Towards international: China-aided stadiums in the developing world

Wei Chang\textsuperscript{a,b,*}, Charlie Q.L. Xue\textsuperscript{a}

\textsuperscript{a} School of Architecture and Civil Engineering, City University of Hong Kong, Hong Kong, China
\textsuperscript{b} School of Civil Engineering, Tangshan University, Tangshan 063000, China

Received 30 November 2018; received in revised form 14 May 2019; accepted 22 May 2019

Abstract  Foreign aid is a form of international relationship between countries. Building projects are a major form of foreign aid. In the past 60 years, China has constructed over 1400 buildings in the developing world, and many of them are stadiums. This study explores how China exported its overseas-aided stadiums in the developing world and considers the importance of these buildings from an architectural perspective. Through an examination of first-hand materials, this study explains the historic vicissitude of China-aided stadium architecture, analyzes the architectural features of these buildings, and presents case studies of representative examples from each historic stage. The investigation of these buildings from three periods in the 20th and 21st centuries fills a gap in the study of Chinese architecture and modern architectural history.

© 2019 Higher Education Press Limited Company. Production and hosting by Elsevier B.V. on behalf of KeAi. This is an open access article under the CC BY-NC-ND license (http://creativecommons.org/licenses/by-nc-nd/4.0/).

1. Introduction

After World War II, the U.S. led the post-war reconstruction of the West under the Marshall Plan and showed its European peers that “you too can be like us” through its modernization (Cody, 2003; Roskam, 2015). The Soviet Union soon announced its Molotov Plan to start aid activities in developing countries with the aim to persuade non-aligned nations and citizens of the Third World to side with either the “red” or “blue” division. Architectural aid projects became critical to “incorporating post-colonial countries into the ideological discourses of the Soviet Union and the United States” (Stanek, 2012) and to exporting their political, social, and economic ideologies (Siampukdee, 2014a,b). China has been receiving massive amounts of construction aid mainly from the Soviet Union since the early 1950s. China began to provide economic and technological assistance to other countries in the late 1950s. Over 60 years, China has become a major non-
Development Assistance Committee (DAC) donor country. According to the Chinese government, by 2015, over 2000 projects had been delivered to more than 160 countries. More than 1500 buildings, such as parliament houses, convention centers, stadiums, gymnasia, theatres, schools, hospitals, libraries, railways, and stations, were constructed. Although these aid constructions sometimes elicited criticism from communities (Doytchinov, 2012; Siampphukdee, 2014a,b; Kacel, 2010; Sorokina, 2012), these buildings generally represent, mediate, and convey modernization efforts, illustrate the architectural historiography of the post-war period (Stanek, 2012), and constantly influence the modernization of the recipient countries.

Among all construction building types, sports facilities make up a significant proportion of China-aided constructions (Fig. 1), and they can be regarded as parts of sports aids, with sports equipment and facilities and technical assistance (coaches, sports experts, referees, and competition management staff) (Yu and Yuan, 2010). The types of China-aided sports buildings cover a wide range, including outdoor stadiums, indoor stadiums of different usages, swimming pools, outdoor track and field courses, and other venues for competitions and trainings. In this study, we opted to focus on stadiums (outdoor and indoor) because they are the most crucial type of sports buildings and the center of all buildings in sport centers in most cases. Moreover, they are the most costly construction category and require special techniques. They are urgently needed because they are lacking in many recipient countries. Moreover, stadiums are among the most popular and longest-lasting aid projects where sports, cultural, and political events are held with national or global attention. Their large scale, complex structure, and evident image generate a powerful influence and thus increase the importance of the discussion and research on this particular type of aid building.

Since the late 1950s, China has been exporting stadium aid to Asian countries and other undeveloped areas, such as Africa and Latin America. In total, over 100 stadiums have been financed, designed, and constructed with China-aided in developing countries, and sometimes even renovation and maintenance are included. Most of China-aided stadium projects are implemented as complete projects, which are the most common form of China’s overseas construction projects. As shown in Fig. 2, the annual number of China-aided stadiums has steadily increased. Particularly, one China-aided stadium was constructed every one to two years. The construction of these stadiums has been increasing evidently since the 1980s. Two peak periods appeared around 1987 and 2007 when China experienced a rise in sports development promoted by the 1990

---

Fig. 1 Sectoral distribution of completed overseas public facility projects constructed with the help of China before 2009 (drawn by the authors on the basis of information from China’s White Paper on Foreign Affairs, 2009, China’s foreign aid, 2009).

1 DAC is one of the most dominant aid organizations worldwide, and it is from the Organization for Economic Co-operation and Development. It consists of 30 members, including the U.S., the U.K., Japan, Korea, and several European countries. They primarily provide Official Development Assistance (ODA). Countries that are outside DAC but also provide ODA to other areas, such as China and India, are referred to as non-DAC countries.

2 The Chinese government has not published a detailed number of donated buildings but revealed the general number of aid projects. Building projects are included in complete projects (set facilities). According to the percentage of complete projects and the real cases that the authors have collected, we provide an estimated number of buildings.

3 This number is from the authors’ own collected database. Sources include government websites and news reports.
Asian Games and the 2008 Olympic Games held in Beijing, respectively. The total number of buildings exceeded 100 after the new century and may increase after the establishment of the Belt and Road Initiative (BRI).

China-aided stadiums were initially referred to as "friendship stadiums" by Copper (1979) in his report titled China’s Foreign Aid in 1978. Afterward, the term "stadium diplomacy" was proposed by the Olympic Committee (Zou, 2015) and foreign scholars (Will, 2012; Menary, 2015). These sport venues have become important places for local authorities and people to celebrate sport events, and most of them have improved citizens’ life and are appreciated by local and international groups. The architectural characteristics of these buildings vary over time and across regions, reflecting the development of China’s design, sports architecture, structure and technology of stadiums, and the vicissitudes of China’s diplomatic policy. Although billions of dollars were invested in building stadiums in the developing world, these Chinese projects have only been lightly mentioned in several economic and international relation studies. They have been rarely examined or mentioned from architectural perspectives.

Therefore, by adopting an architectural perspective, this study discussed the development of China-aided stadiums and their architectural importance, technical standards, structural forms, and prevailing design language in various periods. An investigation of China-aided stadiums was performed by searching historical archives, visiting the sites, and interviewing the designers and technicians involved. The development was divided into three periods according to China’s decisive societal and policy changes in the past 60 years and the influence of such changes on the architectural essence. The background in each period was introduced, and representative building cases were highlighted to reveal the trend and characteristics of architectural design and structure and the technologies of the particular era. Through this work, the authors hope to fill a critical gap in the history of modern Chinese architecture and overseas exportation architecture.

2. 1958–1977: early involvement with exportation of labor and design

Beginning in the 1950s, Mao Zedong, the leader of China, implemented the Leaning to One Side to align China with the socialist bloc in order to exist in the hostile international climate, of which foreign aid was an important part (Zhang, 2012). Among the various types of aid, sports aid was initially used to support developing countries in Asia and Africa (Yu and Yuan, 2010). As a crucial part of such diplomacy, China, which harbored similar socialist ideals, began to design and construct stadiums overseas.

The first China-aided stadium was the National Sports Stadium in Ulaanbaatar; it was constructed in 1958 for the improvement of Mongolia’s sport infrastructure and athletes’ training conditions (Yu and Li, 2016) (Fig. 3). This 12,500-seat stadium has a concrete frame structure in the form of circular walls and only one layer of stand, half of which is covered by the plane steel structure roof. Cultural and regional elements are expressed frankly in the shapes and patterns of the windows and doors and in the colors of the walls, cornices, and the roof. Although this stadium was designed by Soviet architects, China sent workers to...
complete the construction. These highly skilled workers were selected carefully, and many of them even held ninth-grade qualification of construction skill, which was the highest standard in China in that period. With the help of China’s good-quality labor, the stadium was constructed well and continues to function even at present.

In the 1960s, China expanded the recipient regions from socialist to nationalist countries, such as Indonesia and Cambodia, which received stadiums in 1963 and 1966, respectively. The China-aided stadiums constructed in this early stage were usually associated with political aims and crucial sport events. They were generally built when the recipient countries were preparing or applying for major regional or international sport events. For example, the GBK stadium that Indonesia received from China in 1963 was constructed to host the first Games of the Newly Emerging Forces (GANEFO), and the National Olympic Stadium of Cambodia was aided for the opening of the 2nd GANEFO in 1966, which will be discussed in detail later.

In the early times, the involvement of Chinese architects in the design process was minimal because the stadiums were designed by local architects. In this situation, China mainly served as an assistant with providing financial, construction, and labor support. For example, the stadium in Indonesia was designed by Frederich Silaban, a famous Indonesian architect. The National Olympic Stadium of Cambodia was also designed by the country’s famous local architect, Vann Molyvann, whose works are among the most important collections of postcolonial buildings in Cambodia and referred to as the “New Khmer Architecture” (Fig. 4). Molyvann chose to combine the indoor stadium and the outdoor venue and located the former at the western side of the site to form the main entrance of the Olympic center. The four sides have a symmetrical layout and identical facades. The roof of the indoor stadium is covered by four two-way slabs, which are supported by 1500 mm thick waffle beams to achieve a 40 m span using a reinforced-concrete (RC) structure similar to most stadiums. The one-layer stand of the outside venue is exposed, except for the rostrum areas covered by a cantilever structure from the back façade of the indoor stadium. Natural ventilation technologies were utilized in constructing the stadium. The long axis in the master plan was perpendicular to the predominant wind direction in hot weather to achieve good air flow. The bottom parts of the seats of the indoor stadium were designed to act as hollow ventilation openings. Such a design naturally forms the rhythmic patterns of the facades and contributes to the special image of the stadium. Later on, these passive ventilation technologies were widely used in China-aided stadiums. This stadium, which was constructed by Chinese construction companies in Dalian city to solve the problem of Cambodia’s incapability to build mega-structures, is of good quality and has been constantly used since its completion.

Since the late 1960s, Chinese architects have been participating directly in designing China-aided stadiums, such as the Zanzibar Amaan Stadium (1968) in Tanzania and the Abebe Bikila Stadium (1973) in Ethiopia. The design missions of these construction aids were assigned by the Ministry of Commerce to architects from state-owned design institutions (Xue and Ding, 2018). These institutes were under the Ministry of Construction and located in Beijing, Northeast, Northwest, Southwest, Central, and East China as arms of large-scale socialist construction. For example, the Mandela National Stadium in Uganda (1974) was designed by the Architecture Design & Research Institute of the Ministry of Construction, the predecessor of the China Architecture Design & Research Group (CAG), one of the core state-owned design institutes.

Since the late 1960s, Chinese architects have been receiving persistent influence from the Soviet Union in compliance with realism as evidenced by massive new constructions in the Chinese capital and other major cities with Stalinist style. However, in the late 1960s, realism was abandoned in
Fig. 4 National Olympic Stadium, Phnom Penh, Cambodia, built in 1966 (up: site plan, from website vanmolyvanproject.org; down: photos taken by the authors inside the stadium in 2019).

Fig. 5 Hrazdan Stadium, Armenia, built in 1970.
the socialist camp due to political variations, and Soviet architects’ designs began to transit from realism and classicalism to post-modernism and even futurism. Under such an influence, Chinese architects traced back to the modern style and expressed it in overseas-aid projects. For stadiums, completed frame structures were widely used in Soviet Union’s modern sports buildings (e.g., Hrazdan Stadium, 1970, Fig. 5), generating rough massing and unified graveness by using on-site RC, which may also have influenced the designs of Chinese technicians.

Similarly, the China-aided Mandela Stadium in Uganda (Fig. 6) used large cantilever beams and pillars to support larger two-layer stands (45,000 seats) for creating scenic views for the audience. However, two sets of RC frames (one for the façade walls and another for the support of the large roof) generated blocking areas, which is inevitable in RC frame structures to some extent. Modern materials and structures were combined and exposed directly without overcoating. Similar to concrete slabs, beams, and pillars, they contribute to the feeling of geometries and order. This stadium was branded with a sense of solemnity and power, in that period.

3. 1978—1999: independent design with regional considerations

After 1976, China’s new leader, Deng Xiaoping, began to profoundly reform China’s internal and external policies. These changes, especially the reform and opening-up policy in 1978, not only positively promoted the development of China’s foreign relations but also directly affected the operation of China’s foreign aid. In this period, rather than concentrating on providing aid to a few countries, China increased stadium aid to numerous less-developed countries (LDCs) and extended its aid to Oceania. In the 1980s, China supported the concept of South—South cooperation by boosting aid activities between China and

---

8 This stadium was designed by Soviet architects Koryun Hakobyan and Gurgen Musheghyan.

9 The reform and opening-up policy was proposed by Deng Xiaoping in 1978 to open the gate of economic mark of China to the world.
Fig. 7  Up and middle: Stadium of Moi International Sports Center, Kenya, built in 1987. Down: present state of the stadium (photos taken by the authors).
developing countries. During this decade, over 20 large-scale stadiums, a figure that is significantly larger than that in the previous decade, were constructed.

A crucial change during this period was that ideology was no longer the motivation for foreign aid (Ding and Xue, 2015). For China-aided stadiums, Chinese architects explored regionalist design languages and considered the economic potential, local culture, and environmental adaptability of the buildings. Architects viewed aid projects as good opportunities to design freely and experimentally. In other words, while most domestic construction projects were limited by tight budgets, overseas aid projects provided Chinese architects valuable opportunities to integrate modernist and regional approaches, which was partly due to China’s desire to satisfy local users in the recipient countries. China’s aid stadiums consequently bloomed with increased diversity and transition of regionalism, modernism, adaptation, techniques, cultures, or multi-combinations of the above.

Such changes were reflected in many China-aided stadiums, among which is the famous Moi International Sports Center in Kasarani, a suburb of Nairobi, Kenya, to support the fourth All-African Games in Nairobi. This building contains a stadium with 60,000 seats, an indoor arena with 5000 seats, an aquatic complex with 2000 seats, and an athletes’ hostel with 108 rooms and auxiliary facilities on a 100-ha site that was completed in 1987. It was designed by the Southwest China Architectural Design Institute and constructed by workers from Sichuan Province, where the institute is located.

Chief architect Xu Shangzhi took a team of nine architects and engineers to the site in 1980 and stayed there for months. They identified abstract architectural principles in Kenya’s vernacular buildings and combined them with modern technology when building the stadium (Xu, 2003). The building is an ellipse floodlit stadium in which large-scale international track and field events and football competitions can be held. In accordance with the local climate feature and functions, the architects divided the stadium into 24 sections, each having a petalage outline with a tilted-column supporting cantilevered stand. The 24 sections make up a flower in full bloom, which symbolizes the friendship between Chinese and Kenya people. Although the structure of the building remains to be an RC frame, as commonly used
in the 1970s, the three-layer stands show much improvement. Moreover, awareness and thoughts about cultural and regional aspects were on the designers’ working desk. The façade concrete slabs, the pattern of which also adds to the custom elements, were divided and hollowed to achieve natural ventilation and lighting in line with the local climate (Fig. 7). Mask relief sculptures of African feature are located above each entrance as decorations. The open lounge and inner courtyard are adjusted to make the space treatment of the building transparent and vigorous. The exposed post and beam structures symbolize the Masai spirit of East Africa (Fig. 7). Such a serious consideration finally won the clients of Kenya over from their former skeptical mindset, as stated by Xu in his reminiscence (Xu, 2003). The building is in good condition even after several times of maintenance, which were also conducted by China, and functions well at present (Fig. 7).

After the 1980s, Oceania and Latin America began receiving stadium aid from China. The buildings in these areas also reflect Chinese architects’ new concerns. To help Samoa meet the requirements of the 7th South Pacific Games held in September 1983, China designed and constructed a series of sports facilities, including a 1000-people gymnasium, a track field, a 2000-seat stand, and a bowling alley. These sports facilities, which were designed in 1980 and completed in August 1983, gained much praise from athletes and referees from 19 countries during the Pacific Games (Ai, 1987). The designer, Ai Binggen from Jiangsu Provincial Architectural Design Institute, a state-owned design institution, considered the venues’ local and climate conditions in the design. For example, in the indoor stadium, although mechanical ventilation equipment was installed, the doors and windows of each room were carefully arranged to achieve good airflow. The building has a special local-style hollow pattern on the external walls of the rest platforms to generate natural ventilation while adding ethnic characteristics to the facade. Light steel truss structures constitute the four-side awnings, and the middle roof area is opened to introduce natural air. A white roof was used to reduce the heat from solar radiation, and insulation was added to the roof panel to improve the effect of heat insulation and cooling. Although the rough concrete of the façade is exposed, designers opted to use light yellow walls with a dark green cornice to achieve harmony with the natural environment (Fig. 8).

Another example is the China-aided indoor stadium in Barbados, Latin America. This stadium shares similarities with the indoor stadium in Samoa probably because both architects considered the local features and environments of these two coastal countries. Designed by architect Yang Weihua from the Architectural Design Institute of Southeast University, this stadium was one of the best modern indoor stadiums in the Caribbean at its completion in June 1992. It has an area of 16,000 m², with 9941 m² gross floor area and 3988 fixed seats (Yang, 1994). The recipient country’s unique culture and modern lifestyle are reflected in the local buildings that combine traditional spire arches with a unique roof form and a modern block. To reflect this local context, Yang used white tiles on the walls to symbolize the modern features and selected a corrugated red metal shingle for the roof. Powerful vertical structural components and a horizontal cantilevered auditorium were combined to form a modern-style indoor stadium with local characteristics (Fig. 9).

In 1993, the Complete Plant Import & Export Corporation (COMPLANT), under whose umbrella most China-aided

---

Please cite this article as: Chang, W., Xue, C.Q.L., Towards international: China-aided stadiums in the developing world, Frontiers of Architectural Research, https://doi.org/10.1016/j.jfoar.2019.05.007

---

10 COMPLANT is a national-funded company established in 1959 to export large-scale sports construction projects to recipient countries (Su, 1989). It undertook various large aid projects, such as stadiums in Togo, Kenya, the Democratic Republic of the Congo, and Djibouti.
stadiums were completed, was restructured as a comprehensive foreign trade enterprise group with independent accounting, self-management, and self-financing. The management of the aid projects was moved from national ministries and commissions to enterprises’ general contractors. Under these transitions, stadium aid projects became market-oriented and benefit-led. These transitions also required the architects to exert additional efforts on satisfying the recipient countries. The sense of competition also contributed to further consideration of the local contexts and requirements in the design of aid stadium projects.

4. 21st century: internationalized design with cooperation and competition

Since the new century, non-Western donors have been rapidly expanding their overseas aid activities because several Western governments have been scaling back their development finance commitments; among these donors, China has become a major provider. (Strange et al., 2017). In 2000, China launched the China–Africa Cooperation Forum (CACF), through which China provides aid in the form of grants, interest-free loans, and concessional loans. Grants are generally used in LDCs, whereas loans are often

---

Fig. 10  Tanzania National Stadium (source: H. Jiang, national stadium of Tanzania. ArchiCreation, 1 (2007)).

---

11 Before the 1990s, China-aided projects were donated or built with donors as interest-free/low-interest loans. Even when loans became common, interest-free grants were used to fund a considerable portion of early sports building aid projects. With this type of funding, the projects were limited to a certain scale.
a larger portion of the aid portfolio in developed countries (Hubbard, 2017). China’s aid diplomacy transformed from a system based on grants to cooperative agreements. Profound improvement of China-aided stadiums was achieved to meet the high standard of modern sports buildings in the new era for holding international games, which may not happen without good financial support from diverse financing models rather than just donors and low-interest loans.

Since the announcement of the Beijing 2008 Summer Olympics, China has been conducting intensive construction of sports venues consistent with high international standards, which in turn has improved the design and construction level of sports buildings built in the aid program. Moreover, the working mode of architects became flexible and was characterized by multi-cooperation or competitive relations with other firms, including Chinese private firms and overseas companies; this reflects the gradual maturity of Chinese architectural design and the liberalization of the mechanisms for design bids and operation. Under such transitions, large-scale, high-standard, well-designed stadiums have been constructed. Several of the world’s best stadiums were designed and constructed by Chinese architects and engineers. This achievement shows that China’s sports architecture has reached a new high level.

A representative example of this period is the Tanzania National Stadium in Dar es Salaam. This 60,000-seat stadium is among the largest China-aided stadiums ever built. Instead of assuming the usual dominant role, the state-owned Beijing Institute of Architectural Design (BIAD)
cooperated with the South Africa design company WMS, which created a conceptual design for the sports center, to complete the final design. Such cooperation enabled this stadium to become highly modernized and internationalized. Although the stadium was designed according to China’s standards, it meets international standards, such as those of the International Association of Athletics Federations and Fédération Internationale de Football Association. Simultaneously, regional aspects were considered, similar to most of China-aided stadiums’ designs. Architect Jiang Hong from BIAD noticed Tanzania’s love for football games and the low use frequency of track and field competitions. On this basis, he chose to shape the stands with two straight east–west edges and two semicircles rather than the four-circle-center shape that is commonly used in China’s large domestic stadiums to minimize the horizon distance between the audience and the site for football games (Fig. 10). Recognizing that over 10% of the local population was disabled, the number of seats for disabled people was higher than what is required by China’s barrier-free design standard. Two large special barrier-free ramps were also added to increase the traffic convenience and capacity of the stadium.

In addition, highly advanced structures and technologies were utilized in the stadium, which is in line with the development trend of sports buildings worldwide. Despite the traditional RC structural system, this new stadium used a space pipe truss for the main perpendicular and roof structure and a cable-membrane tension structure for the continual V-shape covering to form a modern and international image. The new structure reduced the weight to create a lightsome appearance. In addition, the roof was constructed with an advanced polytetrafluoroethylene material with heat-resistant capabilities (with solar...
reflectance above 70%). To address the rainfall shortage in Dar es Salaam, a special rainwater recycling system was set up. Meanwhile, sound-amplifying technologies were effectively designed and applied to meet the strict requirements of various international competitions (Jiang, 2007).

Notably, several upper middle-income countries have become recipients of China’s stadium aid probably due to the China’s Taiwan question because these countries have economic and technical capabilities to construct international stadiums. Several of these countries are even richer than China in terms of GDP per capita. Therefore, these aid stadiums normally require more considerations and higher standards for architectural design than the usual. A representative example is the Costa Rica National Stadium, which is China’s first aid project in Central America.

Rather than assigning the project to a government institution, the Chinese government invited six design institutes to bid the project. The Central South Architectural Design Institute won the bidding with their “sail in the sea” concept (Zhang, 2008). Constructed with a 299 m span steel arch structure that generates a strong visual impact, this stadium evokes volcanos and sailing boats. From a bird’s eye view, it is shaped like a crater, but it looks like a boat from a side view (Fig. 11). Such symbols and metaphors are commonly used by local Chinese designers to please their clients, the media, the public, and officials. For example, the Beijing Olympic Stadium is called Bird Nest (Li and Xue, 2017). Chief architect Li Fang used green building design methods and technologies for this stadium to achieve energy-saving results with natural ventilation rather than using a mechanical one. As a landmark stadium with the most modern standards in Central America, this stadium realized the dream of citizens in Costa Rica to have a full-scale modern stadium. Their president, Oscar Arias Sanchez, expressed his appreciation, and the design won many awards in China.

In recent years, the tender and bid mechanism has been introduced into overseas aid projects after decades of experimentation in China’s domestic construction industry. Recipient countries held numerous discourse rights in the process for their presence as one of the decision makers to select the design scheme. Most of these countries, which achieved their independence from long-time colonization in the 20th century or even in the new century, tend to express strong consciousness of nationality and culture in their stadiums. This situation requires Chinese architects to consider appropriate expressions in architectural design to satisfy the new party. Regional and metaphorical designs were implanted into the architectural design of China-aided stadiums in a new manner under the discourse of international style, with the combination of new structures, materials, and technologies. For example, the Wrestling Stadium in Senegal, which was visited by China’s President Xi Jinping in its handover ceremony in June 2018, was designed with a belt shape across one side of the main site to symbolize the wrestling sport and its unique culture in the country (Fig. 12). Another representative stadium is the New National Stadium in Cambodia, a significant aid project echoing China’s BRI. The design attracted Hun Sen’s preference because of the imitation of the hand namaste and the Cambodians’ traditional dragon boat in the form and structure of this building, which led to IPPR’s winning of the bid (Fig. 13). This 10,000-seat stadium, which will be completed by 2020, will be the largest

12 This stadium aid may suggest that China views its stadium aid as global rather than regional in scope, and this diplomacy will continue to flourish in the region (Flowers, 2017).

13 Hun Sen, the Prime Minister of Cambodia, made the final decision among three design schemes provided by the Chinese government after the primary choice by Chinese experts in the bidding of the design for the New National Stadium.

14 China IPPR International Engineering Co., Ltd., won the bid for designing and managing this new China-aided stadium in Cambodia.

Fig. 14 Number of stadiums constructed under China’s aid by area (drawn by the authors).
and most costly China-aided stadium ever. China-aided stadiums in the new era tend to be more diversified with higher standards, larger scales, and more powerful influence than those in the old era.

5. Conclusion

China-aided stadiums built from 1950 onwards have undergone three stages of development: 1958–1977, 1978–1999, and the 21st century. By 2018, the Chinese government had constructed approximately 100 aided stadiums in over 50 developing countries, with several large stadiums being processed or under construction. These projects were originally implemented in Asia and Africa (1960s–1970s) and then spread to Oceania (1980s–1990s) and Latin America (after 2000). Nonetheless, Africa still has the highest concentration of projects (Fig. 14). China is responsible for the entire process, that is, from the initial planning stage to the stadium’s completion. This situation requires Chinese architects to consider additional aspects of design, management, and construction with increased possibilities when faced with these stadium projects for various regions. In this study, we summarize the architectural development of China-aided stadiums in the three periods from different aspects, such as policy, designer/institution, working mode, function, style, structure, and technology, to create comparisons (Table 1).

In the early period before the 1980s, China-aided stadiums reflected China’s socialist ideals and its Confucian philosophy of sharing and giving. The donation of ideal stadiums abroad provided good opportunities for Chinese architects to learn and improve their design abilities. As a result, China-aided stadiums took the lead ahead of the domestic ones. Although the structure and technology of stadiums during that time were relatively simple, overseas projects normally have better design and construction quality with undoubted economic support than local projects. After China’s reform and opening up, the change in diplomatic policy and the prominent increase in the number of China-aided stadiums required more economic and effective designs than before. Architects began to explore methods of designing cost-effective “gifts.” Chinese architects changed to give serious consideration to local and regional aspects, in which passive low technologies, such as natural ventilation, were commonly used because most regions that received China’s stadium aid were in a tropical climate. Improvement was achieved in regionalist design to solve the problems caused by cross-border maladaptation.

In the new century, contemporary stadiums use new structures, materials, and technologies, especially those closely related to sustainable and green technologies. China’s domestic sports buildings bloomed with massive large-scale and high-tech stadiums designed and constructed in important cities, which in turn motivated the design and construction of China-aided stadiums to follow the trend. A significant impact of the new era is the multi-cooperation or competitive relations with other firms or even foreign ones due to the bidding of China-aided

Table 1: Summary of China-aided stadiums.

<table>
<thead>
<tr>
<th>Period</th>
<th>Region</th>
<th>Structure</th>
<th>Technology</th>
<th>Representative cases</th>
</tr>
</thead>
<tbody>
<tr>
<td>1958–1977</td>
<td>Initially Asia then extended to Africa and Latin America; socialist countries to nationalist countries</td>
<td>RC frame structure</td>
<td>Passive low technology is sometimes used</td>
<td>National Sports Stadium of Mongolia (1958); National Olympic Stadium of Cambodia (1966); Mandela National Stadium of Uganda (1976)</td>
</tr>
<tr>
<td>1979–1999</td>
<td>Extended to Oceania, centered in Africa; LDCs</td>
<td>Developed RC frame structure; simple steel truss structure</td>
<td>Passive low technology is frequently used</td>
<td>Indoor stadium of Samoa (1983); Stadium of Moi International Sports Center of Kenya (1987); Indoor Stadium of Barbados (1992)</td>
</tr>
<tr>
<td>2000–present</td>
<td>Extended to middle-income countries, concentrated in Asia and Africa; focusing on BRI</td>
<td>Extended RC frame structure; simple steel truss structure</td>
<td>Passive technology with new sustainable technology</td>
<td>National Stadium of Tanzania (2007); Costa Rica National Stadium, 2012; Wrestling Stadium in Senegal (2018); New National Stadium in Cambodia (2020)</td>
</tr>
</tbody>
</table>

Please cite this article as: Chang, W., Xue, C.Q.L., Towards international: China-aided stadiums in the developing world, Frontiers of Architectural Research, https://doi.org/10.1016/j.foar.2019.05.007
stadium projects. Such cooperation and competition contribute to the internationalization and modernization of these stadiums to some degree. Moreover, the new emerging bid operation for aid projects forces Chinese designers to apply cultural and national concepts into their design to persuade the recipient countries, which are one of the main decision makers.

Deborah Brautigam pointed out that although problems occur in China-aided constructions, such as school and hospital buildings being empty and industrial projects being mismanaged (Brautigam, 2008), most of the exported buildings have substantially improved the living conditions of local communities (Ding and Xue, 2015). Most stadiums were efficiently constructed, maintained, and used for crucial sports and national events, and sometimes, they even provide employment and economic development opportunities (Brautigam, 2008; Gu, 1983).

Compared with other aid projects, stadiums are used more sustainably, last longer, and are more successful; they are beneficial to ruling elites and ordinary people (Taylor, 2009) and offer an alternative approach for improving social equality, political emancipation, and citizens’ quality of life.

Furthermore, these overseas projects provide good opportunities for Chinese architects to design high-standard international sports buildings and prepare them to compete worldwide. Architects who were involved in early China-aided projects came from state-owned design institutions, and many of them became experts or leaders in the field due to their overseas experience. Such experience was then applied to domestic stadiums, the design quality of which has been substantially improved. When designing the aid stadiums, architects considered the requirements for holding international competitions to allow these mega-structures to adapt to the local context and environment and to comply with the culture and nationality of the recipient countries. With China’s BRI, many overseas stadium projects that are large in scale and high in standards will be planned and finalized. Research on the development history of China-aided stadiums from the perspective of architecture may provide a supplement for modern Chinese architecture and serve as a reference for future projects to become highly internationalized, localized, and adaptable.

Conflict of interest statement

No conflict of interest.

Acknowledgements

This paper was part of a study supported by the City University of Hong Kong under Project Nos. 7004966 and 7005135 and the National Natural Science Foundation of China under No. 51878584.

References


