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Climate, standard and symbolization: critical regional approaches in designs of China-aided stadiums

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\textbf{ABSTRACT}

Since the late 1950s, China has exported numbers of construction aid projects, among which stadiums occupy a considerable proportion and stand out from other types of China-aided buildings due to their unique qualities. These large-scale projects are located in different geographical and cultural contexts. Critical regionalism has been an influential architectural approach in designs of China-aided stadiums. Through a detailed analysis of case projects, site investigation, first-hand materials, and interviews with designers, the authors aim to explore and highlight critical regional approaches in designs of China-aided stadiums. Three categories of design approaches are revealed: bio-climate, standard-adaptive and symbol-oriented approaches. What design approaches Chinese architects prefer to use at different times and under different conditions, and what can be achieved by using such approaches are also explored. This paper tries to supplement the current scholarship on Chinese architecture.

\textbf{ARTICLE HISTORY}

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\textbf{KEYWORDS}

China-aided stadium; critical regional design; architectural design; developing countries

\section{1. Introduction}

Foreign aid activities originated from America's "Marshall Plan" after World War II (Jeffery 2003, 128) and were continued by socialist countries headed by the former Soviet Union, which also carried out a variety of assistance projects in the developing world. Beginning in the early 1950s, China received a number of aid projects from the Soviet Union and other socialist countries. Later, China began to provide assistance to developing countries such as Asia, Africa and Latin America to catalyze diplomacy and economic development (People's Republic of China State Council Information Office 2011; Brautigam 2008). Currently, China has provided assistance to over 100 countries in more than 2,000 completed projects and has completed over 1,400 buildings, including government offices, parliament buildings, convention and exhibition centers, stadiums, theatres, schools, hospitals, libraries, railways and railway stations, etc.\textsuperscript{1}

Of China's foreign aid constructions, sports facilities constitute a considerable proportion (The Ministry of Commerce of China 2011), together with equipment and technical assistance (Yu and Yuan 2010). Stadiums (both outdoor and indoor) are a main construction category of these sports facilities. In fact, the number of China-aided stadiums has generally been on the rise, especially in the twenty-first century (Figure 1), when the construction of sports buildings increased in China for the 2008 Olympic Games and abroad because of China's commitment to donating stadiums to the developing world. By the end of 2018, the number of China-aided stadiums had exceeded 100 (Xue et al. 2019).

The magnitude of China's foreign aid has attracted the attention of scholars, who have mostly focused on the political and economic aspects of this aid (Copper 1979; Brautigam 2011; Will 2012; Menary 2015; Niu 2016; Dong and Fan 2017) or the relationship between the allocation and benefits that China subsequently might
achieve in various regions (Naim 2007; Noragric 2011; Kilama 2016). Few studies have been conducted on China’s construction aid (Amoah, 2016), let alone aid specifically for stadium construction (Ding and Xue 2015; Chang and Xue 2018; Chang, Xue, and Ding 2019; Chang and Xue 2019a, 2019b, 2019c; Xue et al. 2019).

As the most significant type of sports building, stadiums are among the costliest, most technically demanding, most urgently needed and scarcest type of building for most recipient developing countries. Moreover, stadiums are among the most popular and longest-lasting aid projects, and sports, cultural and political events held in these venues receive national and worldwide attention. Moreover, the large-scale, complex structure and recognizability of stadiums generate more far-reaching influence, thereby increasing the significance of the discussion and research about this particular type of aided building. China-aided stadiums are located in countries and regions, specifically Asia, Africa, Latin America and the Oceania, with disparate geographies, climate, levels of urban development, human histories and other complex factors. Designed by architects – many of whom were the principal architects – from China’s state-owned institutions, these overseas aid constructions represent the exportation of modernism (Ding and Xue 2015; Chang, Xue, and Ding 2019; Chang and Xue 2019a) and design that was state-of-the-art for the period. However, unlike designing China’s domestic stadiums, the environment and contexts of which are more familiar to Chinese architect, designing overseas stadiums for a remote area provide opportunities and challenges for Chinese architects. Whether these exported buildings are in harmony with local characteristics, and whether they respect for the importance of the relationship between architectural and regional factors, such as environment, city and culture, are significant issues during the design.

The authors argue that even with sophisticated technology and a long-span complex spatial structure, stadiums can be designed while considering the regional and local context and can become a tool for place making. Under modernization, critical regional design of these cross-border stadiums has significant meaning because of the correlations among the natural climate, the site environment and the urban context. How the Chinese architects expressed their ideas in these cross-border mega-structures and how Chinese architects tried to implement the critical regionalism, given their understanding and unique background, are interesting topics that constitute an indispensable chapter of modern Chinese architecture.

From this point of view, this paper aims to explore and highlight different critical regional approaches to designing China-aided stadiums through a theoretical and practical analysis of representative cases; this paper also aims to summarize common methods and provide guidance for future architectural designs for cross-border constructions. Based on interviews with the designers (and the engineers involved) and on-site investigations, this paper is structured as follows: the subsequent sections provide a background introduction, a literature review, a definition of the problem and three categories of cases. The aim of this paper is to fill the academic gap in the study of sports buildings and Chinese, Asian and African architecture.

2. Critical regionalism of stadiums

Architecture needs to be rooted in regional material and cultural environment to be vital. Regional design in
architecture received attention during a period when the International Style was being severely questioned. Alexander (1977) criticized the sameness of architectural style, pointed out that local construction is the regular construction and generation of site features, and emphasized the restraint and importance of contexts (urban environment and local architecture), to establish his theory about generative grammar and piecemeal growth. The phrase “critical regionalism” was initially coined by Lefaivre and Tzonis in the 1980s and later developed by Frampton (2003) to reach further elaboration. Specifically, the critical regionalism can be defined as an architectural approach that strives to counter the homogeneity inherent in modernist architecture (Henrique 2013; Slessor 2000). Such homogeneity can be achieved by being sensitive to the local climate and technologies, and by the appropriate expression of the local culture. Lefaivre and Tzonis (2003) also summarized the critical regionalism exploration of modern and contemporary concrete architecture, which illustrate general approaches of regional design under modern and contemporary circumstances. The practitioners of critical regionalism seek to integrate global architectural and technological developments with regional sensibilities derived from spatial, cultural and historical contexts (Yeang 1987, 28).

Critical regionalism differs from regionalism by not resorting to the blind use of vernacular (Henrique 2013). Critical regionalism seeks to balance local needs and capabilities with the progressive lessons of modernization. By being critical of a region’s building traditions, a practitioner is able to extract only the essence of these traditions rather than literal references (Lefaivre and Tzonis 2003, 10). Furthermore, critical regionalists despise post-modern architecture for applying eclectic historical references to contemporary works without considering whether the references are appropriate (Mehrotra 2011, 122). The complex structure, techniques and modernized appearance of stadiums increased the difficulties of appropriated considering regional context in the architectural design. Sports buildings must normally meet the requirements of international or specialized sports competitions and trainings, and the international and modernist style and structural expression seem to be preferred for stadium design.

In terms of the design practice of mega-structure architecture, such as the stadiums, with the return of technical rationality since the 1980s, the theoretical practice has been characterized by the coexistence of internationalized mainstream of modernity and diversified pattern. The exploration of critical inheritance of culture has become a new force of diversified pattern. There are architects that insist on the critical regionalist exploration of large-span sports architecture. These architects consequently generated excellent works. For instance, the Yoyogi national stadium (in Tokyo) designed by Kenzo Tange in 1964, that combined science and technology, national aesthetic taste and traditional architectural forms. Kenzo Tange used the expressionist method of modern structure to integrate the “suspension bridge” and shrine in the traditional Japanese culture into the design, and adopted Japanese traditional pattern “tomoe” as the form of the roof. The stadium’s special structure and material represent Japanese cultural in a modernized and unique way. Seoul’s new stadium for the 2002 World Cup in South Korea was another example; design elements of this stadium imitated symbols found on roofs in Korea’s traditional architecture (Suo 2003). In 1990, when the Asian Games were held in Beijing, architect Ma Guoxin and his team tried to express the traditional Chinese “big roof” architectural style in the design of the main stadium and indoor gymnasium (Ma 2002). These examples demonstrate that large-span sport buildings, if well-conceived, can reflect local identities and thus further instill pride in local people by reflecting multiple types of critical regional design approaches (Figure 2).

3. Critical regional approaches in designs of China-aided stadiums

Critical regional approach in designs of China-aided stadiums have unique characteristics. Designed by architects from state-owned enterprises in China, these stadiums need to satisfy government requirements and special requirements negotiated by China and the recipient countries because the design is part of a political mission (Chang and Xue 2019a). Therefore, the designs of these overseas stadiums defer from commercial designs, or designs by their local architects. Additionally, designs of these overseas stadiums varied due to local climates and the development levels of the recipient countries. These designs also hold various attributes of critical regional designs in different times for structure and technology development of sports buildings worldwide.

To explore the critical regional approaches in the design of China-aided stadiums and determine the cases we focus on, our research started with a literature review of reports and publications. Then, we interviewed architects and other technicians involved in these projects and conducted site investigations abroad for these cases. Based on first-hand materials and theoretical and practical analysis of over 70 China-aided stadium projects, we found that the design approaches can be grouped into three categories: the bio-climatic, standard-adaptive and symbol-oriented regional design; these design approaches will be explained and illustrated separately in the following paragraphs. Therefore, we may clearly determine which approaches Chinese architects prefer to use at which times and under which conditions; we may also determine what can be achieved by using such approaches.
3.1. Bio-climate regional design: early period

In the design of China-aided stadiums, bio-climate thoughts were usually considered first which was obvious in Chin-aided stadiums in the early period, especially before the 1990s, when both the recipient countries (most in Asia and Africa) and China were in low developing levels. Chinese architects favored the use of low passive technology in the design of China-aided stadiums in accordance with the significant factors of climatic and natural elements, such as sunlight and wind. This was sometimes requested by the recipient countries, for their low development level and difficulties in affording the use and maintenance of mechanical ventilation. The economic and infrastructure development are relatively low in these developing countries, where sometimes the power supply is highly unreliable. In addition, although China had donated the aided constructions that was utmost or even beyond the nation’s capability, the economy is still one of the primary considerations during the initial period of foreign aid. Through considered arrangements of architectural design elements, such as layout, orientation, space and materials, these natural elements were utilized appropriately with the application of natural ventilation, shading and other technologies.

For example, the China-aided indoor stadium (Figure 3) in Samoa built in the 1980s reflects such critical regionalism; this stadium uses low passive technologies utilized in modern language to adapt to the local weather. This 1000-seat indoor stadium was designed and constructed to host the 7th South Pacific Games in 1983 soon after the independence of Western Samoa; the stadium contains a track field, a stand for 2000 spectators, a rolling course and a rest room. Architect Ai Binggen from Jiangsu Provincial Architectural Design Institute, considered the venues’ local and climate conditions in the design. Although mechanical ventilation equipment was installed in the stadium, doors and windows of each room was carefully arranged to achieve better airflow, and special local-style hollow pattern on the external walls of the rest platforms was used to generate natural ventilations. In addition, this pattern added ethnic characteristics to the facade. Light steel truss structures constitute the four-side awnings, and the middle roof area is opened to introduce more natural air. A white roof was used to reduce the heat from solar radiation. Insulation was added to the roof panel to improve the effect of heat insulation and cooling. Light yellow walls with a dark green cornice contributed to the building’s harmony with its natural environments (Ai 1987, 28–29).

Such low passive technologies were commonly used in China-aid stadiums, especially in Africa or other tropical regions, where natural ventilation weighs more over mechanical ones, as used in the design of the main stadium of the Moi International Sports Centre in Kenya (Figure 4). The stadium is petal-shaped. The spaces between the adjacent petal parts form large holes between the stands and the roof to introduce more natural ventilation while spreading the sound of the lively competition happening inside to
the outside. In addition, hollow space grid windows, each made of a concrete frame, were widely used as the façade of the main entrance hall, low-floor rooms and other interior transport space, which effectively balanced the sunshade and ventilation required by the local climate.

According to our interviews with the chief engineers and managers from China Sports Industry Group (CSIG), a state-owned enterprise that operates and consults for most of these aid stadium projects, both the recipient countries and the Chinese government greatly encouraged the use of these adaptive technologies in the design of the stadiums for the good cost performance and effectiveness of these technologies. These benefits of adaptive technologies why Chinese architects preferred low passive techniques in the bio-climate regional design approaches in designing of these oversea stadiums.

3.2. Standard-adaptive regional design: development period to present

According to the regulations by the Ministry of Commerce of the People’s Republic of China (MOFCOM), the design, management and construction of all foreign aid projects must comply with Chinese standards and Chinese building codes. This requirement generates conveniences for Chinese technicians’ work and for the exportation of Chinese products and labors abroad. In fact, the stadium projects in early times were basically assigned by Chinese government to some core state-owned design institutions and the absolute using of Chinese standard was a matter of course that the architects never doubted. However, by the late of twentieth century, feedbacks from constructed China-aided stadiums aware Chinese architects and problems and conflicts had generated after being put into use for years. This reminds Chinese architects the challenges of adapting Chinese standard to the recipient countries when design these mega-structures. In addition, the opening of market system in China’s economic reform spread finally to the aid construction mechanism by the early of twenty-first century. China-aided stadium projects stepped into the tender and bid mode. This also force Chinese design institutes and architects to carefully consider the adaptive of Chinese standard to make the design more satisfactory. For stadium projects in less-developed areas, where formal building standards barely exit, Chinese architects need to consider how to better integrate Chinese standards with local habits and customs. Some post-colonial countries still adhere to standards, most of which were European or American standards, that had been imposed by these countries’ former suzerains. Chinese architects need to pay special attention to dealing with the conflict between Chinese standard and others in the design process.
We refer to this adaptation as “standard-adaptive regional design approach”, which refers to the diligent efforts (as stated by most of the interviewees in our research) by Chinese architects to adapt Chinese standard to local circumstances, such as habits, specifications and criteria. Such adaptation is also encouraged in the “Eight Guiding Principles for Design”, proposed in the MOFCOM manual for China’s construction aid projects; among these guiding principles, “standard application” is listed first.

For instance, during the design of Tanzania national stadium, chief architect Jiang Hong from Beijing Institution of Architectural Design (BIAD) noticed the Tanzania’s preference for football games and the low frequency of international games and of track and field competitions; therefore, he chose to shape the stands with two straight east-west edges and two semicircles rather than the four circle-center shape commonly used in China’s large domestic stadiums to minimize the horizon distance between the audience and the football course. Because over 10% of the local population was disabled, the number of seats for disabled people was higher than that required by China’s barrier-free design standard. Two large special barrier-free ramps were also added to increase the convenience and capacity for traffic into the stadium (Jiang 2007, 50–55) (Figure 5).

Another interesting example is the newly constructed China-aided national wrestling stadium in Senegal (Figure 6); the attendance of China’s president, Xi Jinping, at the opening ceremony of the stadium during his visit to Africa in 2018 was broadly reported. There was no precedent or reference for such a large professional wrestling arena before the construction of this 20,000-seat wrestling stadium. There are no regulations for constructing wrestling arenas in China’s sports building standard3, nor were there any construction drawings of wrestling stadiums in China’s standard construction atlas that could be used as a reference4. In fact, Senegal’s traditional wrestling

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3The “Eight Guiding Principles for Design” includes “standard application”, “overall planning”, “investment matching”, “function priority”, “technological innovation”, “environmental protection”, “convenient maintenance” and “sustainable development”.

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Figure 4. China-aided stadium of Moi international sports center, Kenya.
(Source: Drawn by the authors based on pictures from Collection of Chinese Excellent Architectural Designs (5), 1999)
activity (called “lutte”) has unique processes and rules that are different from those of international wrestling. These conditions made applying Chinese or international standards to the design of this stadium difficult, and in some cases, adapting the design to these standards was impossible. Therefore, the designers had to learn the local standards and used modern sports/stadium technology in ways that considered local conventional habits.

The whole game process includes admission, preparation through lining up, a folk show, warming up of the players and competition in the central area. According to the process, the oval field was determined to be 108 m x 68 m and centred by a sand-filled 20-m-diameter competitive venue where two wrestlers compete with each other. One preparation area, two warming up areas and one performance area (which were also filled with sand) were located alongside this competitive venue. Since the ritual performance is also significant, ramps, made of hard plastic, for ritual folk custom shows and award presentations were arranged between the stands and the competition area to facilitate the interaction between contestants and the enthusiastic audience.

Nevertheless, the using of Chinese standards cause problems and doubts concerning the central control of the design and management process by the Chinese government; however, adopting the “standard-adaptive” critical regional approaches improved the situation and contribute to the accomplishment of these cross-border stadiums by reducing the conflicts between Chinese standards and the recipient countries by avoiding the problems that might appear.

3.3. Symbol-oriented regional design: the new era period

Symbol is one of the unique capabilities that humans. As Cassirer (1983, 43) mentioned, “no longer in a merely physical universe, man lives in a symbolic universe.” The symbol can be regarded as a clue to the nature of man (43–45). Thompson even use “symbolic conception” to describe culture: culture is the

Figure 5. China-aided Tanzania national stadium (Jiang 2007, 50–55).
pattern of meanings embodied in symbolic forms, including actions, utterances and meaningful objects of various kinds, by virtue of which individuals communicate with one another and share their experiences, conceptions and beliefs. (Thompson 1990, 856). In architecture, symbolization has been commonly utilized in form designs from ancient times to the postmodernism period as a clear approach to express local characteristics and to add regional attributes to the buildings.

Although some cultural or symbolized design approaches had been applied in some early China-aided stadiums (Chang and Xue 2019c), it was in recent years that symbolization have been extensively used by design firms and have been welcomed by the recipient countries partly because of structural and technological improvements that enable the creation of mega-symbolic forms. As the first modern sports venues (or the first high standard and modernized stadiums) built in their respective countries, these stadiums were designed for holding international sports events. Therefore, these stadiums were expected to be a symbol of their respective nations. In addition, the aid mechanism of China-aided projects constantly changed so that in the new era, the recipient countries participate more in the final decision of the design scheme through tender and bid (Chang and Xue 2019a). The increasing national and cultural awareness of the recipient countries lead to the requirement of more expression and symbolization of their culture and nation in designs. Chinese architects emphasized symbolic, metaphor forms, which could have helped win bid competitions.

A commonly used symbol-oriented regional approach in designing China-aided stadiums is the abstract metaphor and imitation of national artefacts. By displaying the characteristics of certain national objects, such as form and color, the stadium can become a colossal new totem of national culture (Xu 2010). For example, in 2015, BIAD won the bid for the new national stadium project in Abidjan, Cote d’Ivoire aided by China, with the concept of “African drum”. Located in the Olympic city of Abidjan, this large 60,000-seat stadium had to meet the requirements of various international competitions, such as track and field, football and rugby. As introduced by its chief
architect Liu Miao in our interview, the idea of “drum” suddenly occurred to him when he was watching one football game at night after work while relaxing from the anxieties of working on the design of the stadium. The devotion of Africans to local cultural and sports filled in the mind of the designer, and an appropriate concept was inspired occasionally by the sound of the game he was watching. The main image of this mega-structure looks similar to the recipient country’s national drum with local ethnic characteristics. The building’s facade was designed with orange interior walls, white rods and green plinth, which echoes the colors of the national flag and highlights the national image of the recipient country (Figure 7).

In addition, critical regionalism in the design of China-aided stadiums can be expressed through symbolic metaphor of natural elements with aesthetic handling. For example, the new China-aided national stadium in Costa Rica designed by the Central South Architectural Design Institute (CSADI), was shaped similar to the “sail of the sea”; this shape echoes the Costa Rica’s coastal geography and highlights the symbolic significance of this new landmark. In addition, Costa Rica is one of the most famous volcanic country with world-known active volcanoes, and its national emblem also has a volcanic logo. Therefore, the designer Li Fang chose to make a continuously wavy plate on the large arch structure of the stadium to symbolize the volcanos, thereby combining structure design and regional characteristics in the appearance of the stadium. The building is loved by the local people, and whether or not a match is being held, the sport park is full of people exercising and passing the time (Figure 8).

The symbolic metaphor can also be inspired by religious and traditional elements, as can be found in the design of Cambodia’s new national stadium aided by China. The stadium was designed by Chinese architects from China IPPR International Engineering Co. The design company’s use of the concept of “namaste” was preferred by Cambodia’s prime minister, Hun Sen, who was actually the final decision-maker in the choice of the winning scheme. In the design, giant bridge columns with special shapes were located at both ends of the north-south axis; these columns serve as the convergence support of steel cables of membrane roof (Figure 9). The complex structure imitates the hand gesture of “namaste”, which is a traditional Cambodian and Buddhist greeting. The accepting attitude by the recipient country reflects the country’s expectation that stadium projects be symbolic and regional.

4. Discussion

Bio-climate critical regional approaches were used more frequently in designs of China-aided stadiums of the early period, because of low development level of the recipient countries and economic limits from China. This category of approaches requires less on the structure, technology and material, and they are in line with the design level of Chinese architects during the time. Later, due to the economic development of China and the improvement of the infrastructure of the recipient areas, bio-climate approaches, such as the passive technologies, no longer lead the dominated role. Despite being used in some undeveloped areas, or in some small stadium projects, bio-climate critical regional approaches seem to off the table, or the supplement combined with other design approaches when Chinese architects design new China-aided stadium projects.

Unlike bio-climate ones, the standard-adaptive critical regional approaches are slightly passive that originated from China’s mandatory requirements of using Chinese standards for foreign aid projects. In fact, problems and conflicts were not recognized initially until

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**Figure 7.** China-aided stadium in Cote d’Ivoire (Source: BIAD).
years later in the acceptance, using, and maintenance of these stadiums. After the 1990s, China’s foreign aid areas expanded to more regions, even to some relatively developed countries (Chang and Xue 2019a). Different countries have various attitudes and requirements for using Chinese standards. Chinese architects have to pay attention to the adaptability of Chinese standards. This is also the adjustment that designers must make under the market economy of China and the environment of public bidding for foreign aid projects. This adjustment and adaptation achieved some obvious effects, but there were still problems


Figure 9. China-aided Cambodia’s new national stadium and its concept of “namaste”. (Source: drawn by the authors based on pictures provided by IPPR)
remained. From the interview, we learned that from 2018, MOFCOM tries to explore the possibility of “localization” in the design and management of China’s foreign aid construction projects. Some new projects under designing or tendering process have started to adopt local building standards. If this reform continues, standard-adaptive approaches may also fade away in designs of China-aided stadium project.

Although the Symbol-oriented critical regional approaches appeared also in later projects, it is positive approaches meeting the requirements (as required or in advance) from the recipient countries, which is similar with the bio-climate approaches from this aspect, but in a more obvious and radical way. Transition in architecture from modernism to post-modernism changed architectural contexts and generate influence on Chinese architects. With the development of structure and technologies in mega-structure construction, especially the extensive use of space structure and membrane structure, stadiums are transitioning from being simple concrete frame structure forms into diversified ones. With this technical support, Chinese architects are given more freedom and possibilities to create more vivid and complex forms for the stadiums. More importantly, after 2000 China’s aid mechanism was reformed, and representatives of recipient countries were invited to be one of the decision-makers. The recipient countries favor large-scale stadiums to be symbols of the country, the nation and culture. Chinese architects use this category of approaches as the main method to win customers’ satisfaction. Approaches carrying postmodernism, cultural expressions and cultural metaphors have gradually become mainstream. In addition, a stadium with symbolic meaning can also adapt to local building regulations and be climate friendly combined with bio-climate and standard-adaptive design approaches.

Here we summarized the critical regional approaches in designs of China-aided stadiums to better state the tendency and development, as shown in Table 1. This may help with the conclusion of our research explained later in the final part.

5. Conclusion

For the recipient countries, China-aided stadiums provide places for social, cultural or national, as well as sports, activities. However, the design of these megastructures did not attract much attention, or have not yet obtained high recognition (Flowers 2018). But through our research, we tried to analyzed them from the perspective of architecture and explore the design features behind these projects with special backgrounds and contexts. In the view of critical regionalism, three categories of approaches were used in designs of China-aided stadiums – bio-climate, standard-adaptive and symbol-oriented ones.

The three categories of critical regionalist design demonstrate the progress of the demand and design task, from economic functional (bio-climate), socially interventional (standard adaptation) to culturally expressive (symbolization). Bio-climate approaches with low passive technologies were used mostly in the early period, followed by standard-adaptive approaches to decrease problems caused by using Chinese standards after the 1990s, and then the symbol-oriented approaches to better satisfy the recipient countries in the new era. The emergence of the latter two may be regarded as the result of multiple factors such as the change of China’s foreign construction aid system, economic development of both the donor and recipient countries, and requirement of the recipient countries, etc.

In recent years, features symbolic of the recipient country’s cultural or national image tend to be more acceptable for the recipient countries, as stadiums have always become landmarks in the contexts and venues for national or cultural events. With the development of structure, technology and materials in the new era, more possibilities and variations have been given to forms of mega-structures. The symbol-oriented

### Table 1. The development of critical regional approaches in designs of China-aided stadiums.

<table>
<thead>
<tr>
<th>Critical regional approach category</th>
<th>Bio-climate approach</th>
<th>Standard-adaptive approach</th>
<th>Symbol-oriented approach</th>
</tr>
</thead>
<tbody>
<tr>
<td>Period (Early period before 1990)</td>
<td>Developing period to present (late the 20th century to present)</td>
<td>The new era (the 21st century, especially the recent 10 years)</td>
<td></td>
</tr>
<tr>
<td>Background</td>
<td>Early aid mode; Economic limit Low-passive technologies</td>
<td>Enter the market; Problems and conflicts Adaptation of China’s standard into the local environment</td>
<td>Tender and bid in aid projects; Discourse right from the recipient countries Symbolization (imitation) of national artifacts, natural elements and religious/traditional elements</td>
</tr>
<tr>
<td>Effect</td>
<td>Save the budget; Be adaptive to the local climate</td>
<td>Tender conflicts between standards, customs and habits</td>
<td>Help win the bid; Satisfy the recipient countries; Express culture and nationality</td>
</tr>
<tr>
<td>Representative case</td>
<td>China-aided indoor stadium in Samoa; China-aided stadium of Moi International Sports Centre, Kenya</td>
<td>China-aided Tanzania national stadium</td>
<td>China-aided stadium in Côte d’Ivoire; China-aided stadium in Costa Rica; China-aided Cambodia’s new national stadium</td>
</tr>
</tbody>
</table>
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