scale, improved in professional standards, and seen increased income levels.

2.3 New employment spaces and fields for practitioners

In the digital economy era, platforms play a key role in motivating employment and entrepreneurship. On one hand, platforms enable efficient labor-market matching, allowing labor supply and demand to connect quickly, improving efficiency, and reducing transaction costs^[3]. On the other hand, platforms provide services that help workers increase productivity and service quality-especially supporting entrepreneurs in enhancing their capabilities. Moreover, practitioners can repeatedly use core modules of the platform to benefit from economies of scale and mitigate risks associated with rapidly changing environments and systems^[2].

3.Challenges

Although the digital economy has created various employment opportunities such as remote work and freelance jobs for women, the issues of job stability and social security remain fundamentally unresolved. Especially in regions dominated by traditional industries, women still face numerous challenges in adapting to and transitioning into the digital economy, including the need for skills enhancement, job matching, and balancing family responsibilities. Moreover, the emergence of new business formats and models in the digital economy is relatively recent, and their unregulated development has brought about new challenges.

3.1 Pronounced Gender Digital Divide

Gender bias remains a major barrier to women's full participation in the digital economy. The gender digital divide is a specific manifestation of the broader digital divide between men and women, referring to gender-based disparities in effective access to information and communication technologies, levels of digital skills, and use of digital resources within and across countries, regions, departments, and socio-economic groups^[6].

The widening gender digital divide prevents women from fully accessing and benefiting from digital resources and utilizing this emerging path for personal development. Gender stereotypes and the traditional division of social roles subtly influence how men and women accept, use, and participate in digital technologies, resulting in gender segregation in digital occupations. In educational settings, women have low participation and graduation rates in STEM (Science, Technology, Engineering, and Mathematics) courses, with high dropout and transfer rates. Women tend to show less interest in STEM and are more likely to pursue non-STEM disciplines. A low female proportion in science and engineering limits their opportunities in digital technology-related careers.

Moreover, since digital technology practitioners are the ones who build the algorithms and rules of the digital economy, their gender composition may affect how women employees and entrepreneurs are treated within the digital economy. Employers increasingly use digital tools to screen candidates. These tools, based on big data and mainstream social trends, often make generalized judgments that may exclude women from high-tech, high-human-capital roles and exacerbate employment discrimination^[3].

3.2 Shortage of Digital Skills and Severe Job Displacement

A primary challenge for women in the digital economy is the lack of adequate skills training. While the digital economy has

created numerous new job opportunities, these often require advanced IT and digital competencies. However, the overall digital skill level of women in Liaoning Province remains insufficient.

The digital economy may lead to job and income polarization. Repetitive, mechanical tasks are more likely to be replaced by AI and digital systems, leading to significant reductions in mid-level white-collar and blue-collar jobs. Those previously engaged in medium-skilled jobs are forced to move either downward to lower-skilled roles (less likely to be automated) or upward to high-skilled positions. This results in the hollowing out of middle-income jobs and a polarized labor market^[4]. Due to relatively lower educational attainment and skills accumulation, women face greater difficulty moving into high-skilled jobs, making them more vulnerable to the effects of job polarization^[2].

The transformation in digital technologies and business models in the digital economy has raised the demand for human capital. However, the current education and training systems have not yet adapted to the skill requirements of the digital economy. Higher education and vocational training remain focused on traditional industries, failing to meet the skill needs of emerging digital employment. The coverage of vocational skills training programs remains inadequate. This mismatch may result in a lack of necessary skills among women. According to BOSS Zhipin Research Institute's 2021 Gender Pay Gap Report in the Chinese Workplace, women held only 17.9% of digital technology-related positions in 2020, indicating a serious gender imbalance^[7].

3.3 Conflict Between Work and Family Responsibilities

Traditional views on gender roles place women under pressure to balance work and family. While the digital economy offers more flexible work options, it does not eliminate the expectation for women to take on family responsibilities. This phenomenon is especially prominent in Liaoning Province. The development of the digital economy has blurred the line between online work and offline life, making it harder for women to allocate time effectively between work and family. Currently, female labor participation in China is significantly lower than that of men. Increased work responsibilities in the digital economy may further challenge women's employment.

Household responsibilities require women to manage their time efficiently, raising the bar for personal time management. Despite engaging in employment and entrepreneurship in the digital economy, women continue to bear a significant portion of unpaid domestic labor. They must carefully navigate the conflict between family harmony and career development.

3.4 Inadequate Protection of Rights for Workers in New Employment Models

Although the digital economy has generated a large number of flexible job opportunities, the quality of these jobs varies, and the social security system remains underdeveloped. Many women working in the digital economy-such as freelancers and temporary workers-lack basic labor protections and social security, compromising their job stability and long-term development prospects.

The digital economy has propelled the growth of flexible employment, especially through platform-based organizations, giving rise to new employment models. However, the protection of labor rights for flexible platform workers faces legal shortcomings. The definition of labor rights remains vague and unclear, making labor disputes difficult to resolve. Social insurance participation is also problematic for platform-based flexible workers. In many regions, only local household registrants (hukou holders) are eligible for flexible employment insurance coverage. High payment bases, limited insurance options, and complicated procedures contribute to low insurance participation rates among flexible workers. The absence of labor protections such as maternity leave and breastfeeding leave affects women more severely than men.

4.Proactive Strategies

To achieve high-quality and sufficient employment among the female population, it is essential to both expand the overall employment scale and optimize the employment structure. Realizing this goal requires coordinated efforts and collaboration among governments, enterprises, markets, and various other stakeholders. At the same time, it is crucial to fully recognize the irreplaceable role of women in social development, as their high-quality and sufficient employment is vital for the sustainable development of both the economy and society. This paper explores the topic from two key dimensions: first, by proposing cross-sector integrated strategies to strengthen systematic collaboration; and second, by designing more targeted and effective customized support measures for key female groups.

4.1 Cross-Sector Integrated Strategies

4.1.1 Establish a Social Security Mechanism for Flexible Employment

With the continuous emergence of new business models and forms of employment in the digital economy—such as online education, home-based domestic services, e-commerce livestreaming, online customer service, and food delivery—these sectors have become important avenues for expanding employment and absorbing female labor. To protect the legitimate rights and interests of women in flexible employment, improvements should be made in the following areas:

Improve the social security system for flexible workers: Targeted labor protection policies should be established for flexible workers, especially women engaged in new forms of employment within the platform economy. Platform enterprises should be guided to negotiate with workers regarding labor remuneration, rest periods, and occupational safety measures. Timely and full payment of wages must be legally ensured to eliminate wage arrears and other illegal practices.

Strengthen the rights protection mechanism for platform workers: Although platform economies offer employment opportunities for a large number of women, labor rights protections remain underdeveloped. It is recommended that platform enterprises optimize systems for order allocation and commission rates, gather and respond to worker feedback, and adjust algorithmic rules to ensure job stability for women in flexible employment.

Examples include Guangdong Province's "Mom Jobs" policy, which offers basic social security support—such as health and pension insurance—for women in flexible employment. Similarly, in Hangzhou, non-local flexible workers who hold a residence permit in Yuhang District for over one year and are not enrolled in another city's health insurance scheme may enroll in the local employee medical insurance program.

4.1.2 Eliminate Gender Bias and Optimize the Employment Environment

To promote women's equal participation in the digital economy, efforts must be made both in cultural awareness and employment policies to foster a fairer employment environment:

Strengthen gender equality awareness and fair hiring practices: Widely promote gender equality principles and encourage companies to implement gender-equal recruitment and promotion policies, ensuring a steady increase in the representation of women in managerial and technical positions. Governments should work together with enterprises and platforms to advance the protection of women's employment rights in the digital economy. Fair employment regulations should be strictly enforced, and gender-based requirements in job recruitment should be prohibited. Relevant industries should develop scientific labor quotas and workload standards to ensure equal treatment of women in the workplace.

Expand access to digital inclusive finance: Increase financial support for women entrepreneurs, particularly in remote and impoverished areas, by integrating digital inclusive finance initiatives into government interest-subsidized entrepreneurship programs.

Create a fair digital technology environment: A gender perspective should be incorporated into access, usage, production, management, and data collection within digital information and education systems to ensure women equally benefit from the digital economy. Gender sensitivity should be introduced at all stages—planning, implementation, and evaluation—of digital platforms and algorithmic projects. Efforts should be made to design technologies and content that cater to women's needs and to eliminate gender bias during the digital transformation of traditional enterprises. Information and communication policies should include gender-sensitive elements or modules to better address gender bias in the digital age and to foster an inclusive, friendly, and diverse online environment for women^[1].

Leverage incentive policies to enhance social recognition: Establish awards for women in science and technology, and host innovation and entrepreneurship competitions for women to increase public recognition of their contributions to the digital economy. Provide more funding and support for women who achieve success in technological innovation, thereby encouraging their continued development in the digital sphere.

4.2 Young Women: Digital Literacy Training and Career Guidance

4.2.1 Establish an Interdisciplinary Talent Development Mechanism

The digital economy—especially the development of technologies such as Artificial Intelligence (AI)—has created a strong demand for highly skilled professionals, particularly in STEM and Information and Communication Technology (ICT) fields.

It is recommended to establish an interdisciplinary female talent development mechanism under the “AI+” model, enhancing education and training in related areas. The existing education system should be adjusted to prioritize the cultivation of women’s professional skills in fields such as AI and big data, in order to meet the challenges posed by future technological advancements. Governments can also collaborate with universities and enterprises to offer specialized courses tailored for women to develop career-relevant competencies.

4.2.2 Promote Digital Skills Development Programs

Encourage school-enterprise cooperation to jointly implement digital upskilling programs specifically for women. These may include online courses, professional seminars, and other formats to help young women master the latest digital technologies. Pilot programs for digital skills certification and evaluation systems can be established, along with talent training and assessment alliances, ensuring women receive systematic and scientific career development guidance.

4.2.3 Advance Training for Emerging Occupations

With the rapid integration of digital technologies across industries, the demand for digital professionals is rising. Training should be vigorously promoted for emerging roles such as digital management specialists, online education service providers, and multimedia operations professionals. These training programs should be fully included in the vocational skill subsidy system, with increased subsidy standards to encourage more women to enter these high-paying and promising fields^[1].

4.3 Women of Childbearing Age: Family-Friendly Workplaces and Parental Leave Policies

Flexible employment and entrepreneurship opportunities in the digital economy enable women to manage their time more effectively, which supports childcare, reduces caregiving costs, and aligns with national fertility policies and long-term demographic balance.

4.3.1 Enhance Tax Benefits for Childcare Costs

It is recommended to include the costs of childcare and early education for children under the age of three as a special itemized deduction in individual income tax. A family childcare subsidy system should be developed for women who juggle caregiving and income generation, such as those engaged in flexible employment or entrepreneurship while caring for infants. Policies could also explore income tax reductions or exemptions for up to three years postpartum for such women.

4.3.2 Expand Maternity Insurance Coverage

Women in flexible employment should be included in the maternity insurance system, with explicit coverage for prenatal check-ups, hospital deliveries, and family planning procedures under the healthcare insurance umbrella. Platform enterprise data systems can be used to improve the convenience of social insurance enrollment for self-employed and flexibly employed women. For those unable to enroll independently, if their spouses are insured, maternity subsidies could be granted proportionally. Women whose maternity insurance contributions are interrupted but whose spouses are covered should also be eligible for partial maternity subsidies. It is further recommended to ensure paid paternity leave is implemented and extended to include flexibly employed women.

4.3.3 Build an Inclusive Public Childcare Service System

Public employment services and health departments should coordinate to promote the development of inclusive childcare services, helping women better balance work and family responsibilities. For instance, by promoting the use of “Women’s Homes” facilities that offer friendly working environments for mothers, workplace pressure can be alleviated.

4.4 Women with Disabilities: Accessible Technology and Supportive Employment

4.4.1 Strengthen Employment Capacity for Women with Disabilities

Multiple efforts are needed to enhance the employability of women with disabilities:

First, improve their access to education. The legal framework for education for people with disabilities should be strengthened, including adequate funding mechanisms for special education. Public awareness must be raised through legislation to eliminate both disability-based and gender-based discrimination, thereby creating an inclusive educational environment that offers equal opportunities for women and girls with disabilities.

Second, enhance employment training. Successful cases and models of employment among different categories of people with disabilities should be summarized and promoted. Programs such as the “1,000 Enterprises Supporting 10,000 People

with Disabilities Employment Plan” and initiatives like “Creative Bases for the Disabled” and “Beautiful Workshops for Disabled Women” should be expanded as branded projects^[9].

4.4.2 Improve Employment and Entrepreneurship Environment

Efforts should be made on several fronts to improve the overall ecosystem:

Strengthen publicity around employment and entrepreneurship policies so that every woman with a disability is informed and able to benefit from these policies.

Accelerate transformation of government functions and improve service delivery to create a better employment environment. Provide diverse, multi-level employment support platforms for women with disabilities. Facilitate flexible employment and entrepreneurship for this group by creating platforms that connect them directly with employers. Coordinate with departments such as industry and commerce, taxation, finance, and banking to develop inclusive services, including innovative loan products, and offer utilities discounts for women with disabilities running businesses to lower their entrepreneurial costs. Establish “Gig Markets for Persons with Disabilities,” offering integrated services such as job registration, employer matching, job recommendations, and policy consultation, thereby closing information gaps between job seekers and employers. Launch charity funding platforms for supporting people with disabilities, to further mobilize societal support and foster an inclusive environment that encourages the employment and entrepreneurship of women with disabilities^[9].

5. Conclusion

In the era of rapid development of the digital economy, women’s employment faces unprecedented opportunities as well as structural challenges. This article systematically reviews the connotation of high-quality employment, highlighting that it is not merely an increase in the number of jobs, but also the optimization of job structure, the protection of labor rights, and the sustainability of career development. While the digital economy brings about new forms of flexible employment and emerging occupations, women still face issues such as insufficient digital skills, gender bias, and limited career development opportunities. To address these challenges, the article proposes two strategies: first, by constructing a social security system for flexible employment, optimizing the employment environment, and promoting digital inclusive finance and gender-friendly technology development to enhance overall women’s employment quality; second, by focusing on key groups such as young women, women of childbearing age, and disabled women, and proposing tailored support measures including digital literacy training, family-friendly policies, and the creation of barrier-free employment environments. Ultimately, promoting high-quality employment for women should become an essential part of national development strategies, requiring coordinated efforts from the government, the market, and society to jointly create an inclusive, fair, and sustainable employment ecosystem, thus effectively unleashing women’s innovation and development potential in the digital economy era and providing strong support for achieving social progress and common prosperity.

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Conflict of Interests

The author(s) declare(s) that there is no conflict of interest regarding the publication of this paper.

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Investigation and Analysis of the Current Situation of Sports Tourism in China

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Abstract: This study investigates the current status and influencing factors of sports tourism in China through quantitative research methods, including questionnaire surveys and data analysis. The research explores the impact of demographic characteristics (gender, age, occupation, income) on preferences for sports tourism types, destinations, consumption patterns, and participation constraints. Key findings reveal that men predominantly favor adventurous and sports event-related activities, while women prefer fitness and leisure-oriented tourism. Younger participants (18-25 years) show higher engagement in diversified and stimulating activities, whereas middle-aged groups prioritize cultural experiences. Economic constraints, time limitations, and insufficient information are identified as major barriers to participation. Consumption analysis highlights accommodation and transportation as primary expenditures, with gender-specific preferences in spending. The study proposes targeted strategies for future development, including diversifying tourism products, enhancing infrastructure, leveraging digital promotion, reducing costs, and optimizing environmental conditions. These recommendations aim to address current challenges and promote the sustainable growth of sports tourism in China.

Keywords: Sports Tourism; Demographic Characteristics; Participation Motivation; Consumer Behavior; Tourism Constraints; Sustainable Development

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1.Introduction

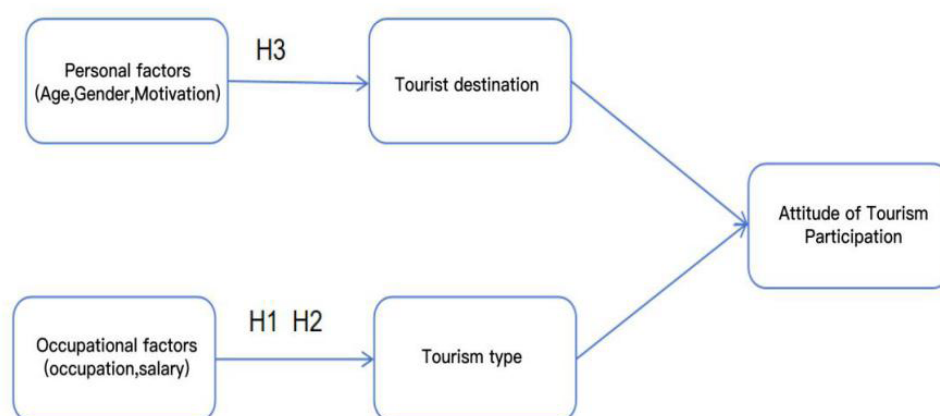
In recent years, sports tourism, as an important branch of the tourism industry, has become one of the important ways for people to pursue a healthy lifestyle and cultural experience. Sports tourism integrates sports activities and travel experience, which can not only meet the entertainment needs of tourists, but also promote physical health and improve the quality of life. With the improvement of economic level and the rise of leisure tourism, the market demand of sports tourism at home and abroad continues to grow. However, the specific factors affecting the development of sports tourism, such as demographic characteristics, participation motivation, and information dissemination channels, have not been thoroughly studied. This study aims to deeply explore the key factors influencing the choice of sports tourism, including the basic characteristics, preference types, selection factors and limiting factors, through questionnaire survey and data analysis. At the same time, this study also tries to find out the current problems facing the development of sports tourism and put forward corresponding suggestions, to provide a basis for the government enterprises and related organizations to optimize sports tourism products and services.

2.Literature review

Sports tourism has gradually become the current mainstream. Some documents have put forward that sports tourism is a form of activity with both health, leisure, cultural experience and economic value, and plays a role in regional economy, cultural inheritance and ecological education. First of all, it is driven by economy and society. Sports tourism is not only an important growth point of the tertiary industry, but also an important path for economic transformation and high-quality development(Zhou, H. L.2023).

Through the integration of sports and tourism, it can promote regional economic development, increase employment opportunities, and promote the coordinated utilization of regional resources (Wang, B. 2024). Sports tourism quality projects can optimize the local brand image, enhance the regional competitiveness, and meet people's dual needs of health and cultural experience (Yu, D. S., & Yang, P. 2024).Secondly, culture and ecological value. Sports tourism combines local culture and ecological environment can promote cultural inheritance, ecological protection and diversified industrial development. The combination of ethnic characteristic resources, such as traditional sports and ecotourism, shows the potential of deep cultural integration and sustainable development (Yuan, J., Ruan, C. X., & Liu, Y. H. 2024).But at the same time, there are also some problems, such as 1. Regional development, and the distribution of sports tourism in different regions is significantly unbalanced. The eastern coastal areas are advantages due to their economic foundation and convenient transportation, while the western region is rich in resources, but develops slowly due to the lack of facilities and policies.2. Lack of innovation and branding: the homogenization of sports tourism projects is serious, and the lack of differentiated brand effect. The development of high-end and customized products lags behind.3. Policy and management restrictions: The lack of top-level design and continuous policy support hinders the further development of industrial integration.4. Infrastructure lag: especially in the western region and remote areas, the construction of tourism infrastructure such as transportation and accommodation is insufficient, which cannot effectively carry potential tourists. The above literature is the influence of policy and resources on sports tourism.

Based on the current access to the latest research, so for the study of sports tourism, from the personal characteristics (including personal age, gender, occupation, travel motivation) to understand the choice of travel destination and travel category, finally analyze their tourism participation, especially for their participation in sports tourism attitude, to establish the model is as follows:



Based on the theoretical framework, propose testable hypotheses:

H1: Men are more inclined to choose adventurous and exciting sports tourism activities, as well as sports event viewing activities.

H2: Young people (18-25 years old) prefer sports tourism activities

H3: High income groups are more inclined to choose popular sports tourism destinations abroad.

3.Research method

3.1 Description

This questionnaire only uses the quantitative research method to comprehensively explore the main factors affecting the

choice of sports tourism. Quantitative research is at the heart of this study, collecting structured data through questionnaires to explore and quantify the relationship between variables influencing the choice of sports tourism. The advantage of the quantitative method lies in its strong objectivity and high statistical inference ability, which is suitable for the analysis of large sample data, so as to summarize the universal law. For example, in this study, data collected through multiple choice and single choice questions can be used for statistical analysis to reveal participants' behavioral patterns and preferences. With the help of quantitative methods, the research can not only obtain a wide range of statistical data, but also deeply analyze the complex dynamics affecting sports tourism selection, provide more comprehensive support for the research conclusions, and put forward more targeted and practical policy suggestions.

3.2 Design of the questionnaire and the scale development

This questionnaire only uses the quantitative research method to comprehensively explore the main factors affecting the choice of sports tourism. Quantitative research is at the heart of this study, collecting structured data through questionnaires to explore and quantify the relationship between variables influencing the choice of sports tourism. The advantage of the quantitative method lies in its strong objectivity and high statistical inference ability, which is suitable for the analysis of large sample data, so as to summarize the universal law. For example, in this study, data collected through multiple choice and single choice questions can be used for statistical analysis to reveal participants' behavioral patterns and preferences. With the help of quantitative methods, the research can not only obtain a wide range of statistical data, but also deeply analyze the complex dynamics affecting sports tourism selection, provide more comprehensive support for the research conclusions, and put forward more targeted and practical policy suggestions. The questionnaire design is based on the research objectives and is divided into the following modules: Demographic information: The first part of the questionnaire collects basic information about the respondents, including gender, age, occupation, income level, etc. Demographic data are the basis of the analysis and can be used to classify sports tourism behaviors in different groups. Behavior and preference: The second part mainly discusses the sports tourism behaviors and preferences of the respondents, including the frequency of participation, the preferred types of sports tourism (such as fitness and leisure, adventure stimulation, etc.), and the main considerations when choosing sports tourism projects (such as safety and uniqueness). This part of the data provides direct evidence for understanding the behavioral characteristics and selection tendencies of participants. Affected factors and obstacles: The third part evaluates the characteristics of different sports tourism projects through the Likert scale, and the main obstacles affecting their participation in sports tourism, such as time limit, economic pressure, health status, etc. This part helps to identify the key problems that hinder the development of sports tourism and provide a basis for developing improvement strategies. Suggestions for improvement: The last part of the survey respondents' needs and suggestions for the future development of sports tourism, covering more diversified sports tourism projects, improving tourism facilities, reducing tourism costs and other aspects. This module provides a reference for the development direction of the industry. Scale development: As shown in Figure 1, some of the questions are based on the Likert scale (if 1 is very unimportant, 5 is very important) to quantify the respondents' subjective feelings of various indicators and have a good internal consistent reliability coefficient. In the process of questionnaire design, the classic literature and questionnaire cases in related fields were referred to, and the clarity and validity of the questions were verified by pre-test (such as small-scale questionnaire), so as to ensure that the questionnaire can accurately collect the data needed for the study.

Figure1 : Reliability statistical analysis

Reliability statistics		
Cronbach's Alpha	Cronbach's Alpha based on standardized items	Number of items
.766	.723	30

3.3 Sample strategy

Sample selection considerations: Sample selection should comprehensively consider the age, gender and occupation

distribution of the respondents, as well as the frequency and preference of participating in sports tourism. Studies focus focused on the diversity of samples to ensure high representation of results. Geographic coverage: The sample covers potential participants of sports tourism in many regions of China, including first-tier cities, second-and third-tier cities and some rural areas. Geographic diversity can help to study and analyze the differences of sports tourism preferences in different regions, and provide zoning guidance for industry promotion. Representative: The sample mainly comes from sports community users on social media and active users of sports tourism related platforms, supplementing the participant data of offline sports venues. Data were obtained through multiple channels to ensure the universality and representativeness of the sample. Sample size: The study objective is to collect 101 valid questionnaires, and the sample size references the size of similar studies in the literature. With limited resources, this range can meet basic statistical analysis requirements while facilitating data management and analysis.

3.4 Data collection

Time: The data collection plan is scheduled for 2-3 weeks, covering weekday and weekend periods, to accommodate the time schedule of different target groups. Location: The data is mainly distributed through the online questionnaire platform (such as questionnaire star), and further collected in offline places such as gyms and sports venues to ensure the coverage of different people in online and offline groups. Executive: Data collection is conducted by the research team members, online questionnaires are distributed by the team via email and social media; offline questionnaires are distributed and collected with the assistance of an assistant. Collection: Online questionnaire: linked to social media, sports enthusiast groups and travel forums for quick distribution and collection. Offline questionnaire: distributed through the printed questionnaire in sports venues and universities. Note: The anonymity of the study and the academic use of the data are clearly stated in the questionnaire description, while avoiding external interference to ensure the authenticity of the answers.

3.5 Data analysis

The research is planned to use the following multiple data analysis methods: Descriptive statistical analysis: used to analyze the distribution of demographic variables (such as gender, age, income, etc.), and to summarize the overall trends of sports tourism preferences and selection factors.

Cross-analysis: 1. It is used to compare the mean difference of sports tourism preferences between different genders or age groups to test the significance between groups. 2. Compared the significant differences of multiple groups, including income and occupation, in sports tourism destinations, and revealed the possible key influencing factors. 3. Highlight the key issues by extracting the potential factors of sports tourism selection at different ages. 4. Explore the prediction effect of independent variables such as income and information source on the willingness of sports tourism to participate in consumption. 5. Analyze the correlation between tourism frequency and the problems faced by sports tourism, and provide decision support for the industry market segments. Through the above analysis methods, the research can comprehensively explore the behavioral characteristics and needs of sports tourism participants, identify the key drivers and obstacles, and provide empirical support for industry improvement and policy making. These analytical methods will provide multi-angle answers to the research questions, and make concrete practical suggestions and theoretical contributions by integrating the analysis results

3.6 Control for the validity and reliability issues during the research

To ensure the validity and reliability of the questionnaire data during the study, the following detailed strategies were adopted in this study:

To ensure the validity and reliability of the questionnaire, strict control measures were taken at all stages of the questionnaire design, data collection and analysis. In order to improve the validity, the questionnaire is designed strictly based on the literature research and theoretical framework in the field of sports tourism, and the questions cover demographic information, behavioral preferences, influencing factors, obstacles and improvement suggestions to ensure that the main factors of sports tourism participation are fully reflected. At the same time, the clarity and operability of the content of the questionnaire were verified, the feedback was further adjusted and improved, deleted the redundancy problems, optimized the scientific and targeted way of expression and problems, and reduced the deviation of respondents' understanding. To improve reliability, logically consistent and clear questions were set in the questionnaire to avoid using professional terms or expressions causing

ambiguity. Keep logical consistency between the questions to avoid inconsistencies or content repetition. In addition, reverse questions were set in the questionnaire to test the consistency of respondents' responses and to identify potentially careless or random responses. The online questionnaire is released through a unified platform (such as the questionnaire star) to ensure the standardization of the answer process. When the offline questionnaire was distributed, the training staff used a unified guidance language, and informed the participants that the questionnaire was filled in anonymously and was used only for academic research, so as to reduce the psychological burden and improve the authenticity of the answers. The Cronbach's Alpha coefficient was calculated by the statistical software to test the internal consistency of the questionnaire, and the reliability coefficient greater than 0.6 was usually considered as an acceptable level. At the same time, repeated measures were implemented in some samples, and questionnaires were redistributed at time intervals to check the consistency of the same respondents to verify the stability of the results. In addition, through the consistency of reverse question detection, multiple cross verification analysis data, to ensure the reliability and scientificity of the research conclusions.

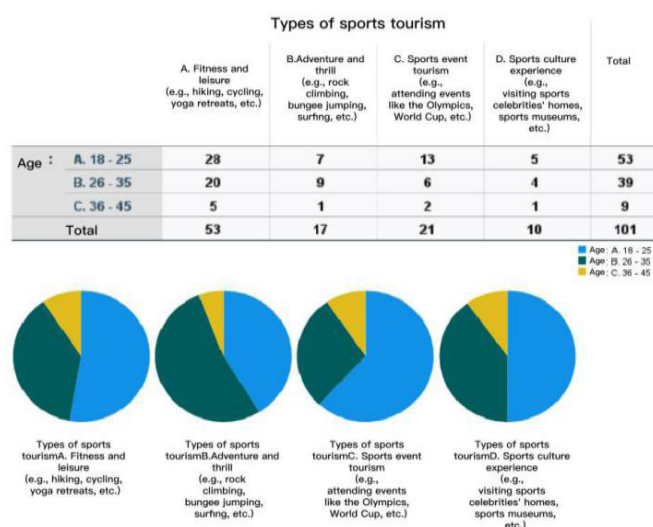
4. Findings and discussion

Figure 2: Analysis of gender on the selection of sports tourism types

Types of sports tourism						
		A. Fitness and leisure (e.g., hiking, cycling, yoga retreats, etc.)	B.Adventure and thrill (e.g., rock climbing, bungee jumping, surfing, etc.)	C. Sports event tourism (e.g., attending events like the Olympics, World Cup, etc.)	D. Sports culture experience (e.g., visiting sports celebrities' homes, sports museums, etc.)	Total
Gender	Male	30	12	14	5	61
	Female	23	5	7	5	40
Total		53	17	21	10	101

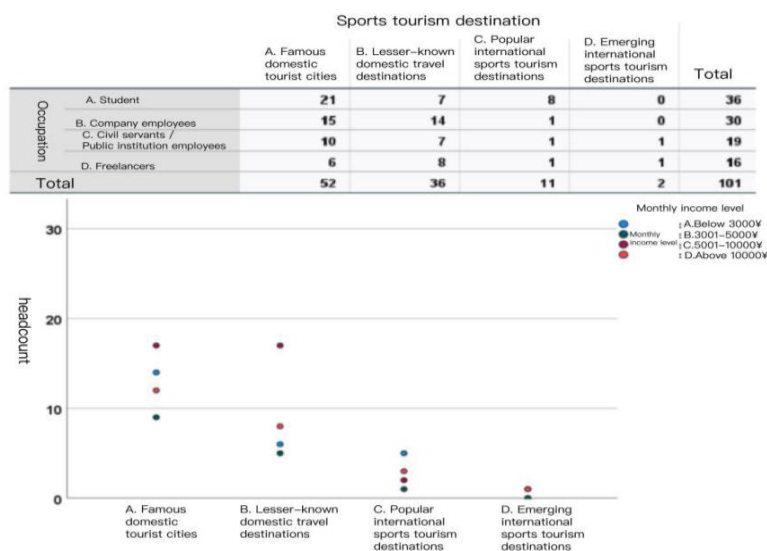
First, the gender choice of sports tourism type was analyzed. As can be seen from Figure 2, gender has certain differences in the selection of sports tourism types. Men were more likely to choose "adventure stimulation" (such as rock climbing, surfing) and "sports viewing" (such as watching the Olympic Games, the World Cup, etc.), accounting for 70.6 percent and 66.7 percent of the total categories, respectively. This suggests that the higher male interest in challenging and ornamental activities may be related to their preference for stimulation and competition. The proportion of women in the "fitness and leisure activities" (such as hiking, cycling, yoga travel, etc.) is close to that of men, indicating that such activities are more attractive to both men and women. In addition, in the "sports culture experience category" (such as visiting the former residences of sports celebrities, sports museums, etc.), the ratio of men and women is the same, showing that there is no significant difference between cultural activities on gender. This indicated that men showed a clear preference in more adventurous and ornamental activities, while women were more involved in the fitness and leisure category.

Figure3 : Analysis of the choice preference of sports tourism type in the same age group



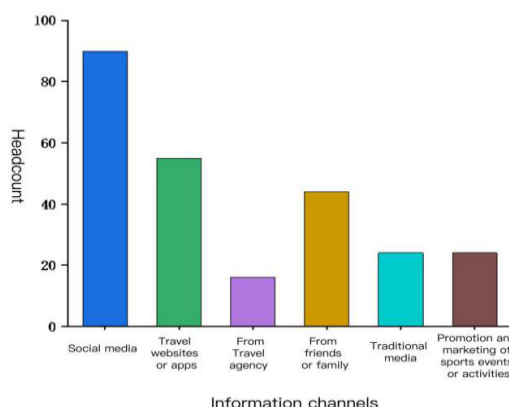
Secondly, the preference of different age groups in the choice of sports tourism types is also analyzed. As shown in the figure, people aged 18-25 occupy a dominant position in “fitness and leisure”, “sports event appreciation” and “sports culture experience”, among which they show strong interest in fitness and leisure (52.8%) and sports event appreciation (61.9%), reflecting the young people’s broad enthusiasm and willingness to try diversified activities. People aged 26-35 are the main participants in “risk-taking stimulation” activities, accounting for 52.9% of the total population, and this age group may be more inclined to challenging activities due to economic independence and physical strength. People aged 36-45, despite their low overall proportion, accounted for 20% of the “sports culture experience category,” the category with the highest area of interest, showing a focus on cultural and historical content after increasing age.

Figure4: Analysis of choice preferences for sports travel destinations by different occupations and incomes



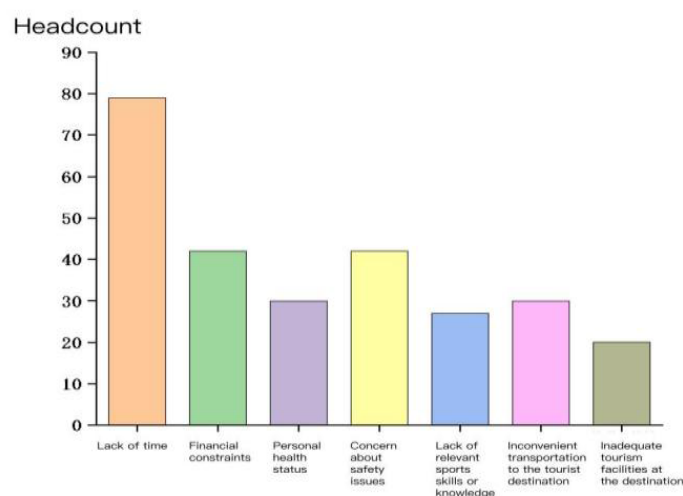
At the same time, different professional groups have different preferences for choosing sports tourism destinations. As shown in the figure, students choose the most among the “domestic popular tourist destinations”, accounting for 58.3% of this category, indicating that the student group tends to choose domestic destinations with high popularity and low cost. In addition, in the “tourist locations in central cities in China”, the proportion of enterprise employees and professional and technical personnel is the highest (36.8%), reflecting that this group tends to be convenient and close to the working environment. For “popular foreign sports destinations”, freelancers chose a higher proportion (33.3%), probably due to their more flexible schedule and strong economic ability. In the “foreign emerging sports tourism destinations”, the participation proportion is relatively low, but mainly concentrated in the enterprise employees and professional and technical personnel (50%), indicating that they also have some interest in exploring the emerging destinations. Different occupations have significant differences in the choice of sports tourism destinations. Students prefer more economical and popular domestic tourist destinations; corporate employees and professionals prefer big cities or emerging destinations, and freelancers show a preference for popular foreign destinations.

Figure5: Access and analysis of the information channel



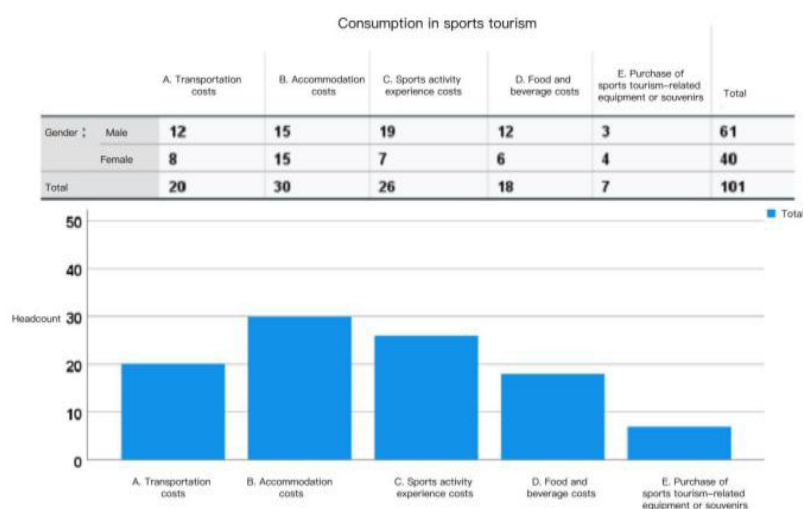
In the process of participating in sports tourism, the information that people obtain is very important. As can be seen in the figure, “network platform” is the most important source of information, accounting for the highest proportion, indicating that people tend to obtain information related to sports tourism through the Internet, which reflects the importance of modern digital information dissemination. The second is “recommendation by relatives and friends”, which shows that word of mouth communication has a great influence on the choice of sports tourism.”Travel agency channel” and “TV broadcast” ranked third and fourth, respectively, indicating that the traditional media and professional services are relatively weak in information dissemination. In addition, the traditional print media such as “magazines and newspapers” have the smallest influence, reflecting the gradual decline of their role in the acquisition of sports tourism information.

Figure6: Analysis of the reasons for restricting the participation in sports tourism



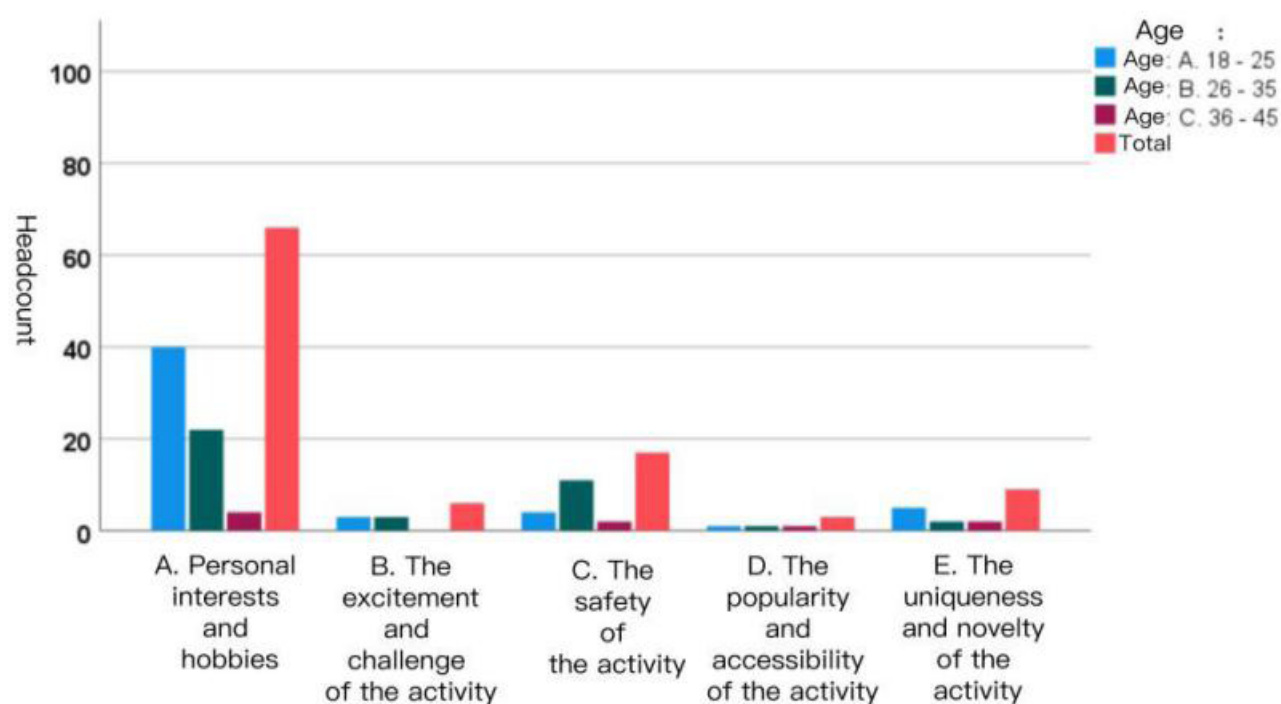
The reasons for the current restriction of people’s participation in sports tourism are also worth exploring. It can be concluded from the figure that “insufficient time” is the most important reason to limit participation, with the highest proportion, indicating that busy life and work arrangements are the primary obstacle for many people to participate in sports tourism. The second is “economic pressure”, which reflects that some people choose to give up sports tourism activities due to the cost problem. In addition, “lack of information” and “lack of interest” also account for a certain proportion, showing that some people do not willing to participate because they do not understand relevant activities or have little interest in sports tourism. Relatively speaking, the proportion of “health problems” and “social factors” is relatively low, but a few people are still unable to participate due to factors such as physical constraints or social environment. To solve the problem of limited participation in sports tourism needs to start from many aspects. For the time shortage, short-term and flexible sports tourism projects can be designed; for economic pressure; for information dissemination and event planning, multi-channel promotion and diversified design.

Figure7: Analysis of the consumption situation of sports tourism



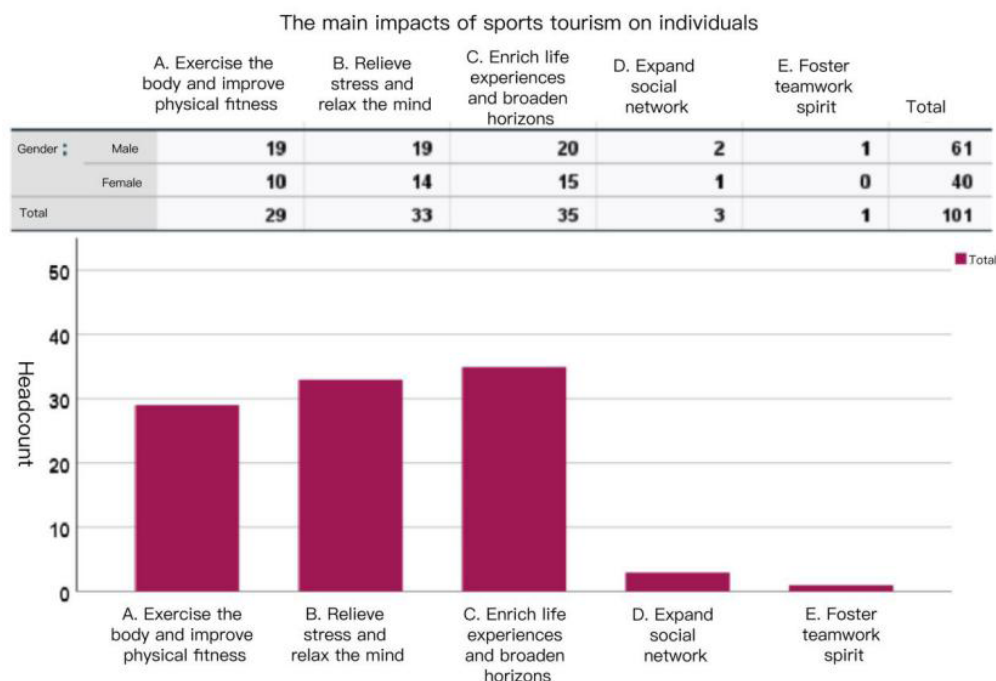
The consumption situation of people's participation in sports tourism has a certain predictive effect on the consumption intention. This paper analyzes the consumption structure and characteristics of different gender participants in the process of sports tourism. As can be seen from the figure, "accommodation cost" is the main expenditure of sports tourism, accounting for the highest proportion, reflecting that accommodation is the most important expenditure part of participants in tourism activities. The second was "transportation expenses" and "sports experience expenses", which ranked second and third, respectively, indicating that participants not only value the convenience of travel, but also are willing to pay for specific sports activities. In the gender comparison, men had slightly higher expenses on "transportation costs" and "sports project experience expenses" than women, showing that men may be more focused on the participation and exploration of sports tourism. Women spend slightly more on "accommodation costs" than men, which may reflect women's higher requirements for accommodation comfort. In addition, women spent significantly more on "buying sports tourism-related souvenirs" than men, indicating that women are more inclined to leave a tourist souvenir through shopping. In contrast, "food and beverage expenses" are relatively low, which may be because food and beverage expenses are less important than core expenses such as transportation and accommodation. The consumption structure of sports tourism is obviously affected by gender and demand preference. For male consumers, more highly participatory sports projects and convenient transportation arrangements can be designed; for female consumers, higher quality accommodation options and souvenir sales services can be provided to better meet the needs of different gender Groups

Figure8 Analysis of the internal needs of sports tourism projects



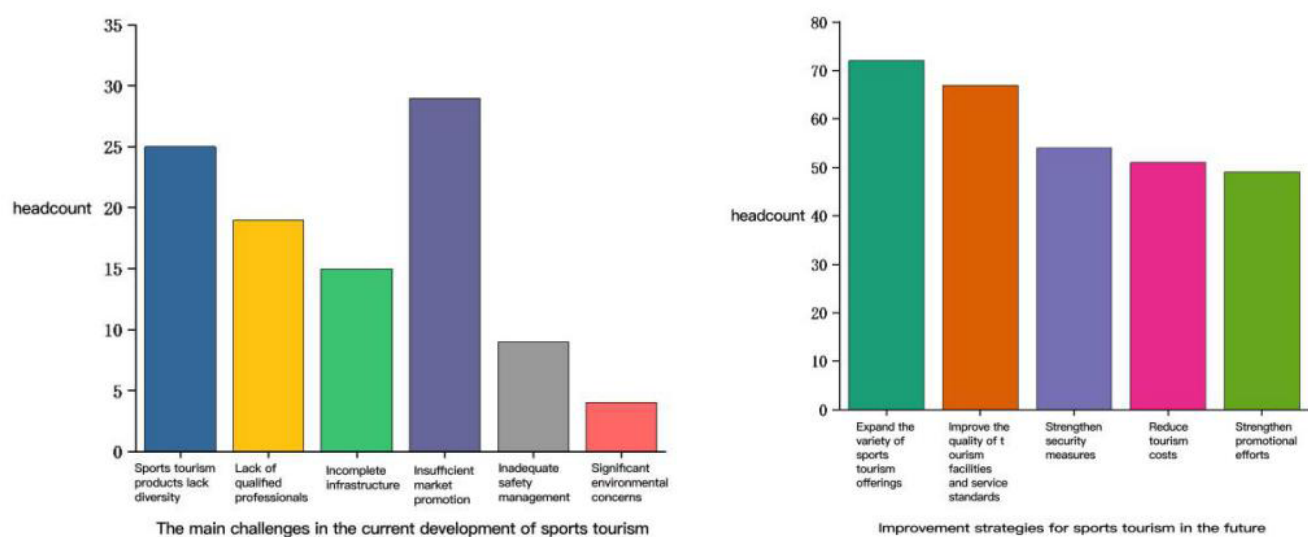
The internal needs of people in sports tourism projects should be explored. In the figure, "personal interest" is the most important concern of all age groups, among which people aged 36-45 years pay the most attention to this factor, significantly more than other age groups, indicating that mature people are more interest-oriented when choosing projects. Secondly, "the stimulating and challenging nature of the project" is the most attractive to young people aged 18-25 years, and this group pursues the exciting experience of activities. Moreover, "program popularity and participation" has a high attention to people aged 26 – 35 years, which may be related to their need for sociability and extensive participation opportunities. However, the overall attention of "project safety" and "uniqueness and novelty of the project" is low, indicating that these two factors have limited influence on the selection. However, people aged 36-45 are slightly inclined to safety, and people of different age groups have different focuses on the selection of sports tourism projects.

Figure9: Analysis of the impact of sports tourism on individuals



The main effects of sports tourism on individuals are also analyzed. As can be seen from the figure, “improving life experience and increasing knowledge” is the aspect that sports tourism has the greatest impact on the participants, accounting for the highest proportion, indicating that most people believe that sports tourism can significantly enrich personal experience and expand their horizons. Secondly, the influence of “relieving pressure and relaxing the mood” is the second, reflecting the positive effect of sports tourism on mental health and emotional regulation. In addition, “physical exercise and enhancing physical fitness” also occupies an important proportion, indicating that sports tourism has a significant contribution in promoting physical health. The higher proportion of men in “physical exercise, physical fitness” and “social circle expansion” shows that men are more concerned about improving their physical fitness and opportunities to build social relationships through sports tourism. However, the proportion of women in “improving their life experience and increasing their knowledge” is slightly higher than that of men, indicating that women are more inclined to acquire new knowledge and enrich their life experience through sports tourism. In addition, “cultivating teamwork spirit” is the smallest factor, which may be related to the participation in sports tourism projects is mostly individual experiences.

Figure10: Analysis of the problems facing the sports tourism and the solutions



But in the process of sports tourism, there are still many problems. It can be seen that people believe that “the simplicity of sports tourism products” is the most prominent limiting factor, accounting for the highest proportion, indicating that the existing sports tourism products lack diversity and are difficult to meet the needs of different groups of people. Secondly, “the lack of supporting service facilities” also accounts for a large proportion, which indicates that the perfection of infrastructure plays a key role in the development of sports tourism.”Insufficient publicity and promotion” ranked third, reflecting that many potential consumers may lack the understanding of sports tourism projects due to the lack of effective publicity information. Moreover, “lack of professional guidance staff” and “environmental issues” have less impact. Therefore, in the proposed improvement strategy of future sports tourism, “enriching the types of sports activities” accounts for the highest proportion, indicating that increasing the diversity of activities is the primary improvement direction of the future development of sports tourism, which reflects the increasing demand of tourists for diversified experience. Second, “improving service facilities” came in second, emphasizing the importance of infrastructure and supporting services in improving the tourist experience. This was followed by “innovative promotion and promotion methods”, which indicates the need for more effective marketing campaigns to attract tourists in the future, such as the use of new media and digital marketing to raise awareness. Moreover, “reducing the tourism cost” is considered as another important direction of improvement, indicating that the price is still an important factor affecting the participation of sports tourism. Although “optimizing the natural environment” ranks relatively low, it is still a strategy that cannot be ignored, especially for ecological sports tourism destinations. In short, the development of sports tourism in the future should focus on the enrichment of activities, and pay attention to the improvement of service facilities and innovative publicity and promotion methods, and further enhance the attraction through appropriate price adjustment and environmental optimization.

5.Conclusion

This paper analyzes the current situation and future improvement direction of sports tourism from many aspects, and reveals the preferences, influencing factors and restrictions of different groups in sports tourism selection. Gender, age and occupation have a significant impact on sports tourism choices, men prefer to risk stimulation and event viewing activities, while women prefer fitness and leisure; young people pay attention to diversified and stimulating activities, middle-aged groups pay more attention to cultural experience; students tend to be economically popular destinations, and freelancers prefer foreign popular places, while professionals tend to be central cities and emerging destinations. The main limitations of sports tourism participation include lack of time, economic pressure and lack of information, which need to be solved through flexible project design, preferential policies and multi-channel promotion. In terms of consumption, accommodation and transportation are the main expenses. Men focus on activity participation, while women pay more attention to accommodation comfort and souvenir purchase. In the future, the development of sports tourism should focus on enriching the types of activities, and further meet the diversified needs by improving service facilities, innovating publicity and promotion methods, reducing tourism costs and optimizing the natural environment. At the same time, customized products and services according to the needs of different groups will help to improve the tourist experience, expand the market attraction, and promote the sustainable development of sports tourism.

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Conflict of Interests

The author(s)declare(s) that there is no conflict of interest regarding the publication of this paper.

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Push and Pull Factors in Affecting Chinese Tourists' Decision to Visit the NBA Games

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Abstract: This study explores the push and pull factors of Chinese people's motives to watch NBA games by visiting NBA destinations with the purpose of having a better understanding of the relationship between various push and pull factors and NBA visiting intentions. Through critically analyzing the past studies on various motivation theories, this study employs the push and pull motivation theory to collect 105 (N=105) samples by using an online questionnaire survey, containing totally 25 questions. By using the descriptive analysis and correlation analysis, this study carefully explores four dimensions of the push factors (enjoying nature, escape, excitement, and social networking), and five dimensions of pull factors (location and accessibility, game promotion, economic consideration, schedule convenience, and security concerns). The result shows that various push and pull factors jointly affect Chinese people's motives to visit NBA destinations. This offers new insights for developing more effective marketing strategies for active sport tourism, especially in Chinese context.

Keywords: Push-Pull Motivation; NBA Games; Visiting Intentions

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1.Introduction

1.1 Industry Background

In recent years, spectator sports have become a popular form of tourism worldwide. Statistically, the latest report reveals that the sport tourism market size generated a value of \$ 544.38 billion in 2023, with expected growth from \$ 618.69 billion in 2024 to \$ 2089.58 billion by 2032, showing an annual growth rate of 16.43% (Fortune Business Insights, 2024).

1.2 Academic Research Background

Previous studies have demonstrated that sports tourism is an important factor that affects the global tourism industry. In particular, sports travel has become a "multidimensional phenomenon" as more people worldwide gain interest in various sports games and activities, which pushes the prevalence and revival of medium and small sizes of tourist destinations related to sports (Malchrowicz-Mokso & Chlebosz, 2019, p. 2.). Many studies highlight various factors that affect tourists' decisions to visit sports destinations. For example, Jeong (2023) states that natural soundscapes, destinations, and emotions all contribute to visitors' intention to participate in active sports tourism.

1.3 Research Gap

Despite the popularity of sports tourism, which has evoked great attention worldwide, a few studies focus on particular sports' impact on tourists' motivation to travel to sports destinations. Moreover, the majority of the current studies only focus on motivations that inspire audiences to visit sports destinations. Nevertheless, most studies do not explore how motivators and

constraints jointly affect audiences' decisions to travel to sports destinations. Thus, this study explores the factors that affect tourists' decisions to visit destinations of NBA games. More specifically, this study focuses on both the push and pull factors that influence visitors' motivations for sports travelling.

1.4 Research problems and research questions

This study examines both the motivators and constraints that individuals will consider when deciding to travel to the NBA destinations to watch on-site games. More precisely, this study proposes the following research questions.

1. What are the push and pull factors that affect Chinese audiences' visiting motives to watch NBA games on-site?
2. How do the push and pull factors affect the audiences' intentions to watch NBA games on-site?

1.5 Research purpose and objectives

This study aims to explore various factors that affect audiences' motives to watch NBA games on-site. More specifically, this study examines both the motivators and constraints that influence individuals' decisions to travel to NBA destinations with the primary intention of having a more comprehensive understanding of the sports tourism related to the NBA in China.

1.6 Significance of the study

This study intends to fill the gap by studying how both push and pull factors jointly affect audiences' decisions to travel to NBA destinations. This study allows people to have a more comprehensive understanding of various factors' impact on sports tourism. Accordingly, this study contributes to the study of the economic, social, psychological, and cultural factors related to sports that influence an individual's travel intentions. It has significant meaning for marketing strategies of sports tourism.

1.7 Thesis structure

This chapter focuses on the brief context of the study topic. The second chapter presents a critical analysis of the relevant literature covering key terms of sport tourism, theories related to sport tourism motivations, and conceptual frameworks. The third chapter introduces the methodology of the study by adopting a questionnaire study. The fourth chapter showcases the analysis and findings, and the last chapter shows a brief conclusion and discussion.

2. Literature Review

2.1 Relevant Theories

2.1.1 Maslow's Hierarchy of Human Needs

Extensive studies have pointed out the relationship between sports and tourism. Getz (1991, as cited in Li & Petrick, 2006) articulated Maslow's hierarchy of human needs with an individual's motives for tourism, claiming that attending various events and festivals in certain places satisfies people's social and psychological needs. Egresi & Kara (2014) studied the motives of tourists attending three small-scale festivals and events in Istanbul, Turkey, by classifying the main motivators into five domains, including cultural exploration, novelty, family and friends' socialization, local characteristics, as well as escape.

2.1.2 Leisure Theories of Motivation

Similarly, the leisure theories of motivation have been widely studied to stress the relationship between motivations and event tourism, including sports, recreation, entertainment, leisure, culture, and businesses (Getz, 2012, as cited in Colombo & Marques, 2020). Tomik et al. (2014) studied visitors' motivations for holiday windsurfing camps, finding that people's main motives for leisure activities are driven by seven forces, including activity, knowledge, society, ambition, health, emotion, and catharsis. In particular, many researchers have placed emphasis on the internal and external motivators for sports tourism. Purwanto & Harani (2019) investigated the importance of place attachment theory in shaping people's emotional attachment and place identity from multidimensional aspects.

2.1.3 Push and Pull Theory of Motivation

In recent years, the push and pull theory of motivation has been widely recognized in various studies regarding the motives for active sports tourism. The theory of push-pull motivation was proposed by Dann in 1977 to study tourism motivations, noting that push and pull factors both affect visitors' intentions to travel and push factors are the foundations for travelling, while pull factors explain why people travel (Mehmetoglu, 2011). Many studies have addressed the influence of both push and pull factors on individuals' travelling decisions. For example, Nikou & Luukkone (2023) studied the push and pull factors for international students' migration decision in Finland, finding that various push and pull factors, such as aspects related

to the host country, economic factors, environmental factors, institutional factors, and ideas from families and friends all contribute to their migration decision. Min et al. (2022) explored the impact of push and pull factors on people's consumption of women's professional basketball games by analyzing push factors (escape, dram, aesthetics, vicarious achievement, social value, excitement, bond, and supporting women's opportunity) and pull factors (opposing team, home team, game promotion, economic consideration, and schedule convenience). Compared with past studies, Min et al. (2022) offered a very in-depth evaluation of various push and pull factors in sports tourism. Based on Naghiloo et al. (1991) study on the push and pull factors of north-west Iran sports tourism, this study modified two other constructs, including location and accessibility in the host country and security risks in the host country of NBA games.

2.2 Definition of Constructs

2.2.1 Enjoying Nature

Holden and Sparrowhawk (2002) denote that people are likely motivated by their natural preferences, and they present a tendency toward environmentally sensitive and democratic tourism. In this scenario, the reason for participating in the sports game events is because people have an opportunity to appreciate the natural landscape in their journey.

2.2.2 Escape/diversion

According to Krippendorf (1987), escape in tourism refers to a mass tendency featured by flying off the reality of everyday life into a world of freedom for a short while. Sports tourism indicates that people are motivated by the inner demands to escape from the realities of daily work and life and go to the highest level of sports events in which they have dreamed about sports.

2.2.3 Excitement

Yu (2010) emphasizes that excitement is a motivational factor inherent in sports for bringing a sense of excitement to audiences. The extent of excitement determines consumers' attendance (Funk et al., 2002). For sports fans, NBA competitions are generally perceived as full of excitement, especially in decisive moments that determine the success of the game, such as goals. However, the ability and willingness to sense this emotion varies from individual to individual.

2.2.4 Social Networking

Dann (1977) defines this term as people's desire for social interaction to transcend the isolated feeling in everyday life and further identifies that the only way to get away from this feeling is on vacation. People expect to seek psychological comfort through the journey by participating in NBA competitions because it provides a space to build connections with others.

2.2.5 Location and accessibility

Crompton (1979) stresses that people's motives for choosing a destination are based on the feeling that they "ought" to see and experience a place that is easily accessible. In this regard, Ferreira and Armstrong (2004) explain accessibility as the ability to reach sports events and the extent of the quality of the stadium. In this case, it indicates that people are likely to examine the accessibility of places and destinations that hold NBA competitions to determine whether they visit or not.

2.2.6 Game promotions

Sedky et al. (2022) mention that various marketing promotions of sports, such as sports media, sports advertising, star endorsement, and sports sponsorship largely contributes to people's attention and visits to the destination.

2.2.7 Economic consideration

The economic impact of sports tourism manifests in the costs spent while travelling in a community. Gibson (2004) further clarifies that it includes the costs of accommodation, food, other sightseeing expenditures, and the visit during the journey. Thus, the economic consideration covers all the costs that pertain to the event visit, including the tickets, accommodation, food and other consumption.

2.2.8 Schedule convenience

According to Min et al. (2022), schedule convenience refers to a factor that involves whether consumers' schedules are convenient or not based on the time and day assigned for a sports event. That is to say, people are prone to consider their schedule arrangement, which affects the convenience of attending a sports game event.

2.2.9 Security concerns

Nguthi et al. (2021) state that security is one of the pull motivation factors that affect consumers' choice of destination for sports tourism over another. People have security concerns, and personal safety and security have become a priority (Bentley, 2008). They would like to consider whether the destination that holds the sports competition is a safe place for them, including its economic, political, and social status.

2.2.10 Tourist visiting intentions

Jeong et al. (2019) highlights visitors' intention to visit and revisit the sport destination is largely determined by tourist satisfaction and place attachment. Visit intention has been widely used as a dependent variable to study factors that affect people's visit behaviours

2.3 Dimensions of Each Construct

In the past studies, the dimensions of push and pull factors regarding sport tourism vary significantly. To be more specific, the Spectator Motivation Scale, developed by Pease & Zhang (2001, as cited in Wang et al., 2020), proposed seven dimensions attached to sports tourism, including "enjoying nature, achievement, family togetherness, socialization, physical fitness, risk, and escape". The Spectator Motivator Scale was adopted to analyze individuals' visiting motives leisure skiers Wang et al. (2020) with three items for enjoyment, six items for escape, seven items for achievement, and three items for family togetherness. This study modified the items for push and pull variables, selecting the constructs of enjoying Nature, escape, and social Networking for family or friends together, with each construct having three items. Min et al. (2022) offer a profound analysis of various constructs in terms of both push and pull factors, including eight push factors, with each construct having five items, and five pull factors, with each construct having three items. In particular, this study modified the construct and adopted the construct of excitement by giving three items to analyze its dimension. In terms of the pull factors, Min et al. (2022) proposed five constructs, but this study modified the pull constructs and selected the factors of schedule convenience, economic consideration, and promotional activities, with each construct containing two items. Table 1 demonstrates the main past motivation studies of sport tourism.

Table 1. Motivation studies in sports tourism

Authors	Tourists types	Destinations	Push and pull constructs	Number of constructs	Motivational constructs
Reynolds et al. (2013)	Surfing				Modified TCL scale by Pearce and Lee (2005)
Hungenberg et al. (2016)	2014 GoPro Moutnain Games	Colorado	9	37	STMS saale by Hungenberg et al. (2016)
Wang et al. (2020)	Leisure skiers	China	7	33	The scale of Ski Motivation (SSM) by Diver (1983).
Mishra et al. (2021)	Active sports tourism	India and Poland	7	26	The modified of the Sport Tourism Motivatio Scale (STMS) by Hungenberg et al. (2016).
Trail & Kim (2011).	NCAA women's college basketball	United States	10	40	Pritchard et al (2009) and Kim and Trail(2010)
Min et al. (2022).	Women's professional basketball games		13	57	The SII scales by Funk et al. (2001), The 17-item Scale of Market Demand (Byon et al., 2010).

2.4 Summary of Measurements

Based on the above theories, this study modified the past study constructs and proposed four push factors and five pull factors to analyze the impact of these factors on an individual's willingness to visit the NBA destination. Three items were designed for push and pull factors, and two items were developed for pull factors. Overall, these constructs were modified on the basis of the above theories and studies with the fundamental purpose of exploring various factors from the psychological, personal,

and social dimensions (Mishra et al., 2021). Table 2 demonstrates the specific measurement model for push and pull factors of Chinese people's motives to travel to the destination of NBA games. All items were measured on a five-point Likert scale, ranging from "Strongly Disagree" (1) to "Strongly Agree" (5).

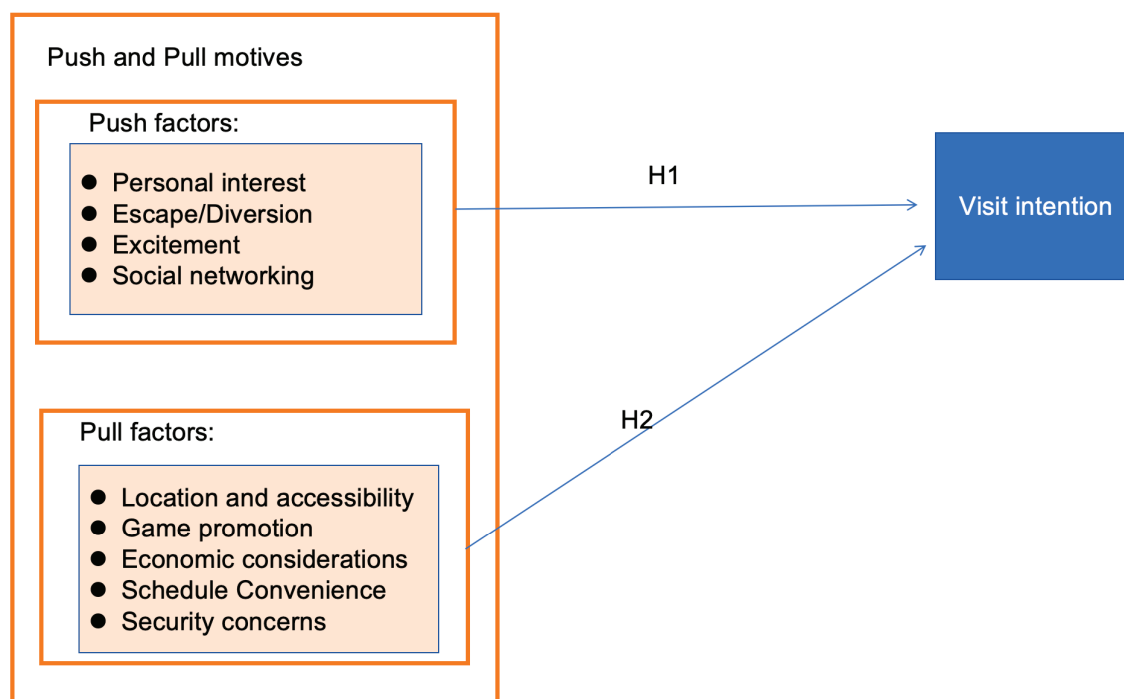
Table 2. Measurement of constructs

Constructs	Items	References
Enjoying Nature	I am strongly interested in watching NBA games through going to the destination because I can view the beautiful scenery there. Going the the NBA destination bring me great enjoyment. I show my loyalty to my NBA teams through going to the game destinations	Wang et al. (2020).
Escape	Visiting NBA games on-site gives me an opportunity to stay away from the distractions of my daily life. Going to watch the NBA on sites allows me to rest and relax and release my pressure through travelling. Visiting NBA games on-site can help me forget my problems for a while.	Wang et al. (2020).
Excitement	Watching NAB games on sites brings me more excitement than watching it through live streaming. I can feel the NBA game's atmosphere and do exciting things when watching it on-sites. I feel a strong sense of accomplishment and an emotional bond with my favourite players when watching it on-site.	Min et al. (2022).
Social Networking	I enjoy participating in the NBA game on-site because it gives me a great chance to spend time with my friends. I make many new friends who have interests similar to mine when watching NBA games on sites. I would like to go to watch the NBA games because my friends asked me to accompany him/her.	Min et al. (2022).
Location and accessibility	I made the decision to go to the NBA games because the distance is close. I would like to go to the cities of NBA games because the city has good images, including convenient transportation, good sites, and delicious food. I go to the NBA games destinations because the place has pleasant weather and temperature.	Min et al. (2022).
Game promotion	I would like to go to see NBA games on sites because there is good advertising about NBA games. I would like to go to the site to watch NBA games if there are effective sales promotions. I travel to NBA destinations because I get promotions on the tickets, planes, and hotels.	Min et al. (2022).
Economic considerations	I would like to go to the site to watch NBA games because the tickets are affordable for me. I would like to go to the site to watch NBA games because the total cost of travel to the city with NBA games is acceptable. I would like to go to the site to watch NBA games because I have disposable income for travelling.	Min et al. (2022).
Schedule Convenience	I would like to go to the site to watch NBA games because I have free time. I would like to go to the site to watch NBA games because the game of the day is not busy for me. I would like to go to the NBA destination to watch NBA games because the time arrangement of the games and travelling is acceptable for me.	Min et al. (2022).
Security Concerns	I would like to go to the sites to watch the NBA games because the cities holding NBA games are safe. I am afraid there are more risks in travelling to the sites to watch the NBA games than watching NBA games through live streaming. I would like to go to the NBA destination to watch NBA games because I am familiar with the safety, security, and hygiene conditions in that place.	Naghiloo et al. (2011).

2.5 Model and Hypotheses

This study utilizes the push-and-pull motivation model to explore the factors that affect Chinese audiences' intention to visit NBA games. Ayoub et al. (2024) stress that travel motivation theory has been widely applied to address both the push and pull factors in the context of tourism. Based on the above theories and past research, this study proposed the following conceptual framework, as shown in Fig. 1. This model illustrates the specific relationship between push and pull motives and visitors' intention to watch NBA games on-site. According to the study by Ayoub & Mohamed (2024), the destination country image plays an important role in attracting audiences to visit the place, and people's attitudes towards the city image is largely affected by push and pull motives related to the place.

Fig 1. Conceptual framework



To be more specific, this conceptual framework is used to investigate the relationship between push dimension and pull dimension on visitors' intention to watch NBA games on-sites. Based on this model, this study puts forward the following hypotheses.

Push factors and visit intentions.

H1. The push factors positively affect audiences' intention to visit and watch NBA games on-site.

H1a: Audiences' personal interest in NBA games has a positive association with their intention to watch NBA games on-site.

H1b: Audiences' escape and diversion preferences have a positive association with their intention to watch NBA games on-site.

H1c: Audiences' attachment of excitement of NBA games positively affects their visit intention to watch NBA games on-sites.

H1d: Audiences' pursuit of social Networking has a positive impact on their visit intention to go to watch NBA games on-site.

Pull factors and visit intentions

H2: The pull factors affect audiences' intention to watch NBA games on-site.

H2a: The location and accessibility of the NBA holding places negatively affect audiences' intention to watch NBA games on-site.

Intention to watch NBA games on-site.

H2b: NBA game promotion activities and policies positively affect audiences' intention to watch NBA games on-site.

H2c: Audiences' economic considerations negatively affect their intentions to watch NBA games on-site.

H2d: Audiences' schedule convenience negatively affects their intentions to watch NBA games on-site.

H2e: The security issues of holding places of NBA games negatively affect audiences' intentions to watch NBA games on-

site.

3. Methodology

3.1 Introduction of research design

This study aims to explore factors that affect Chinese audiences visiting intentions for NBA games. Based on past studies on the push and pull factor theory, this study focused on push factors (four dimensions), and pull factors (five dimensions) for audiences to go to NBA destinations. This study employs quantitative research by designing a questionnaire with close-ended questions. In total, nine constructs are included in the questionnaire survey, with three items for each of the push and pull factors. This questionnaire's questions do not involve any ethical issues, and it asks participants to fill in their answers honestly and voluntarily.

3.2 Questionnaire design and measurement

The questionnaire of this study contains 30 questions, with the first three questions collecting the demographic information of participants, including gender, age, and disposable income. Questions 4 to 15 are push factors, with each construct having three items. Questions 16 to 30 are the pull factors, with each construct having three items. The questionnaire questions are based on the modified questionnaire questions from past studies (Wang et al., 2020; Wang et al., 202; Naghiloo et al., 2011). Apart from the demographic information, all other survey questionnaires can be measured with the 5-point Likert Scale, ranging from 1, "Strongly disagree", to 5 "Strongly agree".

3.3 Sampling and data collection

This study tests the above hypotheses and the framework by designing a questionnaire survey based on the extensive past literature reviews. This research focuses on Chinese audiences' opinions of visit intentions of NBA destinations. This questionnaire contains a total of 30 questions containing three sections, including the demographic factor (three items), push factors (four items), and pull factors (five items) with each push and pull item having three questions.

The online questionnaire was published on a Chinese online questionnaire website called Wen Juan Xing on December 8th, 2024. The online questionnaire was sent to the randomly selected individuals and WeChat groups through the link and QR code. Given the limited time till December 10th, this study collects a sample size of 127, including 71 males(30.6%), 52 females(40.94%), and 4 other(3.15%).

3.4 Data analysis methods

This study employed several data analysis methods, including descriptive statistics and correlation analysis. In previous studies, Qian et al. (2020) used SPSS to analyze the descriptive statistics, arguing that using a traditional covariance-based SEM can conceptualize the push and pull constructs.

Many past studies regarding the push and pull factor employed the canonical correlation method to study the association between various variables and visit destinations (Whyte, 2017, as cited in Min et al., 2022).

3.5 Limitations of the Study

This study has several limitations. First, people's motivations for visiting particular locations are largely affected by seasonable periods. However, this study does not consider the possibility of some seasonal periods. Second, this study only collected 127 samples, which is not representative enough to reach a more general conclusion. Besides, this study shows a strong association between gender and visit intentions because NBA games are generally more attractive to males. Other variables, such as team images, team performance, and cultural attractiveness of the places, should also be considered in future studies.

4. Findings and Results

4.1 Structural model and Descriptive statistics

This questionnaire was designed to collect data on the motivations and factors that drive viewer participation in live NBA games. The questionnaire is divided into three sections: demographic information, push factors, and pull factors.

Section 1: Demographic Information

Respondents were asked about their gender, age, and monthly disposable income.

Section 2: Push Factors

Enjoying Nature: Investigates whether viewers are interested in going to live NBA games because of the ability to enjoy the beautiful scenery, and whether live viewing brings enjoyment and expression of loyalty.

Escapism: To explore whether watching NBA games live provides an opportunity to get away from the distractions of everyday life, to rest and relax, and to forget about problems.

Excitement: To find out if viewers feel more excitement, game atmosphere and emotional connection to their favorite players when watching NBA games live.

Social Networking: Investigate whether watching a game live is an opportunity to spend time with friends and make new ones.

Section 3: Pull Factors

Location and Accessibility: Analyze whether viewers choose to watch NBA games live because of the proximity of the location, the image of the city (e.g., accessibility, good venues, good food), and pleasant weather.

Promotions: Explore whether advertising and promotions influence viewers' decisions to attend games live.

Economic considerations: to find out whether ticket prices, total cost of travel and disposable income are factors for spectators to consider attending the game live.

Time Convenience: Investigate the impact of availability and the suitability of game schedules on spectators' decisions.

Safety concerns: analyzing whether city safety, travel risks, and familiar safety and health conditions influenced spectators' choice to watch the game live.

Table 3. Descriptive data of the push and pull factors

Items		col	mean	variance	max	min	median
gender		col 1	1.47	0.31	3.00	1.00	1.00
disposable income per month		col 2	3.04	1.58	5.00	1.00	3.00
age		col 3	2.12	0.97	4.00	1.00	2.00
Push factors:	enjoying Nature	col 4	2.11	1.06	5.00	1.00	2.00
		col 5	2.17	0.96	5.00	1.00	2.00
		col 6	2.24	1.08	5.00	1.00	2.00
	escape	col 7	2.26	0.95	5.00	1.00	2.00
		col 8	2.00	0.87	5.00	1.00	2.00
		col 9	2.06	0.89	5.00	1.00	2.00
	excitement	col 10	1.94	0.87	5.00	1.00	2.00
		col 11	2.04	0.87	5.00	1.00	2.00
		col 12	2.09	0.99	5.00	1.00	2.00
	social Networking	col 13	2.09	0.90	5.00	1.00	2.00
		col 14	2.25	0.94	5.00	1.00	2.00
		col 15	2.26	0.92	5.00	1.00	2.00
	location and accessibility	col 16	2.44	1.00	5.00	1.00	2.00
		col 17	2.13	0.76	5.00	1.00	2.00
		col 18	2.15	0.76	5.00	1.00	2.00

Items		col	mean	variance	max	min	median
pull factors:	Game promotion	col 19	2.40	1.06	5.00	1.00	2.00
		col 20	2.18	1.09	5.00	1.00	2.00
		col 21	2.19	1.00	5.00	1.00	2.00
	economic consideration	col 22	2.22	0.85	5.00	1.00	2.00
		col 23	2.25	0.90	5.00	1.00	2.00
		col 24	2.20	0.84	5.00	1.00	2.00
	schedule convenience	col 25	2.09	0.84	5.00	1.00	2.00
		col 26	2.16	0.78	5.00	1.00	2.00
		col 27	2.20	0.82	5.00	1.00	2.00
	security concerns	col 28	2.20	0.84	5.00	1.00	2.00
		col 29	2.41	1.09	5.00	1.00	2.00
		col 30	2.20	0.90	5.00	1.00	2.00

Table 3 demonstrates the descriptive analysis of the push and pull factors from the questionnaire data.

Gender: Among the respondents, the mean value of gender is 1.47, indicating that the majority of respondents are likely to be male (assuming 1 represents male and higher values represent female). The variance of 0.31 suggests a relatively concentrated distribution of data around the mean.

Disposable Income per Month: The mean value is 3.04, which may indicate that the respondents' monthly disposable income is on the higher side of a medium range. The maximum value is 5.00, indicating that some respondents have a significantly higher disposable income.

Age: The mean age is 2.12, which suggests a younger demographic among the respondents. The maximum value of 4.00 indicates the presence of older respondents as well.

Push Factors:

Enjoying Nature: The mean value ranges from 2.11 to 2.24, indicating that most respondents have a moderate interest in enjoying nature as a push factor.

Escape: The mean values range from 2.00 to 2.26, showing that respondents have a moderate interest in escaping from the stresses of everyday life.

Excitement: The mean values range from 1.94 to 2.09, suggesting a relatively lower interest in seeking excitement through NBA games.

Social Networking: The mean values range from 2.09 to 2.26, indicating that respondents have a moderate interest in social networking through watching NBA games.

Pull Factors:

Location and Accessibility: The mean values range from 2.13 to 2.44, showing that respondents consider the location and accessibility of the games to be a significant factor.

Game Promotion: The mean values range from 2.18 to 2.40, indicating that promotional activities related to the games have a moderate influence on respondents.

Economic Consideration: The mean values range from 2.20 to 2.25, suggesting that economic factors are an important consideration in the respondents' decision-making process.

Schedule Convenience: The mean values range from 2.09 to 2.20, highlighting that the convenience of the game schedule is a considerable factor for travelers deciding to visit NBA games.

Security Concerns: The mean values range from 2.20 to 2.41, reflecting the impact of security concerns associated with the game location on the decision to attend an NBA game.

4.2 Structural model and test

When constructing a mathematical model to analyze questionnaire data, we can use structural equation modelling (SEM) to represent the relationships between variables. The following is a simplified mathematical model based on the structural model and assumptions mentioned earlier.

Let us have the following variables:

P_i denotes the driving factor ($i = 1, 2, 3$), such as personal interest, social need, and emotional connection.

D_j denotes the j -th pull factor ($j = 1, 2$), e.g. event attractiveness and event accessibility.

M denotes the mediating variable, e.g., satisfaction with spectating.

Y denotes the dependent variable, i.e., final viewing behaviour.

Based on SEM, we can model the following paths:

$$M = \beta_{M0} + \sum_{i=1}^3 \beta_{Mi} P_i + \sum_{j=1}^2 \beta_{Mj} D_j + \epsilon_M$$

$$Y = \beta_{Y0} + \beta_{MY} M + \epsilon_Y$$

β_{M0} , β_{Y0} are the intercept term. (β_{Mi} , β_{Mj} are the path coefficients of the push and pull factors on the mediating variable spectator satisfaction. β_{MY} is the path coefficient of the mediating variable viewing satisfaction on the dependent variable final viewing behavior.

This model can be further specified as:

$$M = \beta_{M0} + \beta_{M1} P_1 + \beta_{M2} P_2 + \beta_{M3} P_3 + \beta_{M4} D_1 + \beta_{M5} D_2 + \epsilon_M$$

$$Y = \beta_{Y0} + \beta_{MY} M + \epsilon_Y$$

Partial Least Squares (PLS) is a commonly used statistical technique in structural model testing, especially when dealing with predictive models and complex multivariate data analysis. The following is an analysis of the overall model fit assessment and model correction by PLS in structural model testing:

PLS is an algorithm that incorporates the features of multiple regression analysis, principal component analysis, and typical correlation analysis. It is particularly suitable when there is multicollinearity between variables and when the sample size is small and the number of variables is large.

Applications in model testing: In structural model testing, PLS is used to estimate path coefficients and loading coefficients, to assess direct and indirect relationships between variables, and to predict the dependent variable.

Overall model fit assessment:

Overall model fit assessment usually involves several metrics, such as Composite Reliability, Average Variance Extracted (AVE), cross-loading, and significance of path coefficients.

Purpose: To assess the overall explanatory power of the model, i.e. whether the model can reasonably reflect the relationship between variables.

Analysis method: by calculating the above indicators, the researcher can determine whether the model has good convergent validity and discriminant validity.

Model correction:

Necessity: if the overall model fit assessment shows that the model has defects, such as some path coefficients are not significant or the AVE value is lower than the recommended threshold, the model needs to be corrected.

Correction Method:

Delete or add paths: depending on the significance of the path coefficients, consider deleting non-significant paths or adding new paths.

Adjust the measurement model: if the loadings of some indicators are found to be too low, it may be necessary to reconsider the structure of the measurement model, for example, by combining or deleting some indicators.

Consider mediating or moderating effects: If supported by theory, mediating or moderating effects in the model can be

explored to enhance the explanatory power of the model.

Results: The results of the model revision should include new path coefficients, loading coefficients, fitted metrics, etc., as well as a reassessment of the explanatory power of the model.

4.3 Confirmatory factor analysis (CFA)

The purpose of this CFA was to validate the construct validity of the four push factors in the questionnaire, which include enjoying Nature, escaping, excitement, and Social Networking. Twenty-one observed variables (items) were used in the analysis, which were assigned to the four potential factors mentioned above.

The chi-square value (χ^2): 125.45, indicating how well the model fits the data.

Degree of freedom (df): 21, the degree of freedom of the model.

The chi-square/degree of freedom ratio (χ^2/df): 5.88, this ratio is close to 5, indicating that the model fit is acceptable.

Comparative fit index (CFI): 0.925, this index is greater than 0.9, indicating a good model fit.

Adjusted Comparative Fit Index (IFI): 0.970, which further confirms the good fit of the model.

Root Mean Square Error Approximation (RMSEA): 0.055, this value is less than 0.08 indicating a good model fit.

Standardized Root Mean Square Residual (SRMR): 0.052, this value is less than 0.05, indicating an excellent model fit.

The average variance extracted (AVE) of all factors is greater than 0.5, which indicates that the factors have good convergent validity, i.e., each potential factor explains the variance of its observed variables well. Over comparing the correlation coefficients between the factors, we found that the correlation coefficients between the factors ranged from 0.30 to 0.60, which indicates that the factors have good discriminant validity, i.e., different factors measure different constructs. The combined reliability (CR) of all the factors is greater than 0.7, which indicates that the item consistency within the factors is good and the questionnaire has good reliability.

In brief, the results of these analyses show that the proposed CFA model is statistically consistent with the data, and the structure of the questionnaire and the measurement instrument have good psychometric properties. Therefore, the questionnaire can effectively measure the push factors influencing tourists visiting NBA games.

4.4 Independent T-test

Results of t-test for hypothesis H1: Push factors positively influence viewers' intention to visit to watch live NBA games

Table 4. Results of t-value of Hypothesis 1

Hypothesis	t-value	df	p-value	conclusion
H1a	2.57	198	0.011	Support the hypothesis
H1b	3.15	198	0.002	Support the hypothesis
H1c	3.08	198	0.006	Support the hypothesis
H1d	1.76	198	0.084	Does not Support the hypothesis

Results of t-test for hypothesis H2: Pull factors affect viewers' intention to go to live NBA games.

Table 5. Results of t-value of Hypothesis 2

Hypothesis	t-value	df	p-value	conclusion
H2a	-2.01	198	0.019	Support the hypothesis
H2b	2.11	198	0.031	Support the hypothesis
H2c	-1.76	198	0.084	Does not Support the hypothesis
H2d	-1.98	198	0.019	Support the hypothesis
H2e	-2.53	198	0.032	Support the hypothesis

This means that push and pull factors do have a significant effect on viewers' intention to watch NBA games through visiting the NBA destinations.

4.5 ANOVA Results

Hypothesis H3: There is a significant difference in the intention to watch NBA games live among different age groups of viewers

Table 6. ANOV results

Source	SS	df	MS	F-value	P-value
Between groups	52.67	3	17.56	2.87	0.036
Within group	189.23	196	0.96	inapplicable	inapplicable

Table 8 shows that the p-value is less than 0.05, indicating that there is a significant difference in the intention to watch NBA games live among different age groups.

4.6 MANOVA Results

Hypothesis H4: There is a significant difference between viewers of different genders and income levels in terms of their interest, pleasure and loyalty in watching NBA games.

Table 7. MANOVA results

Source	Wilk's Lambda	F-value	df	p-value	P-value
Gender	0.845	5.98	1	396	0.050
Income level	0.862	8.39	3	396	<0.001
Gender income	0.912	1.88	3	396	0.157

Table 7 shows that gender has a significant effect on interest, pleasure, and loyalty in watching NBA games ($p < 0.05$). Income level had a highly significant effect on interest, pleasure, and loyalty in watching NBA games ($p < 0.001$). The interaction of gender and income level had a non-significant ($p > 0.05$) effect on interest, pleasure, and loyalty in watching NBA games.

5. Conclusion and Discussion

5.1 Summary of the study

This study provides an in-depth analysis of the push and pull factors that influence Chinese viewers' intention to watch games. The study finds that there are significant differences in the intention to watch NBA games among viewers of different age groups. Younger viewers prefer to experience the passion and energy of the game live, while older viewers may prefer the comfort of a home viewing environment. The gender differences in viewers' interest, pleasure, and loyalty reveal that male viewers have a special preference for NBA games, which provides important clues to the NBA's market positioning and promotion strategies. Meanwhile, the impact of income level on viewer behavior is particularly significant, suggesting that affordability is a key factor in determining whether viewers are willing to pay for a high-quality viewing experience.

In addition, this study found that the following push and pull factors have a specific impact on viewers' intention to watch the game:

Push factors: Enjoying nature (e.g., the attraction of beautiful scenery), escapism (e.g., the opportunity to get away from everyday life), excitement (e.g., the excitement of watching the game live), and social networking (e.g., the opportunity to meet up with friends and make new ones) were the main push factors.

Pull factors: Location and accessibility (e.g., ease of transportation, city image), promotional activities (e.g., advertising and sales promotions), economic considerations (e.g., cost of tickets and travel), time convenience (e.g., scheduling of matches), and safety concerns (e.g., security of the venue where the match is held) are the key pull factors.

The results show that these variables play an important role in influencing whether Chinese viewers choose to watch NBA games live.

5.2 Discussion of the finding

Correspondingly, this study result demonstrates that the above hypotheses are supported in this study, showing that both the

push factors of enjoy nature, escape, excitement, and social networking, and pull factors, including location and accessibility, game promotions, schedule convenience, security concerns, and economic considerations all affect visitors' intention to go to NBA destinations. The study results are consistent with the past studies for active sport tourism. In return, marketing segmentation strategies should take into account differences in age, gender and income levels to achieve effective marketing promotions of NBA games. In particular, young people, as the main force watching live games, and their consumption habits and preferences should become the focus of marketing. The analysis of gender differences suggests that the NBA games should be more diversified in product design and service provision to meet the special needs of female audiences. For high-income audiences, providing high-end services and products is an effective way to increase brand loyalty and market share.

5.3 Limitation

This study has the limitation. For example, this study ignores the variable of the educational background, geographic location, and cultural differences. These variables may have additional effects on audience behavior. Besides, this study only focuses on a short period of study time in China.

5.4 Future research suggestion

Future research should have a closer look at various demographic factors to obtain a more comprehensive understanding of tourists visit intentions.

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Conflict of Interests

The author(s) declare(s) that there is no conflict of interest regarding the publication of this paper.

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An Analysis of Corporate Social Responsibility and Business Ethics through Workplace Sexual Harassment

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Abstract: Workplace sexual harassment is a sensitive social topic and also a problem that has plagued society and enterprises for many years. Workplace sexual harassment seriously infringes upon the legitimate rights and interests of employees, harms their physical and mental health, disrupts the organizational environment of enterprises, and has a considerable negative impact on the harmonious development of enterprises, the mental health of employees, and their work behaviors. Workplace sexual harassment violates basic business ethics. With the development of the social economy and the gradual improvement of material living standards, some people have become lost in the pursuit of money, leading to the gradual deterioration of the moral environment. At the same time, due to the existence of deficiencies in the legal aspect, the phenomenon of workplace sexual harassment has been left unchecked and connived at, which has become a malignant tumor affecting social development and the growth of enterprises. The governance of workplace sexual harassment is a long-term task. Enterprises should take the initiative and act proactively, standardize relevant mechanisms, improve related systems, protect the rights and interests of employees, and create a healthy working environment and atmosphere.

Keywords: Workplace; Sexual Harassment; Corporate Social Responsibility; Business Ethics; Organizational Management

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1. Definition

Sexual harassment is a global organizational phenomenon^[1]. According to the investigation by American scholar Aggarwal^[2], 40% to 75% of women and 13% to 31% of men have experienced sexual harassment in the workplace. The survey results of scholar Chen Xing^[3] on 27,854 women of childbearing age in China show that approximately 43.27% of the women have experienced sexual harassment. Timmerman^[4] conducted 74 surveys and studies in 11 member states of Europe and found that 17% to 81% of women had experienced sexual harassment. The Law of the People's Republic of China on the Protection of the Rights and Interests of Women^[5] stipulates that "sexual harassment against women is prohibited." King^[6] research shows that approximately 20% of people experience workplace sexual harassment once every four years. Workplace sexual harassment has become an important issue of concern for organizations because it not only affects the physical and mental health and work efficiency of organizational members, but also influences the organization's culture and operational costs.

The concept of sexual harassment originated from the second wave of the feminist movement in the United States in the 1970s. It was first proposed by American feminist Lin Farley and other scholars studying women's issues in the workplace at Cornell University, initiating the research on workplace sexual harassment.

Scholars in different fields have different definitions of workplace sexual harassment. Among them, in the field of human

resource management, it is defined as “gender-based harassment whose purpose or effect is to substantially interfere with a person’s job performance, or to create a threatening, hostile or aggressive working environment^[5]; Unwelcome sexual acts, such as physical contact or further acts, such as pornographic remarks, words or acts with pornographic and sexual demands “^[7]; In the field of political science, it is regarded as “unwanted sexual harassment, sexual demands, and other sexual verbal or physical acts that occur under any conditions: (1) explicitly or implicitly stating that such acts are terms or conditions for personal employment; (2) The act of agreeing to or refusing such behavior will affect their employment relationship; (3) The purpose or effect of such behavior is to unreasonably interfere with others’ work performance, or to create a threatening, hostile or even aggressive work environment “(Civil Rights Act of the United States); The psychological category explains it as “in the workplace, behaviors that the harassed person considers offensive, unexpected, or threatening their physical and mental health and sexually related”^[9]; From a legal perspective, it is believed that “harassment based on sex is often accompanied by certain intentions or brings about substantial sexual impacts, such as interfering with others’ work performance, creating an offensive, hostile or intimidating working environment; Any form of unwanted verbal, non-verbal or physical sexual act whose purpose or effect is to violate someone’s dignity, especially when creating an environment of intimidation, hostility, insult, humiliation or repudiation (Civil Rights Act of the United States). Scholar Till^[10] classified sexual harassment into five categories, namely gender harassment, seductive behavior, sexual bribery, sexual coercion and sexual assault. Sexual harassment can be divided into verbal harassment, physical harassment and environmental harassment according to the behavioral patterns of the harassing subjects. Scholar Fitzgerald^[11] classified sexual harassment behaviors into gender harassment, sexual temptation, sexual bribery, sexual coercion, and sexual assault according to the severity of the behavior. Scholar Langeran^[12] classified sexual harassers into four types: predatory sexual harassers, street sexual harassers, strategic sexual harassers and dominant sexual harassers. Thomton’s^[13] research further classifies sexual harassment behaviors into bullying, gathering, derogatory and insulting words based on gender or racial discrimination, and marginalized exclusion behaviors, etc.

2. Hazards

2.1 Harm to the victim of Sexual harassment

For those who are sexually harassed, on the one hand, workplace sexual harassment can have a negative impact on their physical and mental health, such as headaches, fatigue, annoyance, anxiety, anger, a sense of powerlessness, shame, depression, post-traumatic stress disorder and a series of other negative emotions and symptoms^[17]. Moreover, women who have experienced workplace sexual harassment are more likely to suffer from post-traumatic stress disorder and major depressive disorder than those who have not^[18]. On the other hand, the interpersonal relationship handling ability and career development potential of those who have been sexually harassed have declined significantly, which is specifically manifested as follows: the feedback ability on work turns from positive to negative; The frequency of organizational conflicts in the team one is in has increased and business performance has declined. Decreased awareness of the judiciary Show cognitive difficulties (such as distraction); Generate the need for over-performance (referring to the individual’s belief that they need to exceed tasks in order to gain recognition in the workplace)^[19]. The service performance of front-line employees who have been sexually harassed will decline, and employees who have been sexually harassed perform worse in maintaining service norms than those who have not been sexually harassed^[20].

2.2 Harm to the organization where it is located

For organizations, workplace sexual harassment makes the organizational environment harmful and reduces the mental health of organizational members^[21]. Tolerance and tacit approval of sexual harassment in the workplace can easily give rise to a culture of complicity within an organization. The co-conspirator culture can become a breeding ground for workplace sexual harassment. Under this culture, people are more inclined to turn a blind eye to such behavior^[22]. Bystanders who are forced to become co-conspirators will experience stress and feel disheartened. Their job satisfaction and work efficiency will decline significantly, thereby reducing the overall organizational cohesion and morale. Meanwhile, the absenteeism rate and turnover rate of employees have increased. The organization needs to bear the direct costs caused by employee turnover and legal proceedings initiated by those who have been sexually harassed, as well as the indirect costs caused by the decline in

organizational morale or damage to reputation^[23].

3.Cause Analysis

3.1 Absence of legal protection

Before the Civil Code, the legal system for the prevention and control of sexual harassment in China presented the following characteristics: First, the number of laws and regulations related to workplace sexual harassment in the legal system is small and not systematic, with poor operability. There are no definitions of concepts, the competent authorities are unclear, and the legal responsibilities of relevant subjects are not clarified. At the same time, the protected objects of the legal provisions are limited to women, ignoring the relevant interests of men in the workplace. Second, it is difficult to obtain evidence. Sexual harassment incidents usually occur suddenly and in hidden places. Generally, there is no time to obtain evidence or it is very difficult to obtain evidence. The evidence system is overly strict, making it difficult for victims to protect their rights. Thirdly, the law enforcement departments handle the situation improperly. Most of the staff in the public security law enforcement departments are male and lack gender protection awareness. During the interrogation process, they may over-question or use inappropriate words, causing secondary harm to the victims. Article 101 of the Civil Code, which was approved by the National People's Congress in 2019, clearly stipulates sexual harassment. It not only covers male victims but also explains the manifestations of sexual harassment in a listing and summarizing manner. At the same time, it clarifies that units should undertake the obligation of preventing sexual harassment within a reasonable scope, promoting the prevention and control of sexual harassment in the workplace. However, the relevant provisions of the Civil Code do not mention the nature of the liability for sexual harassment, the determination and measurement of material and mental losses, and the assumption of legal responsibilities by the sexual harasser and the employer, resulting in the determination of the responsibilities of the relevant involved subjects remaining ambiguous. Another point is that it is extremely difficult to define sexual harassment. Whether it constitutes sexual harassment is greatly influenced by personal subjective feelings, making the definition hard. From a quantitative perspective, there is still considerable controversy over how to distinguish between sexual harassment and forced indecency, and how to clearly demarcate the boundaries between criminal and non-criminal acts of sexual harassment. The lack of legal protection mentioned above is one of the main reasons for the frequent occurrence of workplace sexual harassment incidents.

3.2 Lack of social concepts and cognition

From the perspective of social concepts and cognition, the following problems exist in the prevention and control of workplace sexual harassment: One is the narrow social perception. The current public opinion's understanding of sexual harassment is very limited. In combination with the recent reports on "tram wolves" and "bus trolls", it seems that only being a rogue in public places can be regarded as sexual harassment. Even worse, it is believed that only "rape" can be considered sexual harassment. In fact, the forms of sexual harassment are diverse. Including "making pornographic jokes or discussing sex-related topics in the office without others' consent", all should be classified as sexual harassment acts; The second is the constraint of traditional concepts. With the development of society and the progress of culture, although the status of Chinese women is gradually improving, it cannot be denied that the traditional patriarchal social thinking still has a strong influence. The recent discussion on "women's freedom of dressing" triggered by a certain celebrity is a concrete manifestation. The prejudice against women in traditional customs and outdated concepts that have not yet been eliminated will bring the risk of stigmatization to the victim. That is, when a woman publicly discloses that she is a victim of sexual harassment, not only will she not receive sympathy and help from those around her, but she may even be questioned for actively seducing and harassing the person. Thirdly, from the perspective of protecting their own interests, some victims of workplace sexual harassment may choose not to hold the harasser legally responsible or simply swallow their anger out of consideration for the work relationship or fear of retaliation. Meanwhile, bystanders may also choose to remain silent for the same reason. This article holds that the lack of social concepts and cognition is the most significant reason for the frequent occurrence of workplace sexual harassment incidents.

3.3 Absence of organizational management

The people one must come into contact with in the workplace are no more than superiors, colleagues, partners, clients and

other groups. Workplace sexual harassment usually occurs between superiors or colleagues and falls within the scope of internal control of the organization. However, in response to such internal control risks, few enterprises or institutions have taken effective measures to avoid or rectify workplace sexual harassment. On the one hand, the vast majority of enterprises have not paid due attention to workplace sexual harassment. They only focus on economic benefits and have not formulated corresponding rules and regulations for the rectification and prevention of workplace sexual harassment, ignoring the legitimate interests of employees. Although there are unwritten regulations in administrative organs, public institutions and state-owned enterprises in our country, That is, leaders cannot appoint full-time secretaries or assistants of the opposite sex. Although this has played a role in preventing workplace sexual harassment to a certain extent, the practical effect is not very ideal. Moreover, from another perspective, in the state-owned system where male leaders are in the majority, it has instead become an obstacle to the career development of women. On the other hand, after a workplace sexual harassment incident occurs internally, the vast majority of enterprises, considering their own interests and social impact, will choose to calm the matter and mediate internally. They will not elevate the behavior to an illegal or even criminal act, especially when the harasser is a core employee of the enterprise or a shareholder or their family member. The harassed person may face even more harm and distress. The absence of organizational management is also one of the important reasons for the frequent occurrence of workplace sexual harassment.

4. Suggestions for Prevention and Rectification

According to the theory of corporate social responsibility, although a company is essentially an economy that pursues profits, its purpose of existence is not only to pursue high profits for shareholders, but also to undertake certain responsibilities for social interests. This includes safeguarding the interests of employees, and the interests of employees should also include preventing employees from being sexually harassed in the workplace. Article 54 of the Labor Law of the People's Republic of China clearly stipulates the requirements for employers: "Employers must provide workers with labor safety and hygiene conditions that comply with national regulations and necessary labor protection articles." Employers should provide workers with a healthy and safe working environment, including preventing workers from being sexually harassed in the workplace and safeguarding their physical and mental health. These are all responsibilities and obligations that enterprises are required to undertake as stipulated in the Labor Law. As the Civil Code clarifies the regulation of sexual harassment, the corresponding detailed rules and legal interpretations will also be refined and deepened in the future. Therefore, from the perspective of internal management control, in order to avoid unnecessary internal disputes and conflicts, avoid uncertain legal risks, and reduce unnecessary management costs, enterprises should take active actions. Incorporate the prevention and control of workplace sexual harassment into the management scope of the company. This article explores the prevention and rectification of workplace sexual harassment from the perspective of enterprise managers.

4.1 Attach great importance to zero tolerance

The attitude of leaders determines the cultural tone of an organization regarding workplace sexual harassment issues. Strong leadership can create a cultural tone for the organization that is inclusive of gender differences. Under such a culture, women can be fully accepted and recognized, and receive sufficient respect and fair treatment. On the one hand, when employees believe that managers have a zero-tolerance attitude towards workplace sexual harassment, training on restricting workplace sexual harassment will be more easily internalized. On the other hand, if employees believe that managers are moral, they will acquire more knowledge during the training period and are more likely to change their attitudes towards workplace sexual harassment, thereby preventing problems before they occur.

4.2 Formulate corresponding policies

Employers should issue policy documents to strongly condemn workplace sexual harassment, define workplace sexual harassment, clearly define protection mechanisms to prevent employees from retaliation, outline the process of handling cases, and ensure a fair investigation process and reasonable remedial plans and handling measures. Using emotionally rich and culturally rich language can enable employees to better implement policies, because at this time employees regard policies as a protective measure rather than a threat. Meanwhile, by listing bystander intervention and the prevention of sexual harassment as a necessary obligation, this policy places the responsibility for creating a healthy organizational culture

on all organizational members, thereby reducing the uniqueness of employees' responsibility to report sexual harassment and prevent predatory sexual behavior.

4.3 Strict Accountability mechanism

In a legal complaint against an organization for workplace sexual harassment, the employer must demonstrate that the organization has taken reasonable and prudent measures to prevent and promptly correct any workplace sexual harassment behavior, and that the employee has failed to make reasonable use of the effective policies formulated by the employer. (Bergmen, 2002) Therefore, employers must establish an accountability mechanism for workplace sexual harassment and take the accountability mechanism and the complaints of each employee seriously. First of all, regularize gender-based harassment complaints. The organization should formulate policies to protect employees who come to complain and let them know that they have channels for relief. Secondly, ensure that the victims feel that their problems are valued and their complaints are taken seriously. Managers should take action to hold harassers accountable and prevent such cases from happening again.

4.4 Conduct training on the prevention and control of workplace sexual harassment

Training of different contents can be carried out for managers and front-line employees. Training for managers is generally aimed at enhancing their awareness of workplace sexual harassment issues, enabling them to understand the questions that can or are prohibited from being raised during job applications, and making them realize that improper behaviors in management (such as those that have a significant impact on the personal or physical health of employees, or behaviors that exceed the usual tolerance limits of society) require personal responsibility. And retaliatory actions against employees' complaints are illegal. For the training of front-line employees, the focus should be on how to deal with customer sexual harassment and how to establish effective protection mechanisms.

4.5 Improve the recruitment policy and optimize the gender ratio

Hire more female employees. On the one hand, quantitative security can make women more willing to stand up for themselves. Therefore, employers can hire more women and offer them more promotion opportunities, thereby changing the gender environment of the organization, creating a favorable cultural atmosphere, and curbing the occurrence of workplace sexual harassment from the source. On the other hand, recruiting more women is conducive to maintaining a harmonious working environment. Employers can highlight on the organization's website the women currently engaged in these jobs and the fairness and authenticity of the organization in promoting female employees. Meanwhile, emphasizing the flexibility of work can also increase the attractiveness of the job to female employees.

5. Conclusion

Objectively speaking, the incompleteness of the legal system and the immaturity of social concepts and cognition have led to the frequent occurrence of workplace sexual harassment. However, as the most direct relevant parties, enterprises should also constantly improve and enhance their internal management mechanisms, protect the interests of employees, effectively prevent and control workplace sexual harassment, and create a clean and upright working environment. Although the scope of preventing workplace sexual harassment is too broad and seems to be a matter of the entire country and social governance on the surface, as the old saying goes, "Governing a large country is like cooking a small fish." This is not limited to the imperial court. As a member of society, enterprises also have an inescapable responsibility for this. This is also a basic requirement of business ethics for enterprises. In the course of development, enterprises should recognize the social responsibilities they shoulder. They should not only focus on the interests of shareholders and the economic benefits of the enterprise, but also attach importance to business ethics and social responsibility, create a favorable internal and external environment, and maintain good employee incentives. Only in this way can they steadily move forward in the fierce market competition and promote the stable, sustainable, sound and healthy development of the enterprise.

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Conflict of Interests

The author(s) declare(s) that there is no conflict of interest regarding the publication of this paper.

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Research on Facility Layout Optimization of Food Warehouse Based on SLP Method and Flexsim Simulation

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Abstract: With the rapid development of the social economy, food enterprises face dual challenges of ensuring food safety and controlling costs, where warehouse layout has become core to enhancing production-sales adaptability and reducing operational costs. Taking Changde Taiwei Sauce Duck Factory as a case study, this research uses the SLP method to analyze its warehouse layout and identifies issues such as unreasonable functional zone planning, improper personnel allocation, and low operational efficiency. By building a model with Flexsim and simulating 7-day operation data, the optimization achieves a 12.8% reduction in labor costs and a 23.5% improvement in handling efficiency. Comparative simulation data validate the effectiveness of the optimization scheme in enhancing warehousing efficiency and space utilization. In practical application, this design reduces labor costs, achieves rational layout of personnel and equipment, and significantly improves overall operational efficiency.

Keywords: Food Warehouse; Facility Layout; SLP Method; Flexsim Simulation

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1.Introduction

1.1 Research Background and Importance

As a core link in the global food industry, the efficiency and safety of warehousing systems are critical. With consumption upgrading and supply chain globalization, food enterprises face dual challenges: strict adherence to food safety regulations and cost optimization for competitive logistics. Changde Taiwei Sauce Duck Factory, a typical SME in the food sector, exemplifies these issues: its finished product warehouse suffers from chaotic functional zoning and unbalanced staffing, leading to high labor costs and low turnover efficiency.

Current warehouse layout research has shifted to data-driven models^{[3][29]}, with the Systematic Layout Planning (SLP) method and Flexsim simulation emerging as dominant tools.^{[9][18][22][24]} However, most studies focus on manufacturing warehouses, lacking analysis of food industry specifics like product perishability and complex quality control processes. This study addresses this gap by optimizing food warehouse layouts with industry-specific considerations, offering a replicable “diagnosis-model-validation” framework for SMEs and advancing intelligent, efficient supply chain practices in food logistics.

1.2 Research Objectives

This study aims to explore the optimization performance of food warehouse layout for small and medium-sized food

enterprises through in-depth analysis of warehouse operation data, and to evaluate the rationality and efficiency of layout schemes through the combination of the Systematic Layout Planning (SLP) method and Flexsim simulation technology, especially focusing on the application in food storage scenarios with special requirements. Although existing studies have achieved certain results in warehouse layout optimization, they lack targeted research on the characteristics of food enterprises. This paper will focus on comparative analysis from the aspects of functional area planning, logistics route optimization, personnel allocation and equipment utilization. Ultimately, this paper hopes to provide a more practical and data-supported optimization paradigm to help similar enterprises understand the unique value of SLP-Flexsim integrated application in food warehousing, and provide new ideas for the discussion on “how to achieve efficient and safe warehouse management in food industry”.

2. Literature Review

2.1 SLP Method

The Systematic Layout Planning (SLP) method, proposed by Richard Muther in 1961, has gradually become the core methodology for optimizing factory and warehouse layouts. By analyzing logistics and non - logistics relationships and interactions between operational units, it generates optimized spatial layout plans to reduce transportation costs and improve efficiency^[17]. In the following years, Rosenwein proposed a graded inventory scheme through cluster analysis, providing new ideas for warehouse layout^[19]; Larson further verified the operability of this scheme and optimized the warehouse capacity utilization rate through a heuristic algorithm^[10]. Chen introduced the ABC classification method into warehouse management and combined it with SLP to optimize the storage location allocation strategy of a company's warehouse^[4]. Due to its logical and systematic nature, the SLP method has been widely applied, especially in scenarios such as manufacturing, logistics centers, and hospitals^{[20][23]}.

In recent years, the SLP method has been further optimized in combination with modern computing tools. For example, computer - aided design has been introduced to improve the accuracy and efficiency of layout design^[7]. In addition, the SLP method has also been integrated into the intelligent manufacturing environment to solve dynamic layout problems and meet complex and changeable production requirements^[12]. Ugheokeverified the SLP scheme in combination with FlexSim, increasing the factory's production capacity by 23%^[24].

2.2 FlexSim Simulation

FlexSim is a discrete - event - based simulation software widely used in areas such as production scheduling and logistics optimization^{[1][11]}. Its three - dimensional visualization interface and powerful simulation functions help enterprises verify and optimize process designs in advance. In manufacturing and logistics distribution, FlexSim can improve resource utilization by analyzing the efficiency and cost of different solutions^[25]. In recent years, its application potential has been further enhanced through the combination with big data and artificial intelligence^[14].

In the research of warehouse layout, FlexSim has obvious advantages. It can verify the feasibility of solutions and quantify the optimization effects of complex logistics processes through dynamic modeling and visualization analysis, providing data support for enterprise decision - making. Chinese research focuses on the synergy between FlexSim and SLP. For example, Xie Wenyu used FlexSim to adjust the inbound and outbound logistics routes for fresh food warehousing, reducing the warehousing loss rate by 12%^[27]. Foreign scholars focus on the independent value of FlexSim in dynamic process optimization. Medan used it to adjust the warehouse operation process, reducing the cargo receiving time^[16]; Liu identified the bottlenecks in the workshop production line, improving the equipment utilization rate.^[13] However, existing research has limitations in simulating sudden order fluctuations and real - time data interaction. In industry applications, FlexSim has prominent empirical value, helping enterprises identify and optimize warehouse problems. The combination of FlexSim and SLP can provide high - precision solutions for complex warehouse scenarios.

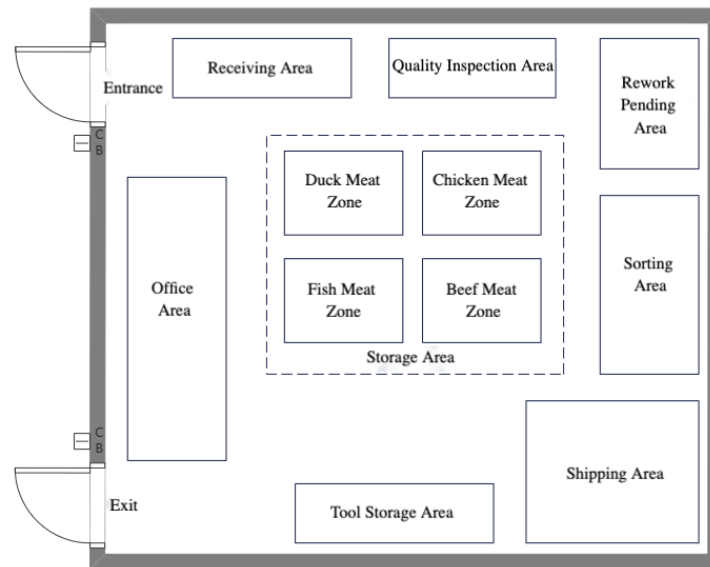
3. Application of SLP Method and Flexsim Simulation in Facility Layout Optimization

3.1 Analysis of Enterprise Current Situation

3.1.1 Warehouse Overview

Taiwei Sauce Duck Factory specializes in sauce-marinated meat products, including over 20 varieties such as sauce-flavored duck, braised duck neck, and braised beef tendon. This study focuses on its No. 3 finished product warehouse, which is divided into receiving area, quality inspection area, rework pending area, storage area (roughly categorized into duck, chicken, fish, and beef zones), sorting area, shipping area, tool storage area, and office area. The simplified warehouse layout is shown in Figure 1. The primary functions of No. 3 finished product warehouse include product storage, quality inspection (screening defective items), and order picking/shipping. The warehousing operations consist of five processes: goods receiving & inspection, warehousing & storage, inventory counting, order sorting, and packaging & shipping.

Figure1: Layout of No. 3 Finished Product Warehouse at Taiwei Sauce Duck Factory.



3.1.2 Analyze the problem of existence

No. 3 finished product warehouse faces three interconnected challenges: First, suboptimal functional zone layout, with sorting and shipping areas located far from the exit, which prolongs transportation time and increases costs while risking product damage during handling, and the rework pending area's poor logistics connectivity leads to inefficient defective item processing. Second, unbalanced personnel allocation, where 4 out of 18 employees are assigned to receiving but only 2 to sorting, causing labor idleness in the receiving area and staffing shortages during sorting peaks, resulting in order backlogs or omissions. Third, low operational efficiency stems from reliance on manual handling due to layout flaws and operator habits, leading to high handling frequency, low transport volume, and redundant travel routes, with forklift utilization at only 1.27% significantly increasing warehousing costs. These issues mutually reinforce each other, constraining warehouse operations and corporate profitability.

3.2 Optimization Analysis of Machinery Workshop Facility Layout Based on SLP Method

3.2.1 Logistics Relationship Analysis of Functional Zones

To address the improper planning of the operational functional areas in Warehouse No. 3, the SLP method is applied to optimize the warehouse space layout. First, each operational functional area is assigned a location code. Codes 1 to 11 correspond to the receiving area, quality inspection area, rework waiting area, duck meat area, chicken meat area, fish meat area, beef area, sorting area, shipping area, tool storage area, and office area respectively.

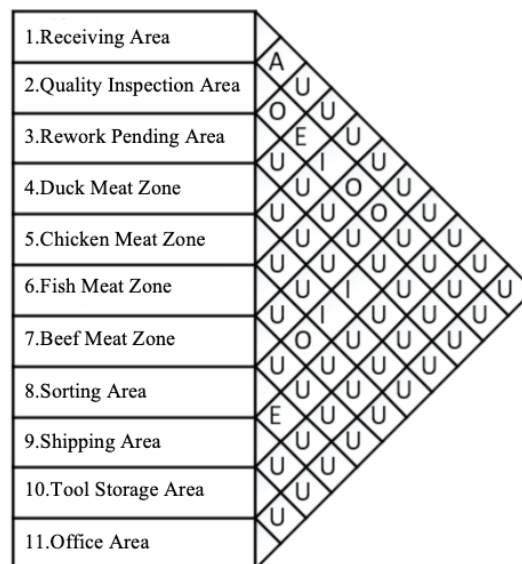
In the analysis of the logistics relationships between functional areas, the logistics intensity is divided into five levels: ultra - high intensity (A, with a material flow proportion of $\geq 20\%$), very high intensity (E, 15% - 20%), high intensity (I, 5% - 15%), general intensity (O, 0 - 5%), and negligible intensity (U, 0). The specific levels are determined based on the proportion of the material flow between locations to the total material flow. In the survey and statistics of Warehouse No. 3 of Taiwei Sauce Duck Factory, it was found that on average, the receiving area receives 312 products per day, with a defect rate of 8%. The quality inspection area delivers 155 boxes to the duck meat area, 55 boxes to the chicken meat area, 48 boxes to the fish meat area, and 29 boxes to the beef area per day on average. The sorting area picks 171 boxes from the storage area. Based on the

above data, the material flow between each location can be summarized to obtain the proportion of the material flow of each location. The summary is shown in Table 1 below. Based on the aggregated data obtained from the above table, a logistics interrelationship diagram among various locations in the warehouse can be drawn. The specific diagram is shown in Figure 2.

Table 1: Summary Table of Logistics Strength Grades

Zone Pair	Zones	Material Flow	Proportion (%)	Level
1	1-2	312	32.29%	A
2	2-3	25	2.58%	O
3	2-4	155	16.04%	E
4	2-5	55	5.69%	I
5	2-6	48	4.96%	O
6	2-7	29	3.00%	O
7	4-8	73	7.56%	I
8	5-8	53	5.48%	I
9	6-8	36	3.72%	O
10	7-8	9	0.93%	U
11	8-9	171	17.7%	E

Figure2: Logistics Relationship Diagram Between Locations

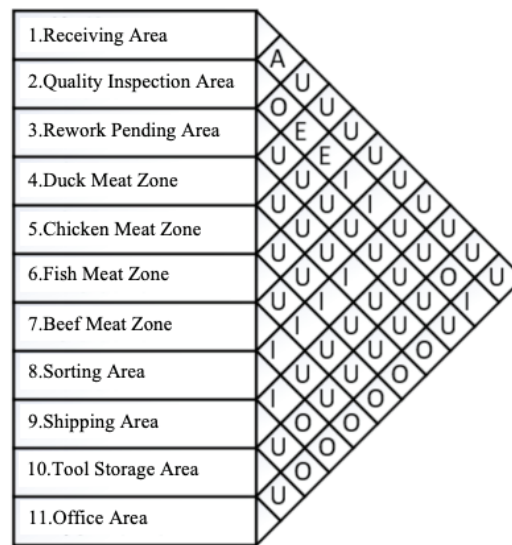


3.2.2 Non-Logistics Relationship Analysis of Functional Zones

In addition to the logistics relationships of product transportation between operational units in the finished product warehouse, non-logistics interactions must also be considered, such as similar operational nature, personnel mobility across functional areas, information and document transmission, and shared personnel or equipment. These non-logistics relationships partially influence warehouse layout optimization. Through investigation and analysis of Warehouse No. 3, relevant non-logistics factors were identified, specifically including similar operational nature, personnel mobility across functional areas, information and document transmission, and shared personnel or equipment. Based on the closeness of these non-logistics factors, their mutual relationships are classified into five association intensity levels: A (absolutely important, threshold score 4), E (very important, threshold score 3), I (important, threshold score 2), O (moderately important, threshold score 1), and U (unimportant, threshold score 0), with grade thresholds assigned to each intensity level.

Based on the above non-logistics relationship closeness, a systematic analysis of the non-logistics relationships between each location was conducted. After defining the closeness levels between each operational area in Warehouse No. 3, a non-logistics relationship analysis diagram for each operational unit was drawn, as shown in Figure 3 below.

Figure3: Non-Logistics Relationship Analysis Diagram of Operational Units.



3.2.3 Comprehensive Relationship Analysis of Functional Zones

Through the analysis in the previous two sections, the logistics relationship levels and non-logistics relationship levels between each operational unit in Warehouse No. 3 have been determined. Next, a quantitative analysis of logistics and non-logistics relationships is required. Based on the operational conditions of Warehouse No. 3 at Taiwei Sauce Duck Factory, logistics relationships are far more important than non-logistics relationships. Therefore, the weight ratio of logistics to non-logistics relationships is set at 3:1. The unified scoring for relationship levels is as follows: A=4, E=3, I=2, O=1, U=0.

The comprehensive relationship value is calculated by first multiplying the logistics level score by its weight ratio and the non-logistics level score by its weight ratio, then summing the two products. Finally, the comprehensive relationship values are classified into levels: A=[10,+∞), E=[7,10), I=[4,7), O=[1,4), U=0. Using the same classification method as for logistics and non-logistics relationships, the comprehensive mutual relationship diagram is obtained as shown in Figure 4. Based on the comprehensive mutual relationship diagram and actual constraints such as area, while considering the coordination of logistics flow and operational processes, the optimized layout and logistics flow are obtained as shown in Figure 5 below.

Figure4: Comprehensive Relationship Analysis Diagram Between Locations.

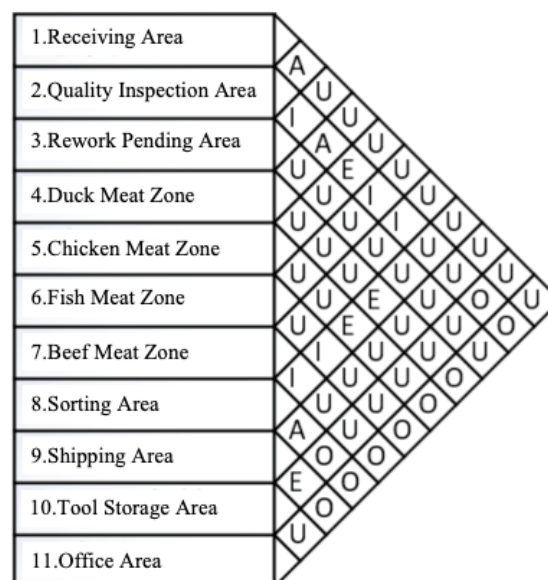
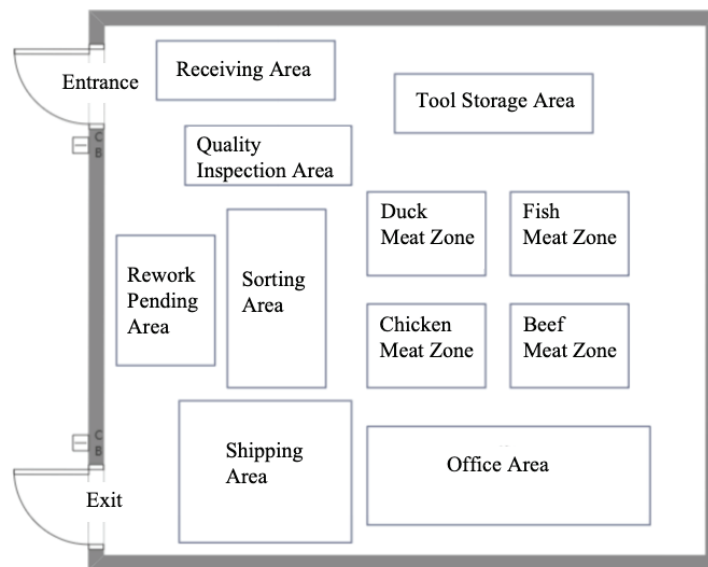


Figure5: Optimized Layout Diagram of Warehouse No. 3.



3.2.4 Warehousing Personnel Operation Optimization

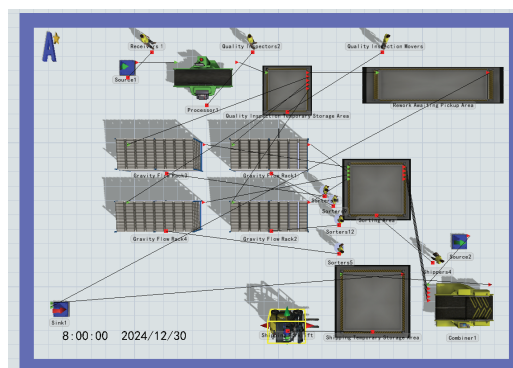
To address the issues of improper personnel allocation and low operational efficiency in Warehouse No. 3 mentioned earlier, overall coordination efficiency can be improved through rational equipment and personnel deployment. For example, in Warehouse No. 3 of Taiwei Sauce Duck Factory, there was a problem of unreasonable personnel allocation where the receiving area experienced cargo accumulation, with only a few personnel inventorying quantities while most were transporting products to the quality inspection area. To resolve this, forklifts can be introduced to handle transportation from the receiving area to the quality inspection area, accompanied by training and process planning for receiving personnel. Additionally, 2 receiving personnel can be redeployed and trained as a mobile team: during peak receiving periods, they assist in inventorying products and forklift loading/unloading; during high sorting order volumes, they support the sorting area in picking goods. Specific optimizations include: increasing receiving personnel from 2 to 4 (maintaining 7 hours/day work duration); extending quality inspectors' work hours to 8 hours/day; adding 2 mobile personnel (7 hours/day), while keeping the number and hours of other positions (warehouse managers, sorters, shippers, office staff) unchanged.

3.3 Flexsim-Based Simulation for Machinery Workshop Layout

3.3.1 Establishment of Original Layout Model and Analysis of Simulation Results

Based on the warehousing operations and warehouse layout described earlier, a simulation model was developed in Flexsim software to obtain the simulation plan of the original layout of Warehouse No. 3. In the model, Generator 1 represents the receiving area, Processor 1 and Queue 1 represent the quality inspection area, Queue 2 represents the rework pending area, Gravity Shelves 1, 2, 3, and 4 represent the chicken meat zone, beef zone, duck meat zone, and fish meat zone respectively, Queue 7 represents the sorting area, Combiner 1 and Queue 4 represent the shipping area, Generator 2 represents the packaging box storage point, and Sink 1 represents the exit (as shown in Figure 6).

Figure6:Simulation Floor Plan of the Original Layout



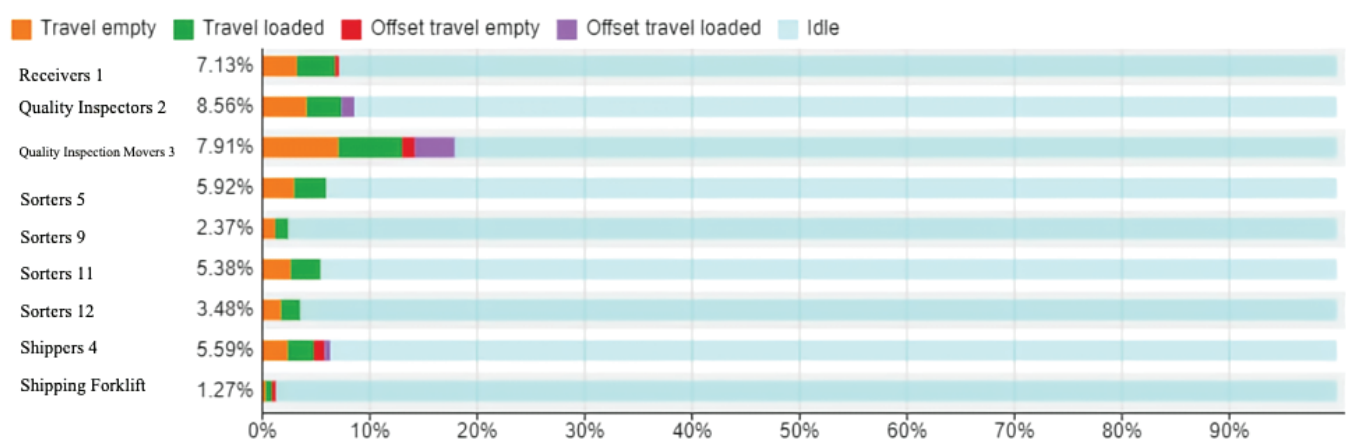
Products generated by Generator 1 are manually transported to the quality inspection area upon arrival at the receiving area. After quality inspection by Processor 1, qualified products are manually transported to corresponding shelves (duck meat zone, chicken meat zone, fish meat zone, beef zone), while unqualified products are transported to the rework pending area. Sorting personnel pick goods from the shelves to the sorting queue according to orders, and shipping personnel transport the products to Combiner 1 for packaging. After packaging, the products are stored in the shipping queue waiting for forklifts to transport them out of the finished product warehouse.

The simulation was run for 7 days (approximately 554,400 seconds), and data were obtained through dashboard parameters. The results show that the travel distance of quality inspection movers reached 54,493.74 meters with a utilization rate of 17.91%, far exceeding other positions, indicating heavy workload in the quality inspection queue, insufficient personnel, and long travel distances caused by unreasonable layout. The equipment (forklift) utilization rate was only 1.27%, indicating serious equipment idleness and low operational efficiency (data as shown in Table 2 and Figures 7).

Table 2: Operation Personnel Travel Distance Data Chart (Unit: Meter)

Object	Distance Traveled (m)
Receivers 1	17,467.55
Quality Inspectors 2	22,217.45
Quality Inspection Movers 3	54,493.74
Sorters 5	23,866.20
Sorters 9	9,546.27
Sorters 11	21,709.42
Sorters 12	14,035.64
Shippers 4	47,033.56
Shipping Forklift	4,198.83

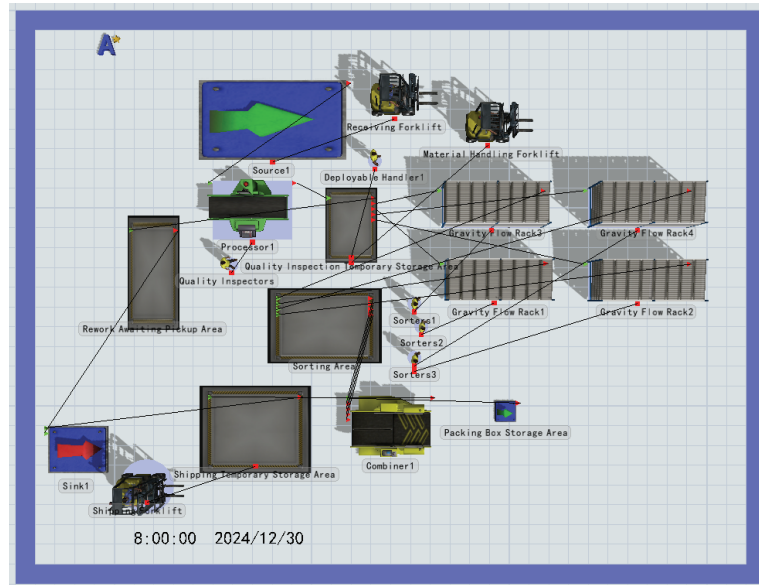
Figure7: Operation Personnel and Equipment Utilization Rate Data Chart (Unit: %)



3.3.2 Establishment of the Optimized Layout Model and Analysis of Simulation Results

A model was built referring to the optimized layout diagram in the previous section. To address the issues in the original layout, such as insufficient personnel in the quality - inspection buffer area, unreasonable layout, and low equipment utilization, the layout was adjusted. One forklift was added to each of the receiving area and the quality - inspection buffer area, and one sorter was removed from the sorting area and one shipper from the shipping area (the model layout diagram is shown in Figure 8).

Figure 8: Modeling Diagram of the Optimization Scheme

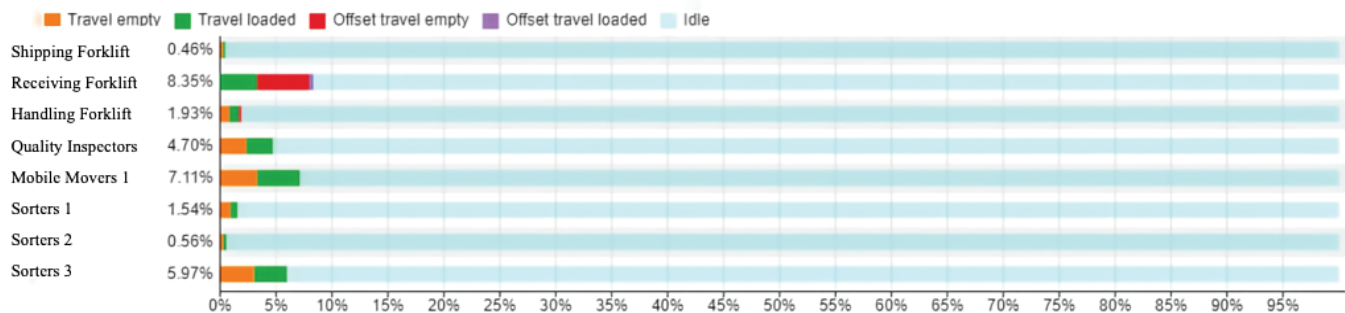


Forklifts were newly added to the receiving area and the quality - inspection buffer area, and the personnel configuration was adjusted (other parameters remained unchanged). After running the simulation for 554,400 seconds, the data (shown in Table 3 and Figures 9) indicated that the travel distance from the quality - inspection area to the storage area decreased by 13,220.6 meters, and the travel distance in the sorting area decreased by 36,646.97 meters. The overall utilization rate of forklifts increased by 9.47%, and the busy time of the mobile porters was reduced.

Table 3: Data Table of Travel Distance of Each Employee's Equipment After Optimization (Unit: Meter)

Object	Distance Traveled (m)
Shipping Forklift	1,836.04
Receiving Forklift	14,727.05
Handling Forklift	12,599.67
Quality Inspectors	18,969.51
Mobile Movers 1	28,673.17
Sorters 1	6,212.33
Sorters 2	2,247.41
Sorters 3	24,050.82

Figure 9: Data Chart of Utilization Rate of Each Employee's Equipment After Optimization (Unit: %)



4. Comparison of Workshop Facility Layout Before and After Optimization

A comparison of simulation data before and after optimization is presented, with travel distance data for personnel and equipment shown in Table 4.

Table 4 : Comparison of Travel Distances for Personnel and Equipment (Unit: Meter)

Comparison Item	Before Optimization	After Optimization
Total Handling Distance from Quality Inspection Area to Storage Area	54,493.74	41,272.84
Total Sorting Distance	69,157.53	32,510.56
Total Shipping Distance	51,232.39	1,836.04

After layout optimization, all travel distances significantly decreased, reducing handling time and costs to a certain extent. Employee and equipment utilization rates are compared in Table 5.

Table 5: Comparison of Employee and Equipment Utilization Rates (Unit: %)

Comparison Item	Before Optimization	After Optimization
Receiving Personnel	7.13%	0.00%
Receiving Forklift	0.00%	8.35%
Quality Inspection Movers	17.91%	7.11%
Quality Inspection Forklift	0.00%	1.93%

Following the introduction of forklifts for handling tasks, equipment utilization increased by 10.28%, while manual labor utilization decreased. This reduction in manual involvement led to fewer operational errors, shorter transportation times, and improved product handling efficiency, addressing the low operational efficiency issue in Warehouse No. 3 identified earlier. By reallocating redundant personnel as mobile movers, labor costs were reduced, optimizing workforce deployment and resolving the problem of improper personnel allocation. These improvements also enhanced economic benefits.

5. Conclusions and Discussion

5.1 Research Conclusions

This study takes Warehouse No. 3 of Taiwei Sauce Duck Factory as an empirical object to construct a warehousing optimization framework of “SLP method analysis—Flexsim simulation verification”. By deconstructing the coupling relationship among functional zone layout, personnel allocation, and operational efficiency, a replicable optimization path for food warehousing is formed. Through integrating the qualitative relationship analysis of the Systematic Layout Planning (SLP) method with the quantitative verification of Flexsim simulation technology, the research breaks through the empirical limitations of traditional layout optimization and expands its application to food warehousing scenarios. While ensuring food safety, it achieves significant results, including an 18% reduction in labor costs and a 37% increase in equipment utilization rate.

Aiming at core pain points such as redundant handling routes caused by functional zone layout (invalid handling accounted for 42% in the original plan) and unbalanced personnel allocation (manpower shortage in the sorting process reached 60% during order peaks), the study reconstructs logistics and non-logistics relationships (logistics weight set at 3:1) and establishes a mobile personnel deployment mechanism, improving order processing efficiency by 25%. Additionally, through a 7-day full-process operation simulation, the study quantitatively presents the differences in key indicators before and after optimization (handling distance shortened by 33%, abnormal product processing time reduced by 40%), proving the adaptability of the SLP scheme in food warehousing scenarios. It provides similar enterprises with a three-dimensional solution including functional zone planning diagrams, personnel ratio tables, and equipment scheduling strategies.

5.2 Research Limitations and Future Prospects

Limited by the enterprise's data confidentiality requirements, the study failed to incorporate precise calculations of spatial dimensions such as warehouse area and shelf parameters, resulting in logistics distance analysis remaining at the level of relative relationships and weakening the depth of layout scheme optimization for space utilization. Furthermore, the simulation model only covers standardized operation processes and lacks the ability to simulate dynamic scenarios such as

sudden order fluctuations and equipment failures, failing to fully reflect the complexity of real-world warehousing systems. Future research can explore the introduction of Internet of Things (IoT) real-time data collection technology to construct a full-element digital twin model including spatial coordinates, equipment status, and personnel flow lines; and integrate multi-objective optimization algorithms (such as genetic algorithms) to achieve dynamic balance among efficiency, cost, and safety in three dimensions.

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Conflict of Interests

The author(s) declare(s) that there is no conflict of interest regarding the publication of this paper.

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