International Journal of Sociologies and Anthropologies Science Reviews
Volume 5 Issue 6: November-December 2025: ISSN 2985-2730
Website: https://so07.tci-thaijo.org/index.php/IJSASR/index

The Development of a Model on the Service Needs of Exercise at the Public Park in Daoli District, Harbin City

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Received 06/05/2025 Revised 20/05/2025 Accepted 30/06/2025

Abstract

Background and Aim: Urban parks are vital in promoting public health and physical activity, especially under China's "Healthy China 2030" strategy. In cold-climate cities like Harbin, fitness needs in public parks present distinct challenges due to seasonal limitations and infrastructure gaps. This study aimed to explore the service needs of exercise activities in the public parks of Daoli District, Harbin, and to develop a service model that responds to the diverse demands of spontaneous fitness groups.

Materials and Methods: A mixed-methods approach was adopted, combining expert interviews with questionnaire data collected from 426 park users. The research identified five core service needs: accessible venues and facilities, professional fitness guidance, health monitoring services, organized activities, and information access. Findings showed that while basic park infrastructure supports informal exercise, significant gaps remain, particularly in personalized guidance and monitoring. Structural equation modeling revealed that service satisfaction was strongly influenced by factors such as professional support, health awareness, and environmental conditions.

Results: The results highlight a misalignment between current service offerings and user expectations, especially among middle-aged and elderly women who form the majority of park fitness groups. Enhancing service delivery requires adaptive infrastructure, trained personnel, and better coordination between public health agencies and park management.

Conclusion: This study contributes a practical framework for optimizing fitness services in cold-region urban parks, providing evidence-based recommendations for municipal planning. The proposed model can inform future policy to ensure inclusive, effective, and climate-resilient public exercise environments.

Keywords: Development of a Model; Model on the Service Needs; Exercise at the Public Park

Introduction

Urban parks have become increasingly vital in promoting public health, especially in the context of national policies such as Healthy China 2030 and the National Fitness Program (2021–2025). These policies emphasize the development of public sports infrastructure and encourage community-based physical activity to address rising health concerns in rapidly urbanizing societies. In alignment with these national goals, cities across China have begun upgrading park environments to support active living.

However, unique challenges arise in cold-climate cities such as Harbin, where seasonal extremes and prolonged winters restrict outdoor exercise opportunities. Although the city has made efforts to expand fitness trails and improve park facilities, many parks remain underutilized during winter due to inadequate climate-adaptive designs and limited sheltered spaces. These limitations affect the sustainability and inclusivity of fitness activities, especially for vulnerable populations such as the elderly.

Despite the growing role of parks in public health, existing research has primarily focused on temperate or southern regions, with minimal attention given to cold-region urban environments. Furthermore, studies often emphasize infrastructure rather than the actual service needs of park users, particularly those participating in informal or spontaneous fitness groups. As a result, a critical gap persists in understanding how to align urban park services with user expectations in colder climates.

This study aims to fill that gap by exploring the service needs of exercise activities in public parks in Daoli District, Harbin. By examining both user perspectives and systemic limitations, the research seeks to develop a comprehensive model for improving service provision and promoting inclusive fitness environments in cold-weather urban areas.

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Objectives

1. To examine the current conditions and challenges faced by voluntary fitness groups in public parks in Daoli District, Harbin.
2. To develop a service needs model for exercise activities in public parks in Daoli District, Harbin.
3. To propose strategies and recommendations for enhancing exercise service provision in public parks in Daoli District, Harbin.

Literature review

1. Urban Parks as Platforms for Physical Activity

Urban parks have emerged as crucial spaces for promoting community health and physical activity, especially in rapidly urbanizing societies. Du (2016) observed that parks in Huzhou are increasingly popular for exercise, yet often fall short in environmental quality and facility maintenance. Similarly, Lin (2010) pointed out that while parks serve an important function, irregular usage times and insufficient hardware infrastructure limit their effectiveness. These concerns reflect broader challenges in ensuring urban green spaces remain functional, accessible, and inclusive for all age groups.

2. Demographic Patterns and Fitness Group Behavior

Several studies have highlighted the dominant demographic patterns of park-based fitness groups. Xu (2014) and Tu (2017) both noted that elderly populations, especially women, represent the majority of spontaneous fitness group participants, engaging in morning and evening activities such as walking, tai chi, and group dance. Qiu (2010) emphasized the broader shift of fitness practices from institutional settings to informal, community-based formats. Although younger users are participating in growing numbers, the primary user base in most urban parks remains older adults and retirees. This demographic trend underscores the importance of tailoring services to age-specific physical and social needs.

3. Service Needs and Institutional Gaps

While park usage is widespread, the supporting service infrastructure often lags behind user expectations. Wang (2016) identified major service needs among Beijing residents, including access to appropriate venues, physical assessments, and structured fitness activities. Yan (2016) further expanded this view by framing fitness service needs as a form of self-development, requiring guidance, organizational support, and information dissemination. However, both studies noted that the disconnect between service design and user needs persists, primarily due to limited institutional engagement with informal fitness groups. Despite the clear public health benefits of park-based exercise, many local governments lack coherent management models that align with grassroots fitness behaviors.

4. Social Dimensions of Park Use

Beyond physical infrastructure, the social environment of parks plays a crucial role in encouraging participation. Karin (2016) described parks as informal community hubs that foster social cohesion and emotional well-being through shared activities. Group exercises such as square dancing, tai chi, and walking clubs not only improve health but also provide opportunities for interpersonal bonding, particularly among older adults. These findings support the view that park fitness services should include both physical and social components to be truly effective.

5. Gaps in Cold-Climate Contexts

Despite extensive research on park-based exercise in China, most studies concentrate on cities with temperate or southern climates. Harbin, as a cold-region metropolis, presents unique challenges such as prolonged winters, infrastructure degradation, and seasonal participation decline. While Xu (2014) provided some insight into fitness behavior in Harbin, little empirical work has examined how environmental conditions intersect with service provision or spontaneous group needs. The lack of climate-resilient service models is a critical gap in the current literature.

6. Synthesis and Justification for the Present Study

Existing research establishes the importance of urban parks in promoting physical activity and identifies key user demographics and service challenges. However, there is limited synthesis on how these

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elements interact in colder climates, particularly for spontaneous fitness groups that operate outside formal health structures. Moreover, few studies have proposed service models that bridge environmental constraints, user behavior, and institutional readiness. This study addresses these gaps by examining the service needs of fitness groups in public parks in Daoli District, Harbin, offering a contextualized, evidence-based framework for improving service quality in cold-region urban settings.

Conceptual Framework

This study proposes a conceptual framework identifying eight key factors influencing satisfaction with fitness services in public parks: scientific guidance, physical monitoring, activity organization and management, external environment, social support, goal setting, health awareness, and perceived risk. These elements are hypothesized to positively affect users' overall satisfaction and service needs. The framework integrates public health behavior theory and urban fitness planning, guiding the questionnaire design and structural model analysis.

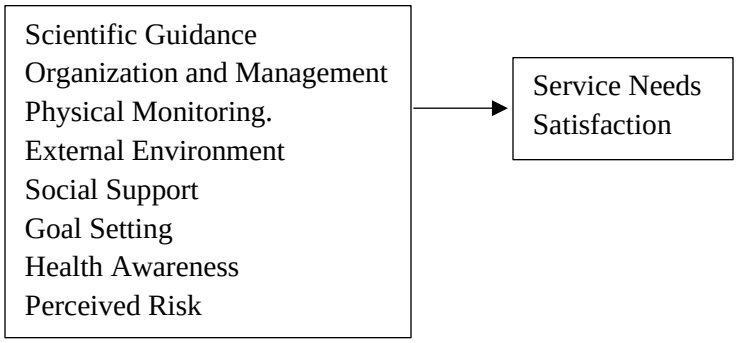

Figure 1 Conceptual Framework

Methodology

This study employed a mixed-methods approach, integrating both quantitative and qualitative research, with the primary aim of developing a model for the service needs of exercise in public parks in Daoli District, Harbin. The research was conducted in three main phases, combining document analysis, expert input, survey implementation, and advanced statistical modeling to ensure the rigor and validity of the findings.

Population and sample

The target population comprised individuals who regularly engaged in exercise at public parks in Daoli District, Harbin. A stratified sampling method was applied to ensure representation across different park settings. A total of 426 participants were selected from four major parks within the district. Additionally, an expert group was recruited for the qualitative phase of the study. This group included five experts in physical education and professional development, as well as two park management professionals, all of whom participated in in-depth interviews and the Delphi process.

Research instruments

Two main research instruments were developed and utilized in this study:

1. Expert Interview Guide: Designed to collect qualitative data on the service needs and operational gaps in public park fitness services. This guide was developed based on a preliminary literature review and aligned with the research objectives.

2. Questionnaire: A structured questionnaire was developed based on insights from literature and expert interviews. It consisted of items measuring service demand factors such as venue and facility needs, skill guidance, physical assessments, activity organization, and fitness information access.

Data collection

The study was conducted in three key phases:

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1. Phase 1: Literature Review

Relevant theories and models related to the service needs of exercise in public parks were reviewed. Existing practices and challenges in urban fitness services were analyzed.

2. Phase 2: Qualitative Data Collection

In-depth interviews with the expert group were conducted to gather insight into the contextual and practical dimensions of fitness service provision. These findings were used to design the initial version of the questionnaire.

3. Phase 3: Quantitative Survey

The finalized questionnaire was administered to the selected sample of 426 park users. Responses were systematically recorded for statistical analysis.

Data Analysis

1. Qualitative Data:

Data from expert interviews were analyzed thematically to identify key dimensions of service needs and to refine questionnaire items.

2. Quantitative Data:

Statistical analysis was conducted using SPSS and AMOS software. The procedures included:

2.1 Descriptive Statistics: Mean and standard deviation were calculated to summarize central tendencies.

2.2 Inferential Statistics: Independent t-tests were used to explore differences across groups.

2.3 Factor Analysis: Confirmatory Factor Analysis (CFA) was employed to validate the structural dimensions of the service needs model.

2.4 Structural Equation Modeling (SEM): Relationships among variables were tested using SEM to evaluate model fit and establish construct validity.

Figure 2 Research Process Timeline

Results

This study utilized SPSS version 27.0 to conduct a frequency analysis of 426 respondents, examining the distribution of their responses related to fitness service needs. For multiple-choice questions, response rates were used to compare the relative proportions among different service needs, while penetration rates were applied to assess how widely each option was selected among respondents.

Table 1 Table of subjects' stay in fitness groups can provide Services

Item	Response		Penetration rate (n=426)
	N	Response rate	
Venue facilities service	379	51.22%	88.97%
Fitness technique guidance	277	37.43%	65.02%
Fitness organization and management services	19	2.57%	4.46%
Physical fitness monitoring service	37	5.00%	8.69%
Information consulting service	28	3.78%	6.57%
Total	740	100%	173.71%

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According to the data in Table 1, the respondents considered the popularity of the venue facilities service to be the highest in spontaneous fitness activities, with 379 people choosing it, accounting for 88.97%. The second highest was fitness technique guidance, with 277 people choosing it, accounting for 65.02%. The number of people choosing the physical fitness monitoring service was 37, accounting for 8.69%. The number of people choosing the information consulting service was 28, accounting for 6.57%. The number of people choosing the fitness organization and management service was only 19 people, accounting for 4.46%. Overall, the venue facilities, service, and fitness technique guidance are the main service types at present; the popularity of fitness organization and management services and information consulting services is low. The total number of responses was 740, with a cumulative response rate of 173.71%, indicating the diverse provision of various fitness services at present.

Table 2 Table of subjects' other services to be obtained

Item	Response		Penetration rate (n=426)
	N	Response rate	
Venue facilities service	56	8.19%	13.15%
Fitness technique guidance	51	7.46%	11.97%
Fitness organization and management services	107	15.64%	25.12%
Physical fitness monitoring service	291	42.54%	68.31%
Information consulting service	179	26.17%	42.02%
Total	684	100%	160.56%

Among the services that people hope to obtain in spontaneous fitness activities, the prevalence of choosing physical fitness monitoring services is the highest, with a total of 291 people choosing, accounting for 68.31%. The second is information consulting services, with 179 people choosing, accounting for 42.02%. The number of people choosing fitness organization and management services is 107, accounting for 25.12%, ranking third. The number of people choosing venue and facility services is 56, accounting for 13.15%. The number of people choosing fitness technique guidance services is 51, accounting for 11.97%. Overall, physical fitness monitoring services and information consulting services are the types of services with high demand from the respondents, while the prevalence of venue and facility services and fitness technique guidance services is relatively low. The total number of responses is 684, with a cumulative response rate of 160.56%, indicating that the respondents have a strong tendency to choose a variety of fitness services.

Table 3 Pearson correlation analysis

		Service demand satisfaction
SG Scientific guidance	Pearson Correlation	0.453
	Sig. (2-tailed)	0
	N	426
EOM effectiveness, organization, and management	Pearson Correlation	0.38
	Sig. (2-tailed)	0
	N	426
PFM Physical monitoring	Pearson Correlation	0.412

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		Service demand satisfaction
	Sig. (2-tailed)	0
	N	426
EE External environment	Pearson Correlation	0.455
	Sig. (2-tailed)	0
	N	426
SS Social support	Pearson Correlation	0.387
	Sig. (2-tailed)	0
	N	426
GS Goal setting	Pearson Correlation	0.426
	Sig. (2-tailed)	0
	N	426
PHA: Personal health awareness	Pearson Correlation	0.448
	Sig. (2-tailed)	0
	N	426
PR Perceived risk	Pearson Correlation	0.398
	Sig. (2-tailed)	0
	N	426

Notes: ** p ＜0.01，*p＜0.05， ns not significant.

The data in Table 3 show that the satisfaction of the service demand is influenced by eight variables: scientific guidance, activity organization and management, physical monitoring, external environment, social support, goal setting, personal health awareness, and perceived risk. The Pearson correlation coefficient is used to represent the strength of the correlation. There is a significant positive correlation between service demand satisfaction of spontaneous fitness activities and scientific guidance (SG) (r=0.45, p<0.01); there is a significant positive correlation between service demand satisfaction and event organization and management (EOM) (r=0.8, p<0.01); there is a significant positive correlation between service demand satisfaction and physical fitness monitoring (PFM) (r=0.12, p<0.01); there is a significant positive correlation between service demand satisfaction and external environment (EE) (r=0.45, p<0.01); there is a significant positive correlation between service demand satisfaction and social support (SS) (r=0.38, p<0.01); there is a significant positive correlation between service demand satisfaction and goal setting (GS) (r=0.426 p<0.01); there is a significant positive correlation between service demand satisfaction and personal health awareness (PHA) (r=0.448 p<0.01); there is a significant positive correlation between service demand satisfaction and perceived risk (PR) (r=0.398, p;0.01).

Structural equation model

The following text will conduct SEM structural equation analysis through AMOS 28.0 software. The advantage of SEM structural equation analysis over regression analysis is that it can examine complex path structures. The analysis of structural equations can better consider the complexity of the data, and the verification of variable relationships based on this has higher power and a structure that is more in line with the real situation. Therefore, the 8 assumptions in this analysis will be verified in the SEM structural equation analysis.

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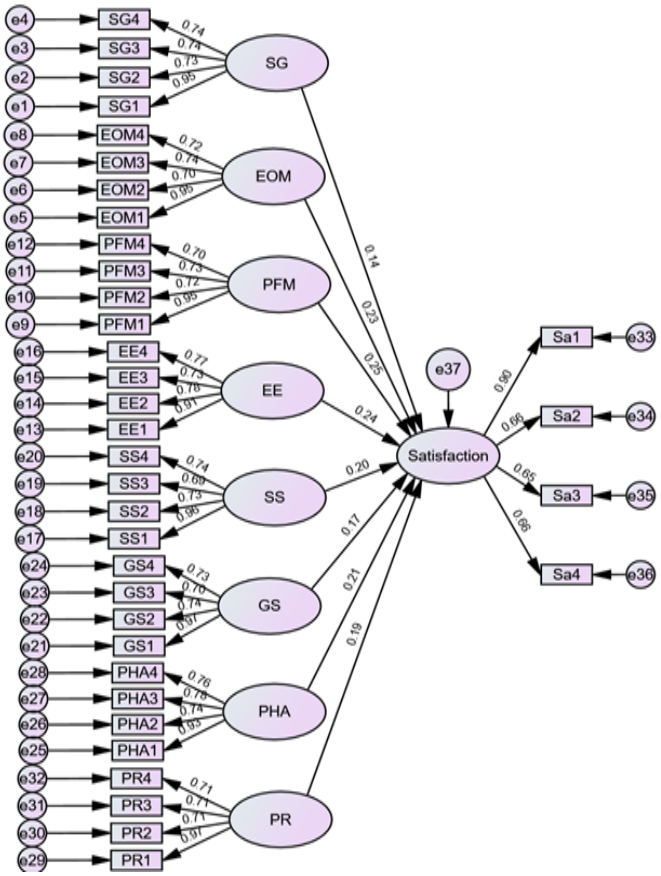

Figure 3 Structural equation model between service demand and satisfaction

Model fit

After the model structure was built using AMOS software, the original data was imported for analysis, and a series of analysis results were obtained., we can see the model fit index in the model fit table, the chi-square ratio of degrees of freedom (CMIN/df) is 1.96 which is less than 3, the p value is less than 0.05, and the RMSEA and other indicators meet the requirements of the analysis. The result shows that the model fit is up to standard, and the collected data can be used to estimate the influence relationship between variables using this model, and the analysis results are referential. When the model fit is up to standard, the next step is to perform path analysis on the influence between variables and verify the proposed hypothesis.

Table 4 Model fitting indicators

Items	CMIN/df	RMSEA	IFI	TLI	CFI
Standard	<3	<0.08	>0.8	>0.8	>0.8
Value	1.96	0.048	0.934	0.928	0.933

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Path analysis

The standardized and unstandardized path coefficients, standard errors, C.R. values, and significance of each path studied.

Table 5 Path analysis results

Path	Std. Estimate	NS. Estimate	S.E.	C.R.	P
SG→Sa	0.141	0.112	0.037	3.046	0.002
EOM→Sa	0.235	0.188	0.037	5.04	***
PFM→Sa	0.253	0.202	0.037	5.418	***
EE→Sa	0.237	0.2	0.04	5.026	***
SS→Sa	0.2	0.164	0.038	4.315	***
GS→Sa	0.173	0.133	0.035	3.8	***
PHA→Sa	0.208	0.165	0.037	4.45	***
PR→Sa	0.185	0.148	0.037	4.035	***

The analysis of the influence relationship between variables is as follows:

In the path "SG → Sa", the standard path coefficient is 0.14, and it reaches the significance level ($p=0.002$), indicating that this path has a significant positive impact.

In the path "EOM → Sa", the standard path coefficient is 0.235, and it reaches the significance level ($p<0.001$), indicating that this path has a significant positive impact.

In the path "PFM → Sa", the standard path coefficient is 0.253, and it reaches the significance level ($p<0.001$), indicating that this path has a significant positive impact.

In the path "EE → Sa", the standard path coefficient is 0.237, and it reaches the significance level ($p<0.001$), indicating that this path has a significant positive impact.

In the path "GS → Sa", the standard path coefficient is 0.173, and it reaches the significance level ($p<0.001$), indicating that this path has a significant positive impact.

In the path "PHA → Sa", the standard path coefficient is 0.208, and it reaches the significance level ($p<0.001$), indicating that this path has a significant positive impact.

In the path "PR → Sa", the standard path coefficient is 0.185, and it reaches the significance level ($p<0.001$), indicating that this path has a significant positive impact.

Discussion

The findings of this study confirm the essential role that urban parks play in facilitating physical activity within community settings, particularly through spontaneous fitness groups. The high utilization of venue facilities (88.97%) and fitness guidance services (65.02%) underscores the foundational importance of accessible, well-maintained public infrastructure and basic instructional support in promoting active lifestyles. These results are consistent with Al Run (2011), who emphasized that spatial design features such as accessibility, safety, and dedicated activity zones significantly influence physical activity engagement across age groups.

In addition to infrastructure, the demand for professional guidance and health monitoring services indicates a shift toward more structured and health-oriented exercise patterns, especially among middle-aged and elderly populations. Kahn et al. (2002) noted that while public awareness of physical activity benefits is increasing, participation often remains low without tailored interventions or personalized feedback. The current study reinforces this view, showing that many participants desire services such as physical fitness monitoring (68.31%) and information consultation (42.02%), yet these are the least accessible services provided in Daoli District parks. This gap between demand and provision reveals an urgent need for targeted, data-driven service delivery models.

Furthermore, the role of social support emerged as a significant factor influencing satisfaction with park fitness services, aligning with the findings of Karin (2016). Her research emphasized that urban parks serve not only physical but also social functions, acting as informal hubs for emotional support and

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community bonding. The current study observed that most spontaneous fitness groups are formed through existing social ties among neighbors, friends, or retirees, highlighting the need for park policies that promote inclusiveness and group activities.

The structural equation modeling further validated the conceptual framework, confirming that eight factors, including scientific guidance, goal setting, health awareness, and perceived risk, positively influence user satisfaction. These results suggest that effective fitness service design must go beyond infrastructure to incorporate psychological, behavioral, and social elements.

Limitations and Future Research Directions

Despite its contributions, this study has several limitations. First, it focused solely on Daoli District in Harbin, limiting the generalizability of the findings to other districts or cities with differing demographics, infrastructure, or governance models. Future studies should consider multi-site comparisons to capture a broader range of urban fitness contexts.

Second, data collection was conducted during a single season, which may not fully reflect year-round service usage, especially in Harbin's harsh winter months when outdoor activity is constrained. A longitudinal or seasonal study design could offer a more accurate representation of user behavior across climatic conditions.

Third, the participant sample was predominantly composed of middle-aged and elderly women, which may have biased the identification of service priorities toward the needs of this group. While this reflects the actual demographic composition of many spontaneous fitness groups, future research should seek to include more diverse age and gender groups to better capture the full spectrum of user needs.

Finally, although this study employed robust statistical tools, including CFA and SEM, it relied on self-reported data, which may be subject to recall bias or social desirability bias. Complementary qualitative studies, such as ethnographic observation or focus group discussions, could deepen the understanding of park-based fitness behavior.

Conclusion

This study addressed three key objectives related to the development of fitness service models in public parks in Daoli District, Harbin.

1. Assessment of current conditions revealed that while public parks provide fundamental facilities that support spontaneous exercise, particularly among elderly women, many of these groups operate without access to professional guidance or structured support systems.

2. The service needs model identified eight influential factors, ranging from scientific guidance and health monitoring to environmental and psychosocial elements, that collectively shape user satisfaction with park-based fitness services. These dimensions provide a comprehensive framework for understanding and addressing community needs.

3. The strategic implications suggest that optimizing fitness services requires not only infrastructure improvements but also the integration of health education, personnel training, and participatory governance. Such efforts will ensure that public parks function as inclusive, adaptive, and health-promoting environments, especially in cold-climate urban areas.

This conclusion reinforces the study's practical relevance and offers a foundation for policy innovation and targeted intervention in urban fitness planning.

Recommendation

1. Enhance Facility Management and Planning

Local authorities should conduct seasonal assessments of public park infrastructure and implement upgrades based on usage data. For example, installing sheltered pavilions, heated flooring, or windbreaks in exercise zones can help maintain activity levels during winter months. Scheduled maintenance plans and community reporting apps can also improve upkeep efficiency.

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2. Respect Group Needs and Coordinate Usage

Park administrators should engage with spontaneous fitness groups through regular community consultations. Implementing a "shared schedule system" for high-use zones coordinated via QR codes or mobile platforms can reduce space conflicts and support inclusivity for tourists, youth, and seniors alike.

3. Strengthen Institutional Collaboration

Authorities should establish formal partnerships with institutions such as Harbin Sports University to deliver seasonal fitness workshops, health screenings, and volunteer trainer programs. Students from physical education programs can earn practicum credit by supporting park-based fitness initiatives.

4. Promote Public Awareness and Cultural Activities

Develop campaigns that combine fitness with local culture, such as "Longjiang Winter Moves" or "Snow Tai Chi Festival." Educational booths, mobile health vans, and social media outreach can increase participation and raise awareness about healthy lifestyles.

5. Transform Governance Toward Service Orientation

Shift Park management from a facility-centric to a service-centric model by embedding fitness service coordinators within district parks. These coordinators can oversee program delivery, user feedback collection, and inter-agency collaboration to align with long-term urban health strategies.

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