Journal of World Architecture, 2026, Volume 10, Issue 5
https://bbwpublisher.com/journal/JWA
Online ISSN: 2208-3499
Print ISSN 2208-3480

A Study on the Development Context and Trends of Sports Stadiums for Domestic and Foreign Super Football Leagues

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Abstract: The professionalized and industrialized development of professional football leagues cannot be separated from the hardware support of football-specific stadiums. As core carriers for tournament hosting, fan gathering, commercial development, and football culture dissemination, football stadiums reflect the comprehensive strength of a country's professional football industry through their construction concepts, spatial layout, functional configuration, and operational performance. Adopting research methods including literature review, case comparison, and inductive analysis, this paper sorts out the evolution of football stadiums in top-tier overseas leagues such as Europe's Big Five Leagues and Major League Soccer (USA), and compares the construction evolution, practical characteristics, and existing problems of stadiums in the Chinese Super League (CSL). The study shows that foreign football stadiums have gone through four phases: multi-purpose mixed-use, popularization of football-specific stadiums, diversified commercial development, and smart low-carbon iteration, forming an operational system featuring specialization, commercialization, intelligence, and low-carbon performance. At present, CSL stadiums in China are confronted with multiple challenges: a low proportion of football-specific venues, limited business forms, extensive operation, unbalanced regional development, as well as lagging smart and low-carbon construction. Against the backdrop of professional football reform and building a leading sporting nation, this paper identifies gaps between Chinese and foreign stadiums, predicts industrial development trends, and puts forward high-quality development pathways for football stadiums adapted to China's national conditions. It provides references for new construction, renewal, match scene optimization, and long-term operation of domestic football stadiums, and supports the standardized and high-quality development of China's professional football industry.

Keywords: Super football league; Football stadium; Stadium evolution; Sino-foreign comparison; Stadium operation

Online publication: November 17, 2026

1. Introduction

Professional football represents a sport industry segment with huge global audiences and remarkable

commercial value. As fundamental hardware for league operation, football stadiums undertake multiple functions including tournament delivery, fan services, commercial monetization, and urban culture output. The quality of stadium construction and operation directly determines the professional standard of football leagues. Top global football leagues are now undergoing stadium upgrades. Europe's Big Five Leagues keep renovating old venues and constructing new smart stadiums, accumulating mature experience in operating football-specific stadiums. Relying on social capital, Major League Soccer (MLS, USA) has built large-scale football-exclusive stadiums and formed a commerce-oriented stadium development model, serving as a typical reference for new football stadium construction [1].

Over more than two decades of development, stadium construction for the Chinese Super League has gradually shifted from old public sports venues to modern football-specific stadiums. Some newly built venues have met international tournament standards in hardware. Nevertheless, development quality varies greatly nationwide. China has a limited stock of football-specific stadiums; post-event comprehensive utilization is insufficient; commercial development remains shallow; smart and green construction is still in its initial stage. Many venues follow the traditional "in-use during matches, idle off-season" pattern, which fails to match the demand for industrial upgrading of professional football [2].

With the steady advancement of building a leading sporting nation and continuous deepening of professional football reform, quality improvement and upgrading of football stadiums have become a key driver for the growth of China's domestic football industry. Existing studies mostly focus on renovation of individual stadiums and partial operational strategies, lacking systematic reviews and horizontal comparisons of the development history of stadiums in top-tier leagues worldwide [3–5]. Accordingly, this paper sorts out the phased characteristics of stadiums for super football leagues, analyzes core differences between Chinese and foreign venues, forecasts industrial development directions, and explores stadium-upgrading pathways suited to China's realities. It offers practical ideas for the planning, construction, and long-term operation of football-specific stadiums.

2. Development context and phased characteristics of sports stadiums for overseas super football leagues

After a century-long development driven by professional football reforms, overseas professional football stadiums are divided into four stages: multi-purpose mixed-use, popularization of football-specific stadiums, commercial-empowered operation, and smart low-carbon iteration. A mature operational system adapted to the market-oriented environment has taken shape (**Figure 1**).

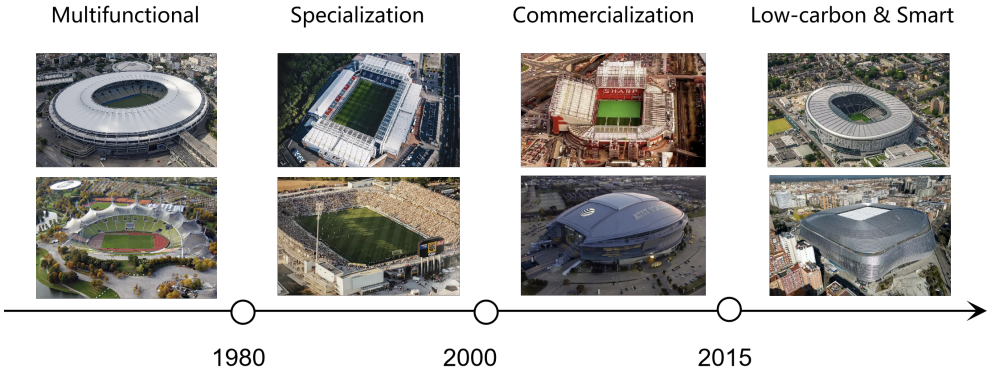


Figure 1. Development context of sports stadiums for overseas super football leagues

2.1. Initial phase of multi-purpose mixed-use (Before the 1980s)

Before the 1980s, football matches across Europe and America were mostly hosted in multi-purpose sports stadiums. These venues accommodated football, track and field events, theatrical performances, and mass assemblies rather than being dedicated solely to football. Typical examples include Maracanã Stadium in Rio de Janeiro and Munich Olympic Stadium [6]. Completed in 1950 as the main venue for the FIFA World Cup, Maracanã Stadium featured a full athletics track for track and field, football, and large-scale assemblies, with spectator stands sitting far from the pitch. Built for the Olympic Games, Munich Olympic Stadium boasted epoch-making tensile membrane roofs and regularly hosted both football league fixtures and track and field competitions.

Stadiums of this phase prioritized large spectator capacity and basic tournament requirements. They were generally equipped with circular athletics tracks, which kept stands distant from the pitch and resulted in scattered viewing sightlines and weak match-day atmosphere. Constrained by economic conditions and construction concepts, venues had simple functional configurations, providing only stands, pitches and basic sanitary facilities. Fan zones, commercial amenities and special functional rooms for players were rarely available. Post-match operation modes were unitary, with revenue heavily dependent on ticket sales and low venue utilization efficiency. As professional football industrialization had not yet taken shape, stadiums were mostly positioned as urban public sports infrastructure with little awareness of market-oriented development. This represented the initial development phase of football stadiums.

2.2. Large-scale popularization phase of football-specific stadiums (1980–2000)

Since the 1980s, market-oriented reforms of European and American football have accelerated. The English Premier League, La Liga, and other leagues achieved rapid growth in professionalism and commercialization, while drawbacks of multi-purpose stadiums became increasingly prominent. Athletics tracks separated spectators from pitches and impaired the viewing experience, and venue conditions could hardly satisfy the refined requirements of football tournaments. This drove the industry toward football-specific stadiums without athletics tracks. Representative venues are Ewood Park in the United Kingdom and MAPFRE Stadium of Columbus Crew [7].

As the home ground of Blackburn Rovers, Ewood Park was renovated in the 1990s with complete removal of its athletics track, shortening the distance between stands and pitch and enhancing spectators' immersive experience. Opened in 1999, MAPFRE Stadium of Columbus Crew was the first full football-exclusive venue in North America. Abandoning athletics tracks, it adopted compact sloped stands and dedicated fan standing sections, setting a model for subsequent football-specific stadium construction across MLS. European clubs carried out large-scale stadium renovations: removing athletics tracks, reconstructing stand layouts, shortening stand pitch distances, and dividing special function zones to optimize viewing sightlines and acoustic environment.

Major League Soccer in the United States started relatively late and initially rented multi-purpose stadiums for matches with insufficient tournament professionalism. The completion of Columbus Crew's football-specific stadium in 1999 introduced a design paradigm of track-free layout, compact stands, and exclusive fan zones, promoting large-scale construction of football-specific stadiums in the U.S. The core logic of stadium development in this period lay in stripping off auxiliary track and field functions, focusing on football itself, improving tournament professionalism and spectator experience, and establishing dedicated

hardware frameworks for professional football.

2.3. Mature phase of diversified commercial empowerment and full-domain operation (2000–2015)

Since the 21st century, the global professional-football industry has witnessed a commercial boom. Football stadiums have evolved beyond mere match venues into sports commercial complexes, and the full-domain operation model gradually matured. Representative venues include Manchester United's Old Trafford and Toyota Stadium in Dallas [8]. Old Trafford underwent continuous renovation and expansion, housing a club museum, theme stores, luxury suites and conference banquet centers, and opening year-round for stadium tours, commercial exhibitions and conferences. In addition to professional fixtures, Toyota Stadium in Dallas accommodates the National Soccer Hall of Fame and is equipped with commercial blocks and youth football training bases, realizing integrated operation of tournaments, cultural tourism and commerce.

Venues such as Real Madrid's Santiago Bernabéu and Manchester United's Old Trafford kept adding supporting facilities, including retail outlets, club museums, luxury boxes, catering, and conference centers. They broke the limitation of match-only utilization and achieved year-round regular opening. Mining commercial value became the core of venue operation in this phase. Through stadium naming rights, venue leasing, live entertainment events, stadium tours, and membership services, revenue sources were broadened to reduce reliance on match-day ticket income. A composite operation system of "tournaments + commerce + cultural tourism + leisure" was established.

Europe and America adopted differentiated pathways: Europe drew on profound football culture and emphasized integration among stadiums, local communities, and fan culture; leveraging its mature sports consumption market, the United States implemented a "stadium plus commercial real estate" development model with deep participation of social capital, achieving faster commercial iteration and fully unlocking the industrial value of stadiums.

2.4. Integrated iteration phase of smart low-carbon development (2015–Present)

Over the past decade, digital and green building technologies have gained rapid popularity, and top-tier overseas football stadiums have entered a smart, low-carbon upgrading cycle [9–10]. Representative venues include Tottenham Hotspur Stadium in London and the renovated New Santiago Bernabéu Stadium in Madrid. Tottenham Hotspur Stadium is equipped with a retractable pitch system, a 360-degree circular large screen display, an IoT-based energy consumption management platform, rainwater harvesting, and solar energy utilization systems. It can host football fixtures, concerts, and American football events. The reconstructed New Bernabéu Stadium features a retractable roof, dynamic LED facades and an intelligent passenger flow dispatching system. It widely applies energy-saving building materials to realize the integration of commercial consumption, competitive events, and low-carbon operation and maintenance.

Both newly built and renovated old venues deploy intelligent security monitoring, passenger flow surveillance, environmental regulation, and high-definition broadcasting systems to adapt to new scenarios such as VR viewing and online interaction. Big data and IoT technologies are adopted for refined management of visitors, equipment, and energy consumption, cutting operation and maintenance costs and improving management efficiency. Green and low-carbon principles have become critical guidelines for stadium construction. New projects widely adopt photovoltaic power supply, rainwater collection, natural

ventilation, and daylighting, while old venues carry out energy-saving retrofits. Tottenham Hotspur Stadium and the New Bernabéu Stadium integrate competitive matches, smart services, commercial operation, and energy conservation. They serve not only as professional tournament venues but also as urban green sports landmarks, marking that overseas football stadiums have entered an era of refined, high-quality development.

3. Development context and characteristics of CSL football stadiums in China

Starting late and evolving alongside professional football reforms, CSL stadium development in China can be divided into four phases: general-purpose public venue utilization, initial specialization transformation, standardized quality upgrading, and smart technology exploration. It is characterized by strong policy-driven momentum, fast iteration speed, and prominent regional disparities (**Figure 2**).



Figure 2. Development context of sports stadiums for the Chinese Super League

3.1. Phase of matches hosted in general purpose public sports venues (2004–2010)

In the early days of the Chinese Super League, China lacked mature football-specific stadiums, and all league matches were held in urban multi-purpose public sports venues. Typical examples are Beijing Workers' Stadium and Dalian Jinzhou Stadium [11]. Fitted with a standard athletics track, Beijing Workers' Stadium mainly hosted National Games and large-scale assemblies, with CSL matches as secondary functions. As a time-honored multi-purpose stadium, Dalian Jinzhou Stadium hosted multiple FIFA World Cup qualifiers for China's national team and CSL fixtures, while retaining its full athletics track and lacking football-specific supporting facilities.

These venues kept complete athletics tracks and prioritized public fitness and large-scale public events, with football matches as accessory functions. Hardware was limited: standardized players' lounges, media workspaces, and VAR support facilities were insufficient, fan service amenities were poor, and spectators experienced unsatisfactory viewing conditions. Most stadiums were owned by local sports administration authorities with public welfare attributes and little market-oriented development. They were only activated during matches and remained idle afterward, failing to satisfy demands of professional football development.

3.2. Initial transformation phase for football-specific stadiums (2011–2018)

As the commercial value of the Chinese Super League increased, demand for dedicated competition venues kept rising, triggering renovation and new construction projects of stadiums nationwide. Representative

venues are Shanghai Hongkou Football Stadium and Tianjin Tuanbo Football Stadium [12]. Transformed from a multi-purpose stadium with athletics tracks removed, Hongkou Football Stadium is China's earliest operational football-specific stadium. Adopting a sunken layout without athletics tracks and referencing European stadium layouts, Tianjin Tuanbo Football Stadium explored the construction of domestic newly-built football-specific stadiums.

Some football-focused cities optimized existing multi-purpose venues, adjusted stand layouts and upgraded lighting and broadcasting facilities. A small number of pure football-specific stadiums were completed. Shanghai Stadium and Guangzhou Tianhe Stadium were renovated to meet basic hardware requirements for CSL matches. Nevertheless, football-specific stadiums remained scarce nationwide. Clubs in many small- and medium-sized cities still used multi-purpose venues with athletics tracks. Commercial development and refined operation and maintenance of stadiums stayed at an early stage.

3.3. Phase of large-scale delivery of standardized stadiums (2019–2022)

Driven by football sector reforms and preparations for international tournaments, domestic football stadiums entered a phase of standardized quality upgrading. Representative venues are Chengdu Fenghuangshan Football Stadium and Qingdao Youth Football Stadium [13]. Fully complying with FIFA standards, these two track-free venues reached world-class levels in lighting, broadcasting systems, VAR workrooms, and functional rooms.

Cities across China constructed and renovated a batch of modern football stadiums complying with FIFA and AFC standards. The completion of Fenghuangshan Stadium, Shanghai Pudong Football Stadium, and Qingdao Youth Football Stadium filled gaps in high-standard football-specific stadium hardware. Construction in this phase focused on hardware compliance and tournament guarantee. However, commercial facilities remained insufficient, and post-event idle venue problems were not fundamentally solved.

3.4. Exploration phase of smart technology and diversified operation (2022–Present)

As China's domestic sports industry pursues high-quality development, football stadiums are breaking away from match-only positioning and exploring digital upgrading and diversified business operations. Representative venues include Shanghai Pudong Football Stadium and the reconstructed Beijing Workers' Stadium [14]. Shanghai Pudong Football Stadium has built smart security and passenger flow analysis platforms, and hosts concerts and corporate events off-season. The renovated Beijing Workers' Stadium adds photovoltaic power supply systems and smart operation and maintenance platforms, and develops fan consumption, cultural tourism, and research and study programs.

Some newly built stadiums deploy intelligent security and passenger flow control systems, and introduce concerts, sports training, and cultural tourism activities to mitigate post-match idleness. However, development is uneven. Only a small number of benchmark venues possess complete smart supporting systems; most old venues have not completed digital renewal. Market-oriented operational mechanisms remain immature. Low-carbon construction and full-domain operation are still at preliminary exploratory stages, leaving obvious gaps compared with high-standard international stadiums.

4. Development gaps and existing problems of stadiums for domestic and foreign Super Football Leagues

4.1. Obvious disparities in stadium specialization

Top-tier overseas leagues have widely adopted track-free football-specific stadiums whose pitch specifications, stand layouts, and functional rooms fully adapt to professional football and guarantee match-day atmosphere and broadcasting quality. In the Chinese Super League, the proportion of football-specific stadiums remains low. Many clubs still use multi-purpose venues with athletics tracks, where large pitch-stand distances impair the viewing experience. Some old venues suffer from chaotic functional zoning and aging facilities that cannot satisfy technical standards for high-definition broadcasting and VAR operation. Hardware shortcomings restrict specialization improvement of the CSL.

4.2. Extensive operation and insufficient commercial development capacity

Mature overseas stadiums implement full-domain market-oriented operational systems. By integrating tournaments, exhibitions, catering, and cultural tourism based on club intellectual property rights, they achieve year-round operation and generate steady revenue as important income sources for clubs. Most Chinese football stadium revenue comes from venue leasing. Development of cultural and creative products, membership services, and commercial leasing remains shallow. Most domestic stadiums are managed by state-owned platforms with limited market flexibility. The "emphasis on construction while neglecting operation" phenomenon prevails. Post-event spatial idleness causes waste, and industrial value is not fully unlocked.

4.3. Lagging smart and low-carbon construction

European and American football stadiums have generally completed smart low-carbon retrofits. Digital technologies enable refined management of visitors, equipment, and energy consumption, while green building materials and renewable-energy technologies are widely applied to reduce carbon emissions. In China, only a few benchmark new stadiums are equipped with comprehensive smart systems. Most existing venues rely on manual operation and maintenance, featuring high energy consumption and low efficiency. Low-carbon concepts receive inadequate attention in stadium planning. Energy-saving technologies and clean energy penetration remain low, and green stadium construction lags behind international standards.

4.4. Restrictions imposed by ownership mechanisms

Many overseas football stadiums are privately owned by clubs or operated by market-oriented capital. Venue functions and business strategies can be flexibly adjusted according to market demand and fan needs. Most Chinese football stadiums are government-funded and operated by state-owned entities, while clubs have no ownership or operational authority. Renovation and business form adjustment involve cumbersome approval procedures and slow market responses. The separation of construction bodies and operation and maintenance bodies tends to prioritize engineering construction over long-term post-construction operational planning, limiting the comprehensive benefits of stadiums.

5. Overall future development trends of stadiums for Super Football Leagues

5.1. Continuous popularization of specialized and standardized stadiums

Top-tier global football leagues will keep renovating old multi-purpose venues and expand coverage of

football-specific stadiums. Construction standards for competition, spectator experience, safety, and services will be further refined. Sightline design, functional rooms, and broadcasting facilities will fully match modern professional football requirements. China's CSL will gradually renovate existing venues and increase the supply of high-standard football-specific stadiums, promoting league quality improvement via hardware upgrading.

5.2. Full-domain operation and in-depth development of commercial industrialization

Traditional match-oriented stadiums are transforming into sports commercial complexes, and full-time, full-domain operation will become mainstream. Breaking time constraints of matches, stadiums will integrate tournaments, live entertainment shows, cultural and creative retail, sports training, exhibitions, and cultural tourism to serve diverse consumer groups. Club intellectual property value will be deeply tapped. Stadium naming rights, brand co-branding, and member consumption will be expanded to build sustainable profit-making models. Stadiums will evolve from public service infrastructure into core carriers of the sports industry.

5.3. Implementation of smart construction and refined services

Digitalization will become a basic configuration for modern football stadiums. Integrated smart platforms will realize unified management of security monitoring, passenger flow surveillance, energy consumption, and equipment. Frictionless access, intelligent wayfinding, and smart match watching will enhance audience experience. Big data and artificial intelligence technologies will support operational analysis and fan event interaction, serving both tournament broadcasting and daily business for refined operation and precise services.

5.4. Low-carbon and eco-friendly principles as mainstream for stadium construction and renovation

Green sustainability will run through new construction and renovation of stadiums. Photovoltaic power, rainwater harvesting, natural ventilation, daylighting, and sponge city design will be widely adopted to reduce stadium energy consumption and carbon emissions. Old venues will keep updating energy-saving equipment to balance competitive event functions, commercial benefits, and ecological benefits, building urban green sports landmarks in line with global sports low-carbon trends.

5.5. Integration of culture sports tourism: Balancing professional matches and public services

Beyond single professional match hosting, football stadiums will boost in-depth integration of sports, culture and tourism to become urban cultural and sports consumption landmarks. While guaranteeing professional league fixtures, stadiums will open fitness, research and study, and leisure spaces to citizens, balancing competitive professionalism with public service inclusiveness, and delivering economic, social and cultural communication benefits simultaneously.

6. Conclusions

Reviewing the development history of stadiums for global super football leagues, overseas venues have

experienced multi-purpose mixed-use, football-specific stadium popularization, commercial development, and smart low-carbon iteration. A mature specialized and market-oriented system has been formed, delivering multi-value for competition, commerce, culture and ecology. Alongside professional-football reforms, CSL stadiums in China have achieved initial transformation from multi-purpose public venues to standardized stadiums. However, multiple shortcomings persist: insufficient supply of football-specific stadiums, extensive operational modes, weak commercial development, lagging smart low-carbon construction, and institutional mechanism constraints. Gaps remain compared with high-standard international stadiums.

Global football stadiums will evolve toward specialization-standardization, full-domain industrialization, smart low-carbon performance, and culture-sports integration. Domestic football stadiums in China should benchmark international trends while respecting realities of China's professional football. Hardware-oriented specialized renovation, market-oriented operational innovation, smart low-carbon upgrading, and culture-sports integrated empowerment shall be adopted to remedy existing deficiencies. A modern football-stadium system adapted to the Chinese Super League and urban development needs, balancing industrial and public welfare benefits, shall be constructed. It will provide hardware support for building a leading sporting nation and high-quality development of China's professional football industry.

Funding

This study was supported by the Youth Science and Technology Fund under the Fundamental Research Funds for the Central Universities (Project No. 2026-BSH-A20).

Youth Science and Technology Fund, Fundamental Research Funds for the Central Universities Climate Response Mechanism and Multi-scenario Design Optimization of the Roof Interface of Ice Sports Gymnasiums in Hot and Humid Regions

Disclosure statement

The author declares no conflict of interest.

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