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Shortfalls and Optimization Pathways of Public Fitness Facility Construction in Gansu Province from a Supply–Demand Fit Perspective

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Abstract: Public fitness facilities are the material base through which public sports services reach communities. As facility construction has moved past simple expansion toward improving the quality and efficiency of the existing stock, the evaluation criterion has shifted from "how much has been built" to "is it a good fit, is it usable, and can it be used sustainably." Drawing on 315 valid questionnaires from the Gansu Province Survey on the Development of National Fitness (2025–2030, management version), this paper examines the supply–demand fit of fitness facilities in Gansu across four dimensions: quantity and type, operation and maintenance, opening and services, and smart technologies. The results show that grassroots infrastructure still faces unmet demand, and that "shortage" coexists with "uniformity"; maintenance, procurement, and venue opening are constrained by funding, staffing, and institutions; and smart-sports coverage remains low, with digital services still concentrated at the hardware end. Taken together, these symptoms point to imprecise demand identification, a disconnect between construction and maintenance, incomplete mechanisms for diversified supply, and the absence of a closed loop in digital governance. The paper therefore argues for establishing category-based allocation and full-life-cycle management, adjusting fiscal and diversified investment structures, improving procurement and quality standards, upgrading smart services, and reorienting performance evaluation around facility integrity, utilization, and public satisfaction.

Keywords: National fitness; Sports facilities; Supply–demand fit; Public sports services; Gansu Province

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1. Introduction

Public fitness facilities are the physical foundation through which public sports services reach the grassroots. Residents' demand for exercise has evolved from "having a place" to convenience, diversity, and quality, and the focus of facility governance has shifted accordingly from sheer quantity to better structure, higher quality, and greater utility. Policy has tracked this shift: the 2022 Opinions on Building a Higher-Level Public Service

System for National Fitness called for optimizing the layout of resources and improving service convenience [1]; the National Fitness Plan (2026–2030) stressed that facility layout should be aligned with population size, structure, and public demand [2]; and the 2023–2025 Work Plan for Upgrading National Fitness Facilities made stock improvement and utility a priority [3]. Gansu's own planning likewise treats grassroots fitness facility construction as a key component of the public sports service system [4].

Scholarship on the supply of fitness facilities has likewise moved from an early focus on quantity and coverage to resource allocation, open sharing, and operational effectiveness. Zheng Jiakun argues that a higher-level national fitness public service system requires the coordinated development of facilities, organizations, and services [5]; Han Hongyu and Zheng Jiakun unpack the "where to exercise" question into tapping underused space, open sharing, and operation and management [6]; and Zhou Biao and Chen Yuanxin advocate integrating construction, management, and long-term operation [7]. A consensus has gradually formed in this literature that facility quantity alone is no longer an adequate measure of supply.

Research on resource allocation and policy governance has advanced in the same direction. Wang Yunsheng notes that China's fitness facilities still fall short in total volume, structure, and service efficiency, and that allocation should be differentiated by region [8]; Jiang Quanhu et al., tracing policy evolution, find that facility allocation is shifting from a scale-and-efficiency orientation toward one of quality and equity [9]; and Luo Siying et al., from the angle of central–local policy coordination, call for stronger vertical alignment and operation and maintenance management [10]. In short, the question for fitness facility construction has changed from "is it there" to "is it well matched and well managed."

The research frontier continues to expand toward digital empowerment, full-life-cycle operation, and service quality. Shao Xuemei et al. caution that digital technology should run through demand identification, resource allocation, service processes, and feedback evaluation, so that smart sports do not come to favor hardware over services [11]; Li Yuanyang et al. hold that high-quality operation requires sound maintenance, support, and dynamic adjustment mechanisms [12]; Chen Congkan and Chen Ning argue for coordinating basic and non-basic public sports services, government and social forces, and urban–rural differences [13]; and Zheng Jiakun and Xu Liping further suggest that facility governance should move from "fixing shortfalls" to "improving quality and effectiveness" [14]. On the whole, existing studies have examined resource allocation, operation and maintenance, digital empowerment, and service effectiveness at length, but few have placed grassroots facility allocation, maintenance, opening services, and smart technologies in a single framework and examined them together using management-side data from Gansu.

In light of this, the paper does not lay out a separate theoretical foundation but takes "supply–demand fit" directly as its analytical lens. By supply–demand fit, the study means the extent to which fitness facilities—in quantity, type, operation and maintenance, opening services, and digital functions—respond to actual exercise demand; the aim is to reduce inefficient, idle, and duplicative supply so that limited public resources become sports services that residents can reach, use, and want to use.

Accordingly, the paper uses management-survey data on the state of national fitness in Gansu to analyze, across quantity and type, operation and maintenance, opening services, and smart technologies, the main manifestations and underlying causes of supply–demand mismatch, and to propose corresponding optimization pathways. One clarification is needed at the outset: because the respondents are sports administrators, the "demand side" in this paper refers to administrators' judgments—based on their working experience—about residents' needs and facility shortfalls, not a direct measurement of individual residents' demand.

2. Data and methods

2.1. Data source

The data come from the aggregated material of the Gansu Province Survey on the Development of National Fitness (2025–2030, management version), comprising 315 valid questionnaires. By institutional affiliation, 175 respondents (55.56%) work at county or district sports agencies, 36 (11.43%) at township level, 30 (9.52%) at municipal level, and 74 (23.49%) in other types of institutions; the sample contains no provincial-level agencies. Work experience is fairly evenly distributed—under 3 years, 3–10 years, and over 10 years account for 33.65%, 31.43%, and 34.92%, respectively. The findings therefore mainly reflect the perceptions of grassroots, especially county- and district-level, sports administrators, and should not be read as the actual demand of the province's residents.

2.2. Methods

Methodologically, the paper relies on descriptive statistics, comparative analysis, and inductive analysis. The first step is to examine the frequencies and proportions of each survey item to identify the issues most commonly flagged by administrators; the second is to reclassify the data along dimensions such as facility allocation, operation and maintenance, opening services, and smart technologies, and to present the main supply–demand tensions in tabular form; the final step is to draw on the existing literature to induce the logic behind the mismatch and to propose optimization pathways. It should be noted that the available statistics provide only aggregate frequencies and proportions, with no individual-level microdata, so the paper conducts no significance testing, regression analysis, or causal inference.

3. The state of supply–demand fit in Gansu's fitness facility construction

3.1. Grassroots demand remains strong, with shortfalls in both quantity and type

By facility type, outdoor fitness paths receive the strongest support, while demand for smart, indoor, elderly-oriented, and children's facilities is also substantial. At the other end, "shortage," "uniformity of types," "inadequate maintenance," "low smartness," and "insufficient age-friendliness" all stand out (**Table 1**). Grassroots shortfalls have thus gone beyond a mere "lack of equipment" to a simultaneous problem of quantity and structure.

Table 1. Support demand by facility type and shortfalls in equipment allocation (N = 315)

Dimension	Option	n	%
Priority facility types (most needed)	Outdoor fitness path equipment	246	78.10
	Smart fitness equipment	193	61.27
	Indoor fitness equipment	181	57.46
	Equipment for the elderly	180	57.14
	Children's fitness facilities	163	51.75
	Equipment for persons with disabilities	113	35.87
Aspects most in need of improvement	Insufficient equipment quantity	192	60.95
	Uniform equipment types	181	57.46
	Inadequate maintenance	173	54.92
	Low smartness of equipment	151	47.94
	Insufficient age-friendliness	138	43.81

Note: All items are multiple-choice; proportions are calculated over the 315 valid questionnaires and therefore do not sum to 100%.
Source: compiled from the management survey report

3.2. Operation, maintenance, and procurement constraints undermine effective supply

The obstacles to the free opening of public venues center on funding, staffing, and facility maintenance; among the causes of facility damage, "delayed maintenance" also ranks high. Procurement faces the additional hurdles of insufficient budgets, complex procedures, and unclear quality standards (**Table 2**). The shortfall has thus extended from the construction side to the operation side—if new projects keep being launched while maintenance budgets, responsibilities, and procurement standards fail to keep pace, growth in facility numbers will not translate proportionally into "effective supply."

On who should bear maintenance costs, government funding and the sports lottery public welfare fund receive markedly higher endorsement than shared multi-party responsibility or social capital. Strictly speaking, this question captures administrators' views of a "reasonable" cost-sharing arrangement rather than the actual composition of funding sources, but it does reveal the grassroots' reliance on stable public funding.

Table 2. Main constraints in venue opening, facility maintenance, and procurement (N = 315)

Dimension	Option	n	%
Difficulties in free venue opening	Insufficient funding	232	73.65
	Insufficient staffing	208	66.03
	Difficult facility maintenance	201	63.81
	Unclear safety responsibility	100	31.75
Main causes of facility damage	Human factors	224	71.11
	Delayed maintenance	204	64.76
	Natural factors	171	54.29
	Equipment quality problems	90	28.57
Preferred bearer of maintenance costs	Government	219	69.52
	Sports lottery public welfare fund	218	69.21
	Multi-party sharing	129	40.95
	Social capital	98	31.11
Main procurement difficulties	Insufficient budget	223	70.79
	Complex procurement procedures	156	49.52
	Unclear facility quality standards	134	42.54
	Difficulty choosing suppliers	89	28.25

Note: All items in the table are multiple-choice. The maintenance-cost item reflects the arrangement administrators consider reasonable, not the actual composition of funding sources

3.3. Smart sports coverage is low, and digital services remain hardware-centric

Smartness attracts considerable attention, but its on-the-ground coverage is still quite limited: 62.22% of respondents report that smart sports facilities cover less than 20% of their area, while only 7.62% report coverage above 50%. Among the types already built, smart fitness paths dominate, far outpacing smart trails, fitness-testing stations, and venue-booking systems (**Table 3**). For now, then, smartness mostly means upgrading the hardware, while service-oriented digital functions remain weak.

The point of digitalization is not to install more smart devices but to improve the ability to identify demand and respond administratively. If device data remain siloed from facility ledgers, booking systems, and maintenance orders, the loop of "demand identification–resource allocation–operational feedback" cannot be closed, and the result departs from the precision-supply direction emphasized in the literature [11].

Facility safety-liability safeguards also need strengthening. Fewer than 40% of respondents report having a well-established safety-liability insurance system; some areas are still at the stage of "drafting measures" or even "no effective safeguard mechanism." Unclear liability raises the risk of grassroots opening and management on the one hand, and on the other, can erode the intensity and sustainability of facility opening.

Table 3. Smart sports facility construction and safety safeguards (N = 315)

Dimension	Option	n	%
Coverage of smart sports facilities	<20%	196	62.22
	20%—50%	95	30.16
	>50%	24	7.62
Types of smart facilities built	Smart fitness paths	230	73.02
	Smart trails	119	37.78
	Fitness-testing stations	103	32.70
	Venue-booking systems	79	25.08
Safety-liability safeguards for facilities	Well-established safety-liability insurance system	119	37.78
	Measures being drafted	97	30.79
	No effective safeguard mechanism	53	16.83

Note: Coverage of smart sports facilities and the safety-liability safeguard mechanism are single-choice items; the types of smart facilities built are a multiple-choice item

3.4. Supply–demand tensions: Quantity, structure, operation, and digital services

Taken together, the supply–demand tensions in Gansu are an overlay of four problems: infrastructure still has gaps, a quantity mismatch; uniform types combined with rising demand for elderly-, child-, and smart-oriented facilities, a structural mismatch; venue opening, maintenance, and procurement constrained by funding, staffing, and institutions, an operational mismatch; and low smart coverage with functions piled on the hardware end, a digital-service mismatch (**Table 4**).

This reading is consistent with the priorities of the "15th Five-Year Plan" period: "filling facility shortfalls" and "smart upgrading" were each chosen by more than 70% of respondents, indicating that the grassroots already treat "continuing to fill the basics" and "raising quality in tandem" as the two main lines of facility work in the coming period.

Table 4. Main types of supply–demand mismatch in Gansu's fitness facility construction and their data manifestations

Fit dimension	Demand-side signal	Supply-side shortfall	Main data basis
Quantity fit	Strong demand for nearby, small, convenient facilities	Insufficient equipment; grassroots infrastructure still needs filling	78.10% support for outdoor fitness paths; 60.95% report insufficient quantity
Structural fit	Rising differentiated demand for elderly-, child-, and smart-oriented facilities	Uniform types; insufficient differentiation across groups and programs	57.46% report uniform types; 57.14% for elderly equipment; 51.75% for children's facilities
Quality and operational fit	Need for safe, stable, continuously usable facilities	Delayed maintenance; insufficient venue funding and staffing	64.76% report delayed maintenance; 73.65% report insufficient funding for free opening

Fit dimension	Demand-side signal	Supply-side shortfall	Main data basis
Digital-service fit	Need for convenient booking, monitoring, guidance, and management	Low coverage; functions concentrated on smart paths	62.22% report coverage below 20%; 25.08% have booking systems
Safeguard fit	Need for stable funding, clear standards, and clear safety liability	Insufficient budgets; procurement standards and liability mechanisms need improvement	70.79% report insufficient budgets; 42.54% report unclear quality standards

Note: This table is an inductive synthesis based on the survey data and does not imply causality

4. The logic behind the supply–demand mismatch in Gansu's fitness facility construction

4.1. Demand identification remains project-based, lacking a basis for refined allocation

Whether supply and demand can be matched depends first on demand identification. Relying on higher-level projects, uniform standards, and experienced judgment has the advantage of quickly expanding total volume, but once demand differentiates, allocation tends to become homogeneous. Existing research has shown that facility policy is shifting from scale and efficiency toward quality, equity, and precision [8–9]. In the Gansu sample, "shortage" and "uniformity of types" emerge simultaneously, which underscores that allocation decisions cannot stop at "where is it missing" but must also ask "who is using it, for what, and how well."

Counties differ considerably in population density, age structure, urban–rural form, and climate, and these differences should guide allocation. Without continuously updated data on population structure, facility usage frequency, and program preferences, similar equipment tends to be duplicated, while the elderly-, child-, indoor, and smart facilities that are actually needed may be under-supplied.

4.2. Construction and maintenance logic are separated, and full-life-cycle management is insufficient

That "inadequate maintenance," "delayed maintenance," and "difficulty maintaining venues" recur across different items in itself shows that construction and maintenance are disconnected. Facilities have a full-life-cycle nature: construction determines "whether it exists," maintenance determines "whether it works," and renewal determines "whether it remains effective over time." Related studies likewise stress that high-quality operation must incorporate maintenance, support, and adjustment into the whole governance process [10, 12].

In practice, construction projects usually have clear budgets and acceptance milestones, whereas routine inspection, replacement of parts, software renewal, and safety insurance are ongoing expenditures that tend to be sidelined. Once follow-up investment falls short, the count stays the same while integrity and usability decline—a gap between "nominal supply" and "effective supply." This is precisely what the shift from "fixing shortfalls" to "improving quality and effectiveness" must address [14].

4.3. Heavy fiscal pressure and insufficiently diversified supply

Given the strong public-interest character of fitness infrastructure, it is reasonable for the government to bear the basic supply responsibility. The problem is that as the total volume of facilities grows, so do the costs of maintenance and opening; if funding relies mainly on new projects and annual fiscal arrangements, construction and maintenance can easily fall out of step. The high endorsement of government funding and the sports lottery fund in the survey reflects the grassroots' dependence on stable public funding.

Diversified supply is not the same as simple marketization; responsibilities should be divided according to the public-interest attributes of each facility. Basic public facilities still need fiscal backing. For comprehensive venues, sports parks, and composite sports spaces that have some room for commercial operation, professional capacity can be introduced through service purchase and commissioned operation to raise efficiency while holding the line on public-interest opening [13].

4.4. Procurement, service, and performance standards have not yet formed a closed loop

Complex procurement procedures and unclear quality standards directly raise the cost of technical decision-making at the grassroots. If procurement over-emphasizes one-time price at the expense of durability, after-sales service, and software upgrades, short-term savings can turn into a long-term maintenance burden. Smart facilities also involve data interfaces, system compatibility, and network security; without complete standards, equipment can end up "usable but hard to manage."

Construction, procurement, operation, and performance standards should therefore be linked up, so that maintenance and service requirements over the equipment's useful life are considered from the moment a project is initiated.

4.5. Smartness still favors adding devices; a data-driven service loop has not formed

Smart sports construction currently centers on smart fitness paths, with digitalization still stuck at the device end. To genuinely improve supply–demand fit, the data on facility ledgers, bookings, use, maintenance, and feedback need to be connected, allowing managers to spot high-frequency facilities, peak periods, and recurring failure points and to reallocate resources accordingly [11].

If data remain locked in individual devices or a single platform, smartness can hardly be converted into service capacity. The emphasis of the next stage should thus shift from "how many smart devices have been installed" to "what management and service problems digital tools have actually solved."

5. Optimization pathways for Gansu's fitness facility construction under a supply–demand fit orientation

5.1. Establish a "population–demand–facility" linkage for category-based allocation

The first task is to build a "population–demand–facility" linkage for category-based allocation. Counties, townships, and communities can produce an annual demand list based on resident population size, age structure, existing facility coverage, and usage frequency: areas with more elderly residents should have a higher share of safe, low-intensity facilities; areas with many children should add child-friendly exercise space; and areas with large climatic or site differences should balance indoor and outdoor facilities.

On this basis, a rule of "basic guarantee plus differentiated supplementation" can be set: basic public facilities hold the baseline of universal access, while incremental projects are allocated according to actual gaps, avoiding duplicative construction. Wang Yunsheng's principle of adapting to local conditions is a useful reference for raising the fit of county-level facilities in Gansu.

5.2. Balance new construction, stock renewal, and maintenance

Filling shortfalls should not focus on new construction alone; renewal and maintenance must be included as well. A unified electronic ledger can be created to record the year of construction, the ownership entity,

equipment condition, and maintenance and safety inspections, with tiered management along "normal use–priority inspection–deadline repair–renewal." Inspection frequency can be increased for high-frequency outdoor equipment, children's facilities, and smart devices, and warranty and repair-response terms should be specified in procurement contracts.

In performance evaluation, indicators such as facility integrity and the closure rate of repairs should be given more weight, so that maintenance receives management attention comparable to new construction and "building over maintaining" is institutionally discouraged.

5.3. Establish full-life-cycle budgeting and optimize the fiscal and diversified investment structure

Insufficient budgets should be addressed at the source: construction costs and future operating costs should be estimated together at the project-initiation stage. Basic public services such as community fitness paths and elderly- and child-oriented facilities should be stably secured by fiscal funds and the sports lottery fund; for sports parks, composite sports spaces, and public venues, professional operators can be brought in to deliver non-basic services once the boundary of public interest is clearly drawn.

Venue opening volume, facility integrity, and public satisfaction can be moderately linked to fiscal subsidies to make public funds go further, and maintenance and operation can be contracted to professional bodies through government service purchase.

5.4. Improve categorized procurement and quality standards to lower grassroots technical decision costs

Provincial sports authorities can produce a categorized procurement guidance list that spells out the safety, durability, ease-of-maintenance, after-sales, and full-life-cycle cost requirements for outdoor equipment, children's facilities, elderly-oriented facilities, and smart devices, respectively. For smart facilities, data interfaces, system compatibility, upgrade and maintenance, and data permissions should also be specified to reduce information silos between devices.

5.5. Move smart sports from "smart devices" to "smart services"

The goal of smart sports should be to make exercise more convenient for residents and management more efficient. Smart fitness paths, smart trails, and other hardware should continue to be improved, while facility search, venue booking, fitness testing, and scientific exercise guidance are added, and facility ledgers, booking data, and maintenance records are moderately integrated to produce management indicators such as facility popularity, failure rate, and service radius.

Smart sports should not be judged solely by the number of smart devices, but by whether booking is convenient, whether information is retrievable, how quickly repairs are responded to, and whether data substantively support decision-making.

5.6. Enhance the sustained opening and professional operation of public sports venues

Sustained opening of public sports venues requires funding, staffing, and maintenance capacity together. The cost of public-interest opening should be accounted for by venue size, opening hours, service volume, and facility wear, so that subsidies correspond to actual services delivered; professional capacity can be supplemented through service purchase, commissioned operation, and participation by social organizations,

while free or low-fee opening hours, the basic service list, and safety liability should be clearly defined.

5.7. Build a performance evaluation system centered on use effectiveness

Supply–demand fit ultimately comes down to whether facilities are actually used. The evaluation system can keep input indicators such as new additions and coverage, but outcome indicators should be weighted more heavily, focusing on facility integrity, opening rate, usage frequency, repair-response time, usage of smart services, and public satisfaction.

For areas that have already achieved basic coverage, the focus of assessment should gradually shift from "building one more" to "making good use of what exists." Moving along the evaluation chain of "construction input–facility condition–opening services–actual use–public feedback" and feeding performance results back into the next year's project planning, resources will naturally flow to areas where supply–demand tensions are sharpest, and use-effectiveness is highest.

6. Conclusions and limitations

Drawing on 315 management questionnaires, this paper finds that the supply of fitness facilities in Gansu has entered a stage of overlapping shortfalls across quantity, structure, operation, and digital services. Infrastructure still faces unmet demand, but problems of equipment variety, maintenance, age-friendliness, and smartness are equally prominent; the opening of public venues is constrained by funding, staffing, and maintenance; and smart sports coverage is low, with service functions still concentrated on hardware.

The causes of these problems can be traced to imprecise demand identification, the separation of construction and maintenance, pressure on stable operating funds, insufficient linkage between procurement and service standards, and the absence of a closed loop in digital governance. Shortfall-filling in the "15th Five-Year Plan" period should therefore go beyond spatial gaps to address shortfalls in structure, quality, operation, and digital services simultaneously.

Gansu should orient itself around supply–demand fit, establishing category-based allocation and full-life-cycle management, refining an investment structure that combines fiscal backing with diversified participation, improving procurement and quality standards, moving smart sports from smart devices toward smart services, and redefining performance evaluation in terms of integrity, utilization, repair timeliness, and public satisfaction. At the bottom, this means shifting facility governance from "project completion" to "continuously producing public sports services that are accessible, usable, and good to use."

Several limitations should be noted: a management survey cannot substitute for residents' actual demand; the existing report provides only aggregate proportions, precluding subgroup analysis and causal testing; and the sample is dominated by county- and district-level sports agencies and lacks provincial-level respondents. Future work could match residents' demand, administrators' perceptions, and objective facility ledgers to test the degree of supply–demand fit more rigorously.

Disclosure statement

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