

Research and analysis of Olympic venue development and utilization

—Based on the examples of Barcelona, Sydney, Beijing and Rio Olympic venues

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<p>In every Olympic Games, those huge and beautiful Olympic venues are their unique symbols. However, after the revelry of the Olympic feast, the post-game operation of these venues has coincidentally become a worldwide problem. The huge volume of these Olympic venues, the huge maintenance cost, the difficulty of function development and the lack of utilization rate all make their reasonable operation another difficult and time-consuming challenge. Modern Olympic Games are accompanied by massive stadiums and Olympic parks, leading to increasing difficulties in the development and utilization of the venues after the games. This makes it necessary for the host city to consider the post-game development and utilization of the venues during the bidding and construction period of the Olympic Games. In many Olympic Games in the past, because the post-game development and utilization of the venues were not considered at the early stage of construction, the Olympic venues could not be reasonably utilized after the games, and the host cities were put into a heavy financial burden.</p> <p>The purpose of the research provides a theoretical basis and reference for improving the development and utilization of the existing and future Olympic venues through the research and analysis of the post-match development and utilization of the Barcelona, Sydney, Beijing, and Rio Olympic venues.</p> <p>The research takes the 1992 Barcelona Olympics, 2002 Sydney Olympics, 2008 Beijing Olympics and 2016 Rio Olympics as the research objects. Based on the definition of the Olympic venues, the definition of the development and utilization of the Olympic venues, and the historical evolution of the Olympic venues, the construction and competition of the Barcelona, Sydney, Beijing, and Rio Olympics are analysed through the publication of literature and comparative analysis methods. The history, current situation and characteristics of post-development and utilization.</p> <p>In response to related issues, the following suggestions are put forward: 1. Adopt a model of government-enterprise cooperation; 2. Undertake professional sports competitions; 3. Adopt a diversified operation model; 4. Introduce a professional management team; 5. Develop the public sports industry.</p>	
Keywords Barcelona, Sydney, Beijing, and Rio Olympic 、 Olympic venues、 Venue development and utilization	

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1 Introduction

1.1 Background

It is well known that the quadrennial Olympic Games is an international sporting event, and although it is only a short half-month event, its impact is enormous. This is because the Olympic Games are not only a way for countries to use sports to exchange their cultures, but also to promote mutual understanding among peoples. It has had a significant impact on many aspects of the contemporary world, including politics, economics, philosophy, culture, art and the media, which cannot be ignored.

The modern Olympic Games are accompanied by large-scale stadiums and Olympic parks, making it increasingly difficult to develop and utilize the venues after the games. This makes the host city to consider the post-competition development and utilization of the venues during the bidding and construction period of the Olympic Games. Looking back at the past Olympic Games, many countries hosting the Olympic Games have been burdened with a heavy financial burden due to the lack of post-game development and utilization of Olympic venues, high idle rate and high maintenance and upkeep costs. Even for a country, hosting the Olympics is a costly event.

The following figure shows Forbes (2016) statistics on spending on the Olympic Games since '92 (including the Summer and Winter Games), from the figure 1, it can see that the biggest spending is the 2014 Winter Olympics in Sochi, Russia, which finally reached \$21.8 billion. And even the lowest expenses are not less than 2 billion dollars. On average, it costs about \$6.5 billion to host an Olympic Games. This is still a direct cost, some incidental costs, such as transportation, urban renewal, pollution control, etc. did not count.

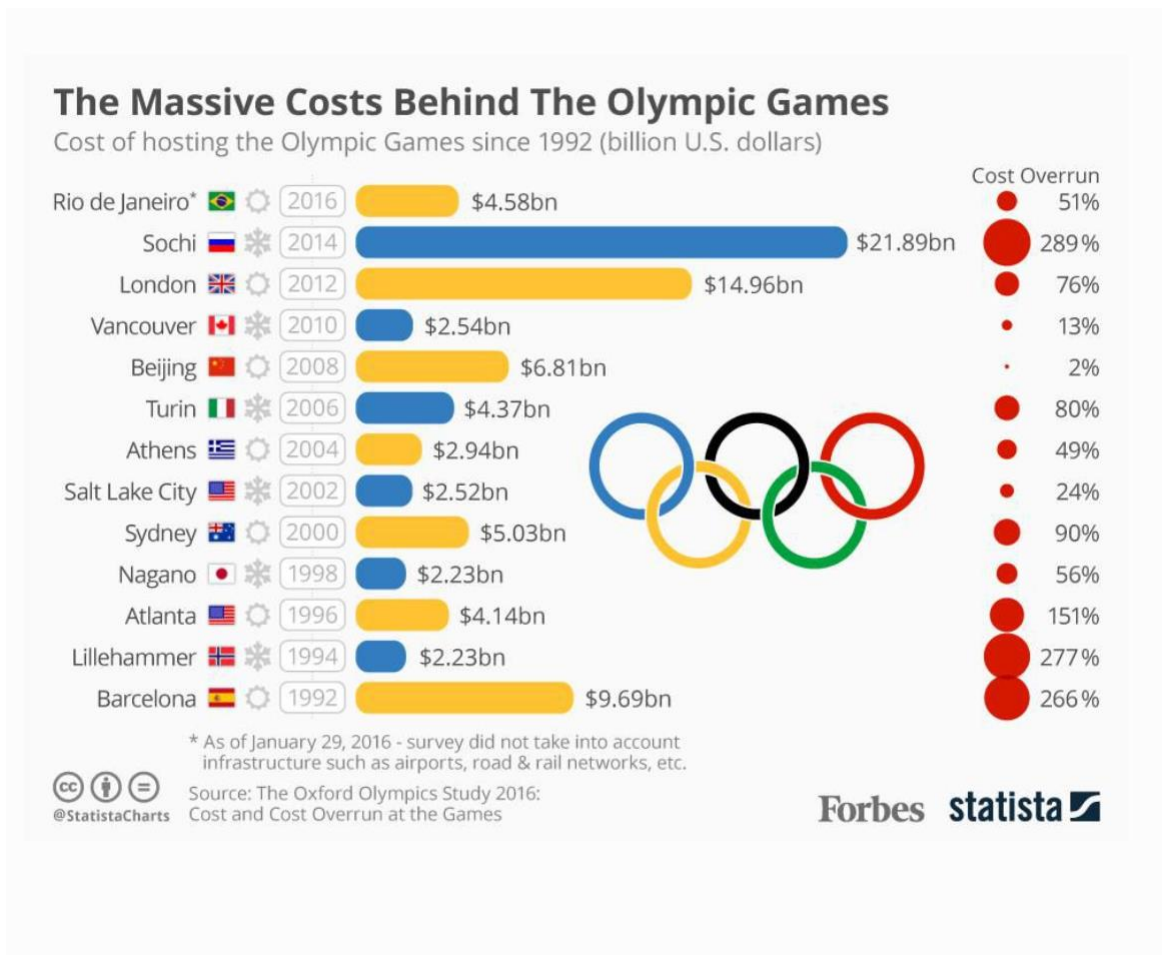


Figure 1. The Massive Cost of Hosting the Olympic (Forbes 2016)

Therefore, how to make the Olympic venues that cost a lot of money to build get reasonable development and utilization after the games is a crucial factor for the healthy development of the Olympic movement.

1.2 Purpose and significance of the research

In the history of many Olympic Games, due to the failure to consider the post-game development and utilization of the venues at the early stage of the construction of the venues, the Olympic venues built with a lot of money and labour before the games could not be reasonably utilized. Secondly, the host city will also fall into the economic downturn after the Olympic Games. The research of this paper selects Barcelona, Sydney, and Beijing Summer Olympics venues as the research objects. Through the analysis of various data and reports, description of the current situation and trend prediction, the aim of this study is to provide a reference model for the development and utilization of modern Olympic venues. At the same time, the research combines the current situation of post-competition development and utilization of three Olympic venues in Barcelona, Sydney, and Beijing

Olympic Games, and puts forward further suggestions for improvement to provide theoretical basis and practical basis for the post-game development and utilization of future Olympic venues.

2 The definition and historical evolution of Olympic venues

2.1 Definition of Olympic venues

Modern sports venues originated in the late 1880s, and developed by leaps and bounds after the 1960s. Stadiums are specially constructed indoor or outdoor sports buildings and sports buildings to meet the needs of sports competitions, sports training, sports entertainment, and sports culture. Most modern venues exist in the form of aggregates. Sports venues shall include indoor sports buildings and outdoor sports buildings. (Lin Xianpeng, 2006a)

Among them, the Olympic venues are large-scale modern sports buildings that carry various activities such as sports, culture, commerce, politics, religion, and entertainment (Lin Xianpeng, 2006b). Sports and related industries are divided into 8 categories. Among them, sports venues are listed as the second largest category. According to this classification, it can be clear that the Olympic venues have certain industrial attributes (China National Bureau of Statistics. 2008). One of the most prominent is that stadiums are an important platform for the integration and development of sports industry and cultural industry (Journal of Chengdu Sport University, 2009)

2.2 Definition of development and utilization of Olympic venues

In this article, the development and utilization of Olympic venues are mainly considered and suggested from two aspects. One is that the Olympic venues, as the legacy of the Olympic Games, have their unique scarcity and value; the other is that the Olympic venues as a product have a variety of commercial attributes that can be tapped.

In terms of the word development, development is a process of creating growth, progress, positive change, or adding material, economic, environmental, social, and demographic components. The purpose of development is to improve people's living standards and quality of life, and to create or expand local income and employment opportunities without damaging environmental resources. Development is visible and useful, not necessarily immediate, and includes an aspect of quality change and the creation of conditions for the continuation of the change (Society for international development, 2021).

Regarding the utilization rate, on the one hand, it is to improve the effectiveness of things or people; the second is to use means to make things or people serve themselves "Modern Chinese Dictionary Editing Office, Institute of Language Studies, Chinese Academy of Social Sciences (Fifth Edition) 2005"

Based on the above definitions and theories, this article will define the development and utilization of the Olympic Games as the use of its unique rarity to develop the Olympic venues as special spiritual and material products, including the development of venue functions and venue values. Develop different products and spiritual values to increase the utilization rate of the venues, so that the Olympic venues can exert their maximum effectiveness.

2.3 The historical evolution of the Olympic venues

2.3.1 The initial development stage of Olympics venues (1896-1919)

The Olympic Games is an international sports event that originated in ancient Greece. The original Greek Games were held every four years and lasted for hundreds of years until they were abolished in the early Christian era. The revival of the Olympic Games took place in 1896 and was held every four years thereafter, except during World War I and World War II.

Starting from the first Olympic Games in 1896, due to limited funding issues, it was difficult to hold the early Olympic Games, and the main stadium became the largest expenditure for limited investment. Under the condition of shortage of funds, the existing facilities or natural conditions are mainly used to meet the requirements of the game, and most of them are rebuilt on the abandoned stadium. This also determines the geographical dispersion of its Olympic venues. Because during this period, the World Expo was popular, and the country concentrated a large amount of manpower, material, and financial resources on the venues of the Expo, and did not give the Olympic Games resources to build the Olympic venues. For example, the first modern Olympic stadium was rebuilt on the ruins of the ancient Athens stadium, and the marble stadium was the main stadium for the first Olympic Games. The main venue for the 2nd Olympic Games was the racecourse of the former French Jockey Club. Because the World Expo and the Olympic Games were held at the same time, and the economic conditions at that time were relatively difficult, the Olympic venues were only borrowed from the former French Jockey Club in Blogny on the outskirts of Paris. As the main stadium, the racecourse has only 500 seats for the audience, so that the opening ceremony of the Olympic Games was not held. Until the 1908 London Olympics, the White City Stadium was the first stadium built specifically for the

Olympics, and it was also the first comprehensive stadium in history, which also provided some standards for the Olympic building. (Suiqiang, 2018a, 29)

2.3.2 The rapid development stage of Olympic venues (1920-1979)

After 1920, host cities paid more and more attention to the impact of the Olympic Games. Government funding and donations gradually increased. At the same time, the increase in competition events and the improvement of the level of competition resulted in the addition of some other venues in addition to the main stadiums of the Olympic Games at this stage. The increase in the types and scale of the Olympic venues and the corresponding expansion of the scale of land use put forward higher requirements for the coordination of all aspects of the overall planning of the host city. At that time, supporting facilities such as transportation and communication were not yet developed. The most convenient way is to combine the site selection of the main stadiums to build other stadiums to form a concentrated sports centre. Supporting facilities and saving investment are very effective. For example, in the 1928 Amsterdam Olympics, the Olympic Centre contains many facilities such as Olympic stadiums, boxing arenas, and training venues. For the first time in the history of the Olympics, its structure and functions have shown the meaning of the sports centre. (Suiqiang, 2018b, 29)

At the same time, due to the decline of the World Expo, people's enthusiasm for the Olympics has increased. The host cities have paid more and more attention to the importance of the Olympics, and the host cities are willing to invest more energy and money to build large-scale Olympic venues. Therefore, at this stage, the construction of Olympic venues has entered a stage of rapid development. For the 8th Olympic Games, Paris overcame various difficulties and put forward a variety of plans and designs for the design and construction of the venues, and finally built the "Korombo" sports field that can accommodate more than 60,000 people. The main venue of the 9th Olympic Games, the Amsterdam Olympic Stadium also won the architectural medal of the Olympic Art Competition. In the middle of the stadium is a football field, and on the outside is a track and field track with a circumference of 400 meters. In the subsequent Olympic Games, the host city has carefully designed the Olympic venues. The scale of the Olympic venues has also become larger and larger. The versatility has been concretely reflected. The diversified elements of the building have been constantly highlighted, which has enabled the construction of the Olympic venues to enter a rapid development. Many stadiums at that time are still in use today. (Suiqiang, 2018c, 29)

2.3.3 The modern transformation phase of Olympic venues (1980-present)

From this stage, the Olympic Games entered a period of rapid expansion. The share of capital and competition land required for hosting the Olympics, as well as transportation, communications and other infrastructure equipment in the overall urban planning has increased sharply. The close relationship between the overall layout of the Olympics and the overall urban planning has surpassed the previous stage. Development, the layout of the sports industry, and the overall benefits of the entire society all play a pivotal role. (Suiqiang, 2018d, 29)

Because the continuous improvement of social productivity has promoted economic development, the significance of the Olympic Games during this period is more extensive and sacred. Various countries and governments are willing to spend more human, material, and financial resources on the Olympic Games. In the construction of Olympic venues, the characteristics of science and technology, humanities and fashion are more embodied. And during this period, the construction of Olympic venues is not limited to the city centre, serving the city residents after the game. The host cities of each Olympic Games have used their own sports facilities to transform and utilize their original facilities to varying degrees. For example, in 1992, the main stadiums such as Barcelona chose to re-serve stadiums that existed before the Olympics become. (Suiqiang, 2018e, 29)

In addition, drawing on the experience of the difficult operation and use of venues after the Olympic Games in the past, the construction of Olympic venues is more concentrated in urban universities, and the design and planning concepts of venues are more inclined to the full utilization of venues, namely the use of Olympic games and the comprehensive use of venues after the Olympics. Such a change can increase the utilization rate of the Olympic venues, reduce the cost of daily maintenance of the venues, and save resources. Many of the venues of the 23rd Los Angeles Olympic Games were built on university campuses. After the Olympics, various universities will operate the Olympic venues, so that the embassies and venues can be used in a sustainable manner. Sports facilities on university campuses occupies about 18%-30%. In addition to the needs of various universities' intercollegiate and even international sports games, the selective placement of Olympic venues in them can not only avoid redundant construction, but also maintain after the game. And utilization is relatively sufficient. For example, many venues and Olympic villages for the Atlanta Olympics are located in universities, and the Beijing Olympics has set up a table tennis hall on the campus of Peking University. (Suiqiang, 2018f, 29)

3 Research object and research methods

3.1 Research object

This paper takes the summer Olympic venues as the research object, focusing on three venues of Barcelona, Sydney, and Beijing Olympic Games.

3.2 Research methods

3.2.1 Literature method

This paper mainly refers to materials such as the official report of the Olympic Games, the China Knowledge Network, the library, and academic journals. This paper is mainly based on the official reports of the Olympic Games, the Chinese Internet, libraries, and academic journals. The article focuses on the terms "Olympic venues", "Olympic cities" and "post-competition venue utilization".

3.2.2 Comparative analysis method

This paper compares three venues of the Olympic Games in Barcelona, Sydney, and Beijing. It compares and analyses the construction and post-competition development and utilization of the different venues, as well as the management and operation modes among the venues, to find out the advantages and disadvantages among the venues and make suggestions for the development and utilization of the Olympic Game venues in the future.

3.2.3 Research framework and process

Table 1. Research framework and process

Time	
September 2020	Established research topic: Development and utilization of Olympic venues-taking Barcelona, Sydney, Beijing, and Rio Olympics as examples
October 2020- December 2020	Determine research methods and collect various types of data
January 2021- February 2021	Focus on the history, current situation and characteristics of the Barcelona Summer Olympics venue construction and post-match development and utilization.

March 2021-April 2021	Focus on studying the history, current situation and characteristics of the construction and post-match development and utilization of the Sydney Summer Olympic Games venues.
May 2021-June 2021	Focus on the history, current situation and characteristics of the Beijing Summer Olympic Games venue construction and post-match development and utilization.
June 2021-July 2021	Focus on the history, current situation and characteristics of the Rio Summer Olympics venue construction and post-match development and utilization.
August 2021-November 2021	According to the combined analysis of research objects and research methods, suggestions and summaries for the development and utilization of Olympic venues are put forward.

4 Discussion and results

4.1 Research and analysis of Barcelona Summer Olympics Venue construction and post-game development

4.1.1 Background of Barcelona Olympic Stadium construction and post-game utilization

Barcelona is the capital of Catalonia and the capital of the province of Barcelona in Spain, located on the northeast side of the Iberian Peninsula, bordering the Mediterranean Sea, and is known as the city of sports in Europe. Barcelona is known worldwide for its La Liga giants FC Barcelona. The successful hosting of the 1992 Summer Olympics not only gave Barcelona the opportunity to build and renew the city, but also to promote the development of tourism in the city. This led to tourism becoming the mainstay of Barcelona, which was one of the expected goals of hosting the Olympics at the time. As a result, Barcelona spent hundreds of millions of dollars to complete urban infrastructure projects such as airport expansion, municipal road renewal, beachfront beach maintenance and environmental facility upgrades to make full use of it. (Su Wang, 2008)

After the 1992 Olympic Games, Barcelona continued to thrive in tourism. The number of visitors to Barcelona increased dramatically. In 2016, the number of visitors reached 9,065,650 (see figure 2.) At the same time, high value-added industries such as design and trade became new growth areas for the city's economy. By hosting the Olympic Games, Barcelona has upgraded and transformed its industries, earned the name of "Design Capital" in Europe, and gradually become an economic centre that can have a greater impact on the European economy. (Barcelona tourism statistics, 2017a)

Hotel accommodation

	1990	1992	2000	2010	2015	2016
Number of hotels	118	148	187	328	381	408
Rooms	10.265	13.352	16.561	31.776	34.573	34.872
Beds	18.569	25.055	31.338	61.942	67.603	67.640

Number of visitors and overnight stays

	1990	1992	2000	2010	2015	2016
Tourists	1.732.902	1.874.734	3.141.162	7.133.524	8.303.649	9.065.650
Overnight Stays	3.795.522	4.333.419	7.777.580	14.047.396	17.656.329	19.162.580

Barcelona Airport passenger traffic

1990	2000	2010	2015	2016
9.050.380	19.809.540	29.209.536	39.676.366	44.121.218

Cruise passengers Port de Barcelona

1990	2000	2010	2015	2016
115.137	572.571	2.350.283	2.540.302	2.681.368

Figure 2. Barcelona tourism statistics (Architecture of the games 2017b)

Barcelona people have a high sense of identity for hosting the 1992 Olympic Games. This is because the city was regenerated by the Olympics, and the citizens could feel the improvements brought by the Games, which is the most important legacy of a major event. (China Youth Daily, 2013.)

4.1.2 The planning layout and construction of the Barcelona Olympic Stadium

The Barcelona Olympic Games are concentrated in four regions (see Figure 3.), Montjuïc Area, Diagonal Area, Vall d'Hebron Area and Parc de Mar Area, and 15 Olympic co-host cities. This layout facilitates the integration of urban transportation and government resources to drive the development of the region. The three main venues of the Olympic Games, namely the stadium, the sport hall, the swimming pool, and other sports facilities, are in the Montjuïc area. The stadium was built in 1927 for the International Exhibition

held in the city in 1929 (Cornudella & al.1992, 126). The Parc de Mar area was the most renovated area for the Games (Barcelona Olympic 2017), and was the birthplace of the Spanish Industrial Revolution. After the industrial area moved out, the area gradually became a place for household and industrial waste, and environmental pollution was very serious. Through the opportunity of hosting the Olympic Games, Barcelona completely cleared the railroad between the city and the waterfront, relocated all the factories, and built the metro line and the Olympic dock.

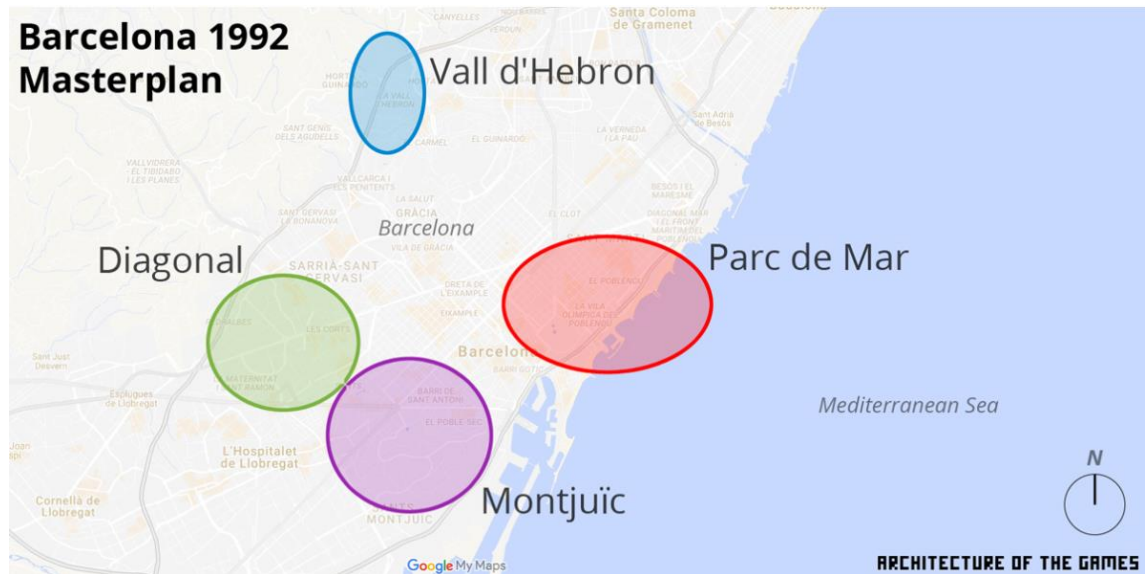


Figure 3. Barcelona masterplan and venue map (Architecture the Games 2017b)

In addition to the above, the Parc de Mar area is also developing sports, tourism, and other services, which will restructure the industrial structure of the area while completing the regeneration of the area. With the help of the urban renewal plan, Barcelona left a deep impression on the world during the Olympics.

4.1.3 Post-game development and utilization of the Barcelona Olympics

After the Olympic Games, Barcelona handed over most of the Olympic sports facilities to professional companies through a public tender process. The operation of these facilities required the creation of suitable programs for different groups of people at reasonable prices, providing enough convenience for everyone. By operating in this way, the usage of the venues is greatly increased. Many people even go out of their way to stand in long lines to get a relatively inexpensive season ticket membership to use the venues.

To the south of the Olympic Village, the government of Barcelona has created the "World Forum Cultural Activities Zone", which combines sports and culture in accordance with the construction of the Olympic venues. At the same time, the coastal area has been transformed by road, railroad diversion, factory relocation and beach management. This not

only made Barcelona a tourist and leisure destination, but also made Barcelona an internationally famous tourist city due to the huge advertising effect brought by the Olympic Games to the city. (Urban research, 2021a)

Since the 1992 Olympic Games, Barcelona has received an increase in the number of tourists from abroad every year, and tourism income has become one of the important sources of income for the city's residents. According to the 2019 Tourism Competitiveness Report published by the World Economic Forum (2019), Spain was named the most competitive tourist destination among 140 countries and territories, with its beautiful coast, unique gastronomy, and culture, topping the list for the third consecutive year. (World economic forum, 2019)

4.2 Research and analysis of Sydney Summer Olympics Venue construction and post-games development

4.2.1 Background of Sydney Olympic Stadium construction and post-game utilization

Sydney is located along the southeast coast of Australia and is the capital of New South Wales, as well as the most populous and densely populated city in Australia. As an international metropolis, Sydney has already established several stadiums that meet the construction standards of Olympic venues before hosting the Olympic Games. At the same time, good results have been achieved in all previous Olympic Games.

Homebush Bay, about 30 kilometres west of downtown Sydney and up the Parramatt River (Homebush Bay, was once the largest landfill in New South Wales. Since the 1960s, 9 million cubic meters of domestic and industrial waste have been landfilled there. There is not only have garbage buried underground, but dozens of hills of waste stand above ground, ranging from 13 to 28 meters in height. Among them, 160 hectares out of 760 hectares are heavily contaminated. After winning the right to host the Olympic Games, the government took the opportunity to use the construction of the Olympic venues to pull out this 'Sydney stain', investing 2.3 billion Australian dollars in environmental improvements. (Guangzhou Daily Ocean 2008)

Most of the venues in Sydney are very simple in design, using as little material as possible. At the same time, it is designed to be very flexible so that it can be easily dismantled

when changing its use without causing waste. Most of the permanent buildings and components are designed with longevity in mind, thus minimizing repair and maintenance; temporary buildings are designed to meet the requirements of use, without excessive use of high-grade materials. On the other hand, the venue has also built a comprehensive clean energy system. Firstly, solar power is used for the lighting of the stadium; secondly, rainwater collected by the rainwater receiving device irrigates the flowers and plants in the Olympic Park; finally, the stadium is designed with a natural ventilation design, without using any mechanical ventilation devices, and without using fluorine refrigerators or air conditioning units.

4.2.2 The planning layout and construction of the Sydney Olympic Stadium

The Sydney Olympics was the first Olympics to bring together the stadiums, athletes' village, press village and press centre in one area (see Figure 4.), avoiding the need for athletes and journalists to commute between their residences and the games.

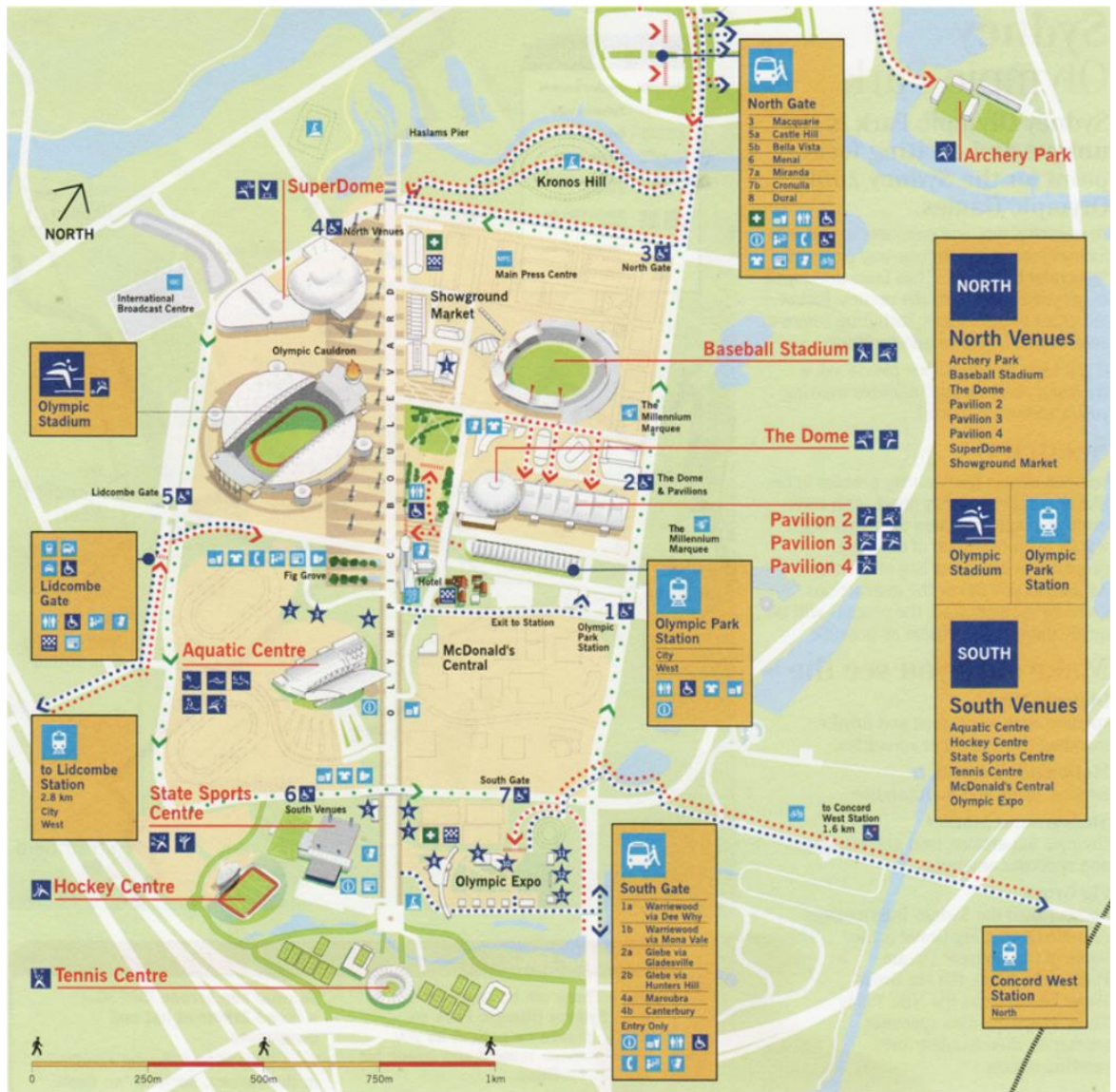


Figure 4. Sydney Olympic Park (Architecture of the Games 2014c)

The Sydney Olympic Park covers 640 hectares. The Park is positioned to be built as; a sports city, a learning community, and a sustainable community. The master plan aims to make the Olympic Park the new urban area of Sydney and to attract people to live there after the Olympic Games.

The Olympic Village, located to the northwest of Olympic Park, provides 2,500 homes for 300 groups, accommodating 15,000 athletes and officials during the Games and 5,000 residents afterwards.

4.2.3 Post-game development and utilization of the Sydney Olympics

The Athletes' Village in the Olympic Village was fully pre-sold prior to the Sydney Olympics. The Sydney Athletes' Village features 660 townhouses, 1,400 apartments and 500

temporary combination rooms, with a total capacity of 15,000 athletes and staff. When building this project, the organizing committee considered its post-competition use. Making it a living community that can accommodate 5,000 people. At the time of construction, the interior walls of each suite were designed to be detachable. Although athletes were only required to eat in the large dining area of the Olympic Village during the Olympics, the rooms were equipped with kitchen facilities in consideration of future use. During the Olympic Games, the government adopted a leaseback approach, renting the houses from the owners for the athletes to live in. After the Olympic Games, the houses are back to the owners. In this way, the vacancy and effective use of the houses are effectively avoided. After the Olympic Games, each room simply needs to be carpeted, repainted and kitchen appliances installed, and then it can be turned back into a normal residence. The Athletes' Village is now part of Sydney's Newington precinct, a community equipped with schools and shopping centres.

Similarly, in 2002, the New South Wales government sold the Olympic Park Press Village to Ostrander Properties for nearly \$100 million. The Village, which housed more than 6,000 journalists during the Olympics, was sold to be converted into 750 self-contained apartments.

And Sydney Olympic Park became a concentration of sports organizations after the games. For example, the Australian Football League Committee, the Paralympic Games, the Institute of Sport, and the Tennis Association all have their headquarters in the Olympic Park. In 2002, Sydney Olympic Park was successful in developing the title of the venue, and in 2008 ANZ Bank was awarded the title for seven years at a price of \$31.5 million. (Benton 2020)

4.3 Research and analysis of Beijing summer Olympics Venue construction and post-games development

4.3.1 Background of Beijing Olympic Stadium construction and post-game utilization

Beijing is an international city with history and modernization, and it has always been the pursuit of the Chinese people to host the Olympic Games. From the beginning of the Olympic bid to the holding of the Games, all people supported the hosting of the Olympics and everyone looked forward to the Olympics. In the late 20th century, with the deepening of China's reform and opening and the improvement of its comprehensive national power, China wanted the world to understand the real status of China in all aspects and change

the world's view of China. The bid for the Olympics became the best opportunity for China to present itself to the world.

China's national economic growth is largely dependent on coal energy. While it has lifted millions of people out of poverty, it has also directly caused rapid environmental degradation and haze to sweep through the cities. The route from Beijing to Shanghai is one of the most polluted areas in China, where 10 percent of the land area produces 34 percent of China's PM2.5 emissions (China power team 2018). China also hopes to use the Beijing Olympics Game as an opportunity to improve the air quality in Beijing and its surrounding cities.

4.3.2 The planning layout and construction of the Beijing Olympic Stadium

The construction of the Beijing Olympic venues was based on the objective situation of rapid urban development and the main direction of urban development, as well as the need to meet urban environmental planning objectives and the effective use of post-competition facilities. Based on the above requirements, the Beijing government, based on several factors such as return on investment, urban development direction, site conditions, urban layout, environmental protection, and post-competition utilization, located the main sports venues for the Olympic Games in the northern part of the city where the current economic situation and future development conditions are better.

The overall planning of Beijing Olympic Park covers an area of 1159 hectares and is divided into three parts: north, centre and south (Baidu 2021). The Olympic Stadium, National Swimming Centre, International Convention Centre, Tennis centre and Olympic Village are among the Olympic venues and related facilities to be built in the Olympic Park (see Figure 5).

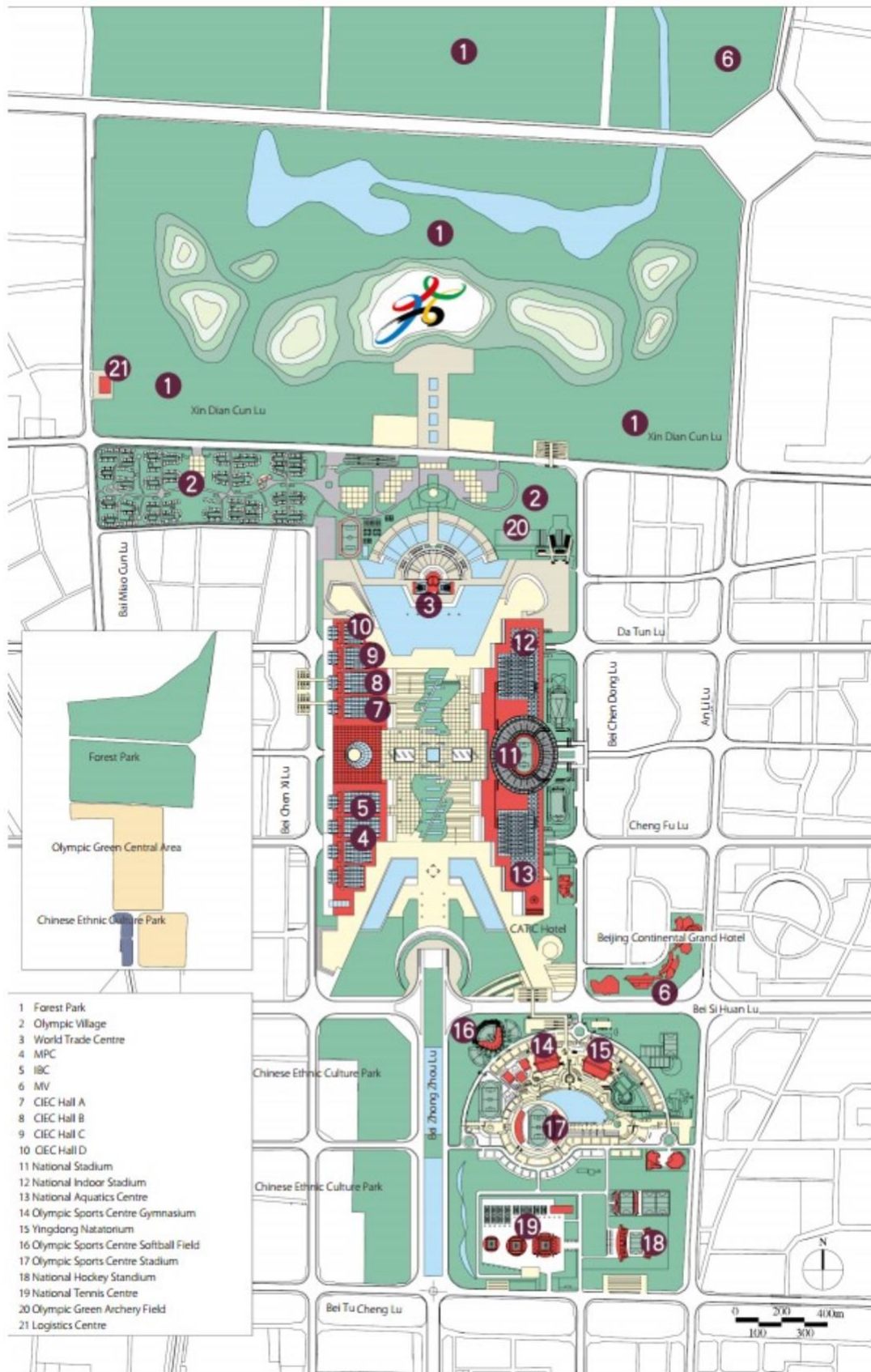


Figure 5. Thought on Beijing's Map of the Olympic Green (Zucube 2016)

4.3.3 Post-game development and utilization of the Beijing Olympics

The Beijing Municipal Government attaches great importance to the development of Olympic venues. At the early stage of the construction of the venues, full consideration and unified planning was given to the overall layout, post-competition utilization, public demand, community support and market operation. After the games, the Olympic Park Management Committee was also established, which is specifically responsible for the development of the resources of the Beijing Olympic Park venue complex. Insisting on sports characteristics and diversified integrated development is also the new idea of Beijing Olympic venues' operation. China National Stadium has hosted major sports events such as the Italian Super Cup soccer tournament, the International Football Invitational Tournament, and the ROC World Car Championship; at the same time, it has also held various large-scale concerts and the large-scale landscape opera Turandot, with more than 200,000 people watching the performances, and developed as many as 150 licensed commodities. The National Swimming Centre actively introduces many large events such as FINA Short Pool World Cup Series and World Diving Series; on the other hand, it also creates a social welfare service platform and participates in environmental protection, love donation and other public welfare activities in the form of providing venues and services free of charge. The National Tennis Centre has made efforts to make the China Open a long-term venue, and the China Open has been upgraded to a top eight tournament in the world. The creation of resident performances with independent brands and the creation of four seasons of diversified large-scale activities is the "Chinese" exploration of the National Stadium to try to solve the post-competition operation problems of the main stadium of the Olympic Games. According to the "festival, season, week, meeting", the National Stadium actively plans large-scale cultural and sports activities and resident performances with independent brand characteristics. Among them, the social and economic benefits of "Bird's Nest Snow and Ice Season", "My Olympic Children's Experience Centre" and "Bird's Nest - Attract" are particularly outstanding, especially the "Bird's Nest Snow and Ice Season" is a model for the winter operation of the world's main Olympic stadium.

4.4 Research and analysis of Rio summer Olympics Venue construction and post-games development

4.4.1 Background of Rio Olympic Stadium construction and post-game utilization

In October 2009, the International Olympic Committee announced at the 121st plenary meeting that Rio de Janeiro had won the right to host the 31st Summer Olympic Games, referred to as the Rio Olympics. It was held in Rio de Janeiro, Rio from August 5 to 21,

2016. It was the first time the Olympic Games were held in a South American country in 120 years since the founding of the Olympic Games in 1896. (Wikipedia 2021)

For this reason, Rio's domestic and international communities have paid more attention and expectation to this Olympic Games. Before the successful bid for the Olympics, according to the results of a separate poll conducted by the Rio de Janeiro Organizing Committee and the International Olympic Committee (IOC) on June 19, 2009, Rio de Janeiro's support rate for Olympic applications was 85%, the same rate as Madrid. The highest candidate city. (China News Network, 2009)

In order to guarantee the smooth holding of the Olympic Games, the city of Rio has newly built expressways, rapid transit, subways, urban light rail and other lines, which are currently in good operation. Rio International Airport has been expanded, boarding gates have been increased, more restaurants and shops have been built, making Rio's gateway more modern. (Xinhua net, 2017a)

It is particularly worth mentioning that Metro Line 4 is a dedicated Olympic line. This metro line has the highest utilization rate after the Olympics, and it connects the central area of the city and the main Olympics area of Baja. The expressway connecting the Deodoro Division and the main Baja Division is the second toll highway in Rio. Rodrigo Vieira, Minister of Transportation of Rio City, said that Rio has no new roads for nearly 20 years, and the newly built roads taking advantage of the Olympic Games have greatly eased the traffic situation in Rio. (Xinhua net, 2017b)

The Rio Maua Pier, which was renovated because of the Olympics, has changed from an area where homeless people once lived to a new tourist area. Visitors in front of the Museum of Tomorrow line up every day, and the Olympic Avenue is full of tourists. There are also couples who come here to take wedding photos and art photos. The bars and exhibition halls converted from the old wharf warehouse have also become the venue for art exhibitions and cultural festivals. On New Year's Day in 2017, many celebrities posted photos of New Year's Eve when they came to the bar here. The Olympic torch not far away permanently stays opposite the cathedral, and it is also a must-see attraction for tourists who come to Rio to take photos. (Xinhua net, 2017c)

4.4.2 The planning layout and construction of the Rio Olympic Stadium

The venues of the Rio Olympic Games formed four divisions: Maracana Division, Copacabana Division, Barra Division, and Deodoro Division.



Figure6 .RIO 2016 Maps, (Architecture of the game 2013d)

There are 33 venues open for use in the Olympic Games, of which 18 are existing buildings, 8 are newly built venues, and the other 7 are temporary venues that will be demolished after the game. Most of the stadiums are located in the downtown area of Rio. And there are 5 stadiums located outside Rio. They are all existing stadiums and are used for football matches. (Gang Li, 2016)

The Barra competition area is located in the southern part of Rio. The competition area is close to the ocean and has beautiful beaches. It has 8 sports venues and undertakes cycling, judo, basketball, weightlifting, gymnastics, fencing, diving, badminton, synchronized swimming, boxing, Golf, handball, and other competitions.

The Copacabana competition area, located in the east of Rio City, is surrounded by many attractions in Rio. It attracts tourists from all over the world every year. The competition area has 4 stadiums to undertake rugby, equestrianism, design, Hockey, mountain biking, and other games.

4.4.3 Post-game development and utilization of the Rio Olympics

The main area of the Olympic Games is the Barra Olympic Park. From January 21, 2017, the Olympic Park is open to the public on weekends and holidays, and has become a place for people to relax and entertain. According to the design of the year, the leisure area has a total area of 250,000 square meters, including gardens, sports equipment areas for the elderly, artificial turf courts, and children's roller-skating venues. The Maracanã Stadium, the opening and closing venue of the Olympics, which has been abandoned from the Olympics to the beginning of 2017, was reopened after the start of the Rio Football League. In addition, Maracanã is also a "pilgrimage site" for many tourists from all over the world to Rio. Major hotels in Rio can help tourists book Maracanã tickets, even if there is no match day. Make an appointment to visit. (Yan Zhao & Weihua Chen, 2017a)

Before the Olympics, the Rio municipal government has many good ideas. However, due to the financial crisis in Rio, especially the Rio state government, the completion of the project will take time.

The swimming pool and the future stadium in the Olympic Park are temporary facilities, and they are planned to be demolished and moved elsewhere after the Olympics. In the future, the dismantled materials of the stadium will be used to build four public schools, but the demolition work has not yet been carried out due to insufficient funds. (Yan Zhao & Weihua Chen, 2017b)

The Deodoro competition area was built for the Olympics and the extreme park for mountain bikes and BMX projects. After the Olympics, it was converted into a mass summer water playground according to the plan. It was opened to the public in September 2016, but due to funding problems, and closed again at the end of 2016. The BRT line connecting the city centre and Deodoro was not completed before the Olympics. It was originally planned to restart after the Paralympic Games in September 2016, but it has been shelved due to insufficient funds. The desilting project in Guanabara Bay was criticized before the Olympics. During the Olympics, the municipal government took special measures to intercept rubbish to ensure the water quality of the competition waters. But after the Olympic Games special measures were lifted, the pollution problem has not been eradicated. (Yan Zhao & Weihua Chen, 2017c)

4.5 The relationship between the construction of Olympic venues and post-game development and utilization

4.5.1 Public-private partnership between the construction and post-game development of the venues

The government and private sectors or companies establish "partnerships" in the Olympic venues and services system. In general, the construction and post-competition development of Olympic stadiums involves outsourcing of services, outsourcing of operations and maintenance, joint-ownership organizations, and concessions. For example, the Barcelona Olympics delivered most of its sports facilities to companies for operation through public bidding after the Games; Ali Sports, a subsidiary of Alibaba, signed contracts with the National Stadium and National Aquatics Centre of the Chinese Olympics in 2016. The contracting parties will combine their respective resource advantages to develop the "international network + sports" and "venues + international network" topics in depth. Ali Sports will cooperate with the National Gymnasium and National Aquatics Centre in the areas of information integration and Internet applications, intangible asset development, large-scale events, cultural and entertainment activities, and national fitness events.

4.5.2 The construction of the Olympic Park and the post-game development is an opportunity to integrate urban development

The Olympic Park is essentially a park-like integration of various Olympic venues and facilities, and a model of large-scale, centralized venue space layout. Since the first modern Olympic Park appeared in the 1952 Helsinki Olympics, to the 2008 Beijing Olympics. Most Olympic Games host cities have established Olympic parks. In terms of post-game use, the Olympic Park can attract large crowds and expand the frequency and scope of use of the stadium by combining people's daily leisure and tourism activities, thus achieving better economic returns. Moreover, the Olympic Park can combine the stadium with local traditional culture and festivals to become a large gathering place or leisure activities, creating economic and cultural benefits from it.

4.5.3 Infrastructure is important for venues construction and post-game development and utilization

The key to achieving the perfect integration of venue construction and post-game use is to plan the construction of the venues according to the post-event use needs, especially the post-event use of the venues and the direction of their operation. In this regard, Barcelona, Sydney, and Beijing are all successful examples. The key to their success was to invest in improving transportation facilities at the beginning of the Games. The benefits of

this are that it reduces the logistics and time costs of building the venues before the games; it facilitates transportation for athletes, journalists, and spectators during the games, which enhances the favourability of the Olympic Games; and it reduces the transportation costs for visitors after the games, which enhances the visitor experience.

5 Olympic venue development and utilization proposals

5.1 The venue should be positioned for post-competition use at the beginning of construction

Multi-purpose use model, the Olympic Games in the construction of Olympic venues in the process of the full consideration of the post-competition use, while combining the urban ecology of multi-functional design. For example, the Barcelona Olympic Games took into account the construction of the coastal tourist area when planning and building, and the roads in the coastal area were renovated at the early stage of the construction of the venues; the athletes' village of the Sydney Olympic Games was planned to be sold to local residents after the Olympic Games before construction, and kitchen facilities were installed for the apartments in advance during the construction of the sports village. After the Olympic Games, the apartments can be used for various sporting events, concerts, exhibitions, etc., or auctioned as residential houses.

5.2 The Post-game management model: The post-competition management of the Olympic Games will be led by government departments

5.2.1 Resource allocation

The post-game management led by government management has the strongest resource allocation ability, which can combine the integrated development of stadiums with urban planning and other industries after the games, and make macro-control according to the development situation and demand. But the government department-led management does not mean that all countries set up special administrative departments to be responsible for management, some countries set up special authorities, such as Sydney and Beijing; more national cities set up state-controlled state-owned enterprises to manage the operation of the venues, such as Barcelona.

Sydney is an example of a dedicated administration set up on behalf of the government after the games. The New South Wales government changed the Olympic Coordination Bureau to the Sydney Olympic Park Authority after the Sydney Games. Its work can only change from stadium construction to Olympic Park management, and it is also responsible for the operation and management of major Olympic Park assets, land, planning, business development and other things.

5.2.2 Operations Management

Since the Olympic Park requires a very large sports complex, in addition to the upkeep and maintenance of the venues, there are a large number of supporting facilities. It requires a very high burden of operating costs in post-game management and its financial risk is high. The government, as a city manager, has a very high risk tolerance and is well positioned to seek the welfare of sports for its citizens and enrich people's urban life. The disadvantage is that poor operation may lead to financial deficits and opposition from taxpayers. Therefore, in the future, Olympic venues, while government departments are the leading management, private companies will also be introduced to participate, and the government and private companies will jointly participate in the post-game development of Olympic venues.

5.3 Foster new industries in the host city through the construction of Olympic venues and post-game development

The construction and post-competition operation of Olympic venues can drive the economic development of the surrounding area, integrating the city's related industries and enterprises to form economies of scale. This will reduce management costs, and the expenses for post-competition venue maintenance and upkeep can be shared among businesses. After the Olympic Games in Barcelona, the Olympic Port and the nearby 5 km stretch of beach are open to citizens and visitors free of charge. At the same time, a business district of Spanish restaurants, high-end hotels, large casinos, and specialty cafes was built in conjunction with local entrepreneurs, and it soon became a haven for surfers and sunbathers.

5.4 Focus on intangible asset development of Olympic venues

Olympic venues are different from general stadiums and have unique Olympic cultural values, so Olympic venues themselves are an intangible asset brand. After the games, the management should focus on the development of stadium advertising, naming rights, licensed products, and other projects. It is estimated that in recent Olympics, the revenue of related licensed goods reached ten percent of the overall revenue of the Olympics, and the contribution of mascots is more than half of the related licensed goods. As the revenue of the mascots of the Sydney and Athens Olympics both exceeded \$200 million, the Beijing-related units estimated that the revenue of the 2008 Olympic mascots could exceed \$300 million (Public Television Service Foundation 2011). In addition, Telstra won the title of Sydney Olympic Stadium in 2002, and the name of Sydney Olympic Stadium was changed to "Telstra Stadium", making Sydney Olympic Park out of the gloom of continuous losses.

5.5 Planning and design of Olympic venues and standards should be moderate

In the planning and design of Olympic venues, we should prevent over-standard construction, over-standard services, and over-standard expenditures; share the competition venues as much as possible under the rules of the competition and the conditions of the venues; strictly limit the scale of new venues to prevent the economic burden of maintenance and upkeep of the huge venues after the competition.

6 Conclusions and suggestions

6.1 Conclusions

Olympic venues belong to large sports buildings, which are carriers and platforms carrying sports, culture, entertainment, commerce, politics, religion and other activities, so at the early stage of the construction planning of Olympic venues, the diversity of post-event venue uses should be considered. In addition to continue to serve sports activities in the event, should also focus on the development of sports and other uses of alternate use, such as: concerts, cultural exhibitions, etc..

The layout of the Olympic venues is related to whether the host city can use the Olympic Games as a major sports event to gain an opportunity for urban renewal and development. In the planning layout and design concept of the venues, while meeting the needs related to the holding of the Olympic Games, it should also be based on the needs of urban development, as well as the needs of long-term use after the games. The planning and design of Olympic venues should avoid construction that exceeds the actual demand, resulting in excessive financial expenditure.

In the mode of management, the government should take the lead and join private enterprises to jointly develop and operate the venues after the games, which can well achieve the lowest cost and obtain the maximum resource allocation capacity, thus ensuring the maximum management efficiency.

Economically speaking, the standard of venue construction should be controlled during the planning and design period of the venues to prevent huge investment in venue construction and poor post-game operation, which will fall into the post-game economic trough and drag down the economic development of the city.

Olympic venues also carry Olympic cultural value, so the development of intangible assets such as naming rights, advertising sponsorship is also a very important part of the post-game development of the venues.

6.2 Suggestions

1. Adopt the model of government and enterprise cooperation

The financing and investment model of the previous Olympic Games indicated that a single government financing model is extremely risky. As a public sector, the government

needs to pay for the Olympic Games and bear the risk of recovery in the later period. Compared with a single government financing model, a private company or capital financing model and a hybrid financing model combining government and private capital are more appropriate. This model also applies to the post-match operations of venues. If the profits and losses arising from the subsequent operation of the Olympic venues are still borne by the government, there is a great risk for Rio's economic recovery and it is not conducive to the subsequent operation and management of the venues. After the Olympics, the post-match operation of the venues can adopt the PPP (public private partnership) model, where the government will sell or contract some venues to private companies. For venues, these private capitals understand the rules of market operation better, and the venue's operating model is more in line with economic development, thereby improving the operating efficiency of venues after the game; for the government, cooperation with enterprises can effectively reduce subsequent operations. The risk of having enterprises jointly bear the profits and losses has greatly reduced the financial burden. The improvement of the operating efficiency of the venues is conducive to the recovery of the finances.

2. Undertake professional sports competitions

Olympic venues are built for Olympic events, so venue facilities are the most suitable for hosting sports events. Integrating professional sports events into the venue's post-match operation strategy is a very worthwhile option, which will greatly improve the subsequent utilization of the venue.

Spain is one of the top sports powers in the world. Spain's more popular sports include football, basketball, tennis, cycling, handball, etc. Football is Spain's national football, Spain is also a world basketball power, and Spain's basketball league is considered the world The second-ranked basketball league. Spain is also a powerhouse in tennis, especially on clay courts. Spain's golf also has a certain strength. (Wikipedia, 2021b) After the Olympics, all kinds of Olympic venues can cooperate with professional sports events, host professional leagues, lease or sell to professional clubs, and become their home stadiums or training bases.

3. Diversified operating models

With the development of human society, people enrich their lives through increasingly rich spiritual and cultural activities, and the increasingly rich activities need venues to carry them, which also points a way for the subsequent operation of the Olympic venues. The

venues need to adopt a diversified operation model after the game, relying on the organization of large-scale sports, politics, culture, religion, commerce, and other activities, broaden their functional positioning, and provide more options for the subsequent operation of the venues.

Rio are passionate and passionate about enjoying life. The Rio Carnival, known as the world's three major carnivals, is still hot. Among the many carnivals in Rio, the Rio Carnival is the most famous. Rio Carnival is generally held in March and lasts about 4 days. Rio is a country of immigrants. There are many religions in the East and the West. Among them, Catholics account for about 75%, and believers often perform street performances. (Ada Saunders, 2021)

Rio's rich cultural heritage has laid a solid cultural foundation for the diversified development of the Rio Olympic Park and provided a suitable soil for the subsequent use of the Olympic venues.

4. Introduce a professional management team

After large-scale sports events are over, the follow-up use of sports heritage plagues event organizers. They often lack experience in post-match management of venues, which leads to the idleness and abuse of venues after the game. At this time, a professional sports frontier management team is needed to guide the operation and management of the venues after the game. The professional sports heritage management team has a wealth of experience in managing sports heritage. It can make correct and reasonable assessments of stadium facilities, fully develop and utilize the resources of the stadiums and facilities, and combine the characteristics of the stadiums and the social environment in which they are located. Reasonable planning and positioning of operation and management can meet the needs of the market and the needs of the public to a large extent, greatly increase the utilization rate of venues after the game, increase economic income, realize the economic effects of the Olympic Games, and reduce the government's financial burden.

5. Develop the public sports industry

According to a survey conducted by the Social Survey Centre of China Youth Daily on a survey of 1991 respondents in China, 85.2% of the respondents felt that there was a lack

of public fitness venues around, and 21.3% of the respondents felt that they were very lacking.

After the Olympics, various Olympic venues can cooperate with professional sports events to host professional leagues, lease or sell to professional clubs, and become their home stadiums or training bases.

7 Research model

According to the research in this article, take the history, current situation and characteristics of the construction and post-match development and utilization of Barcelona, Sydney, Beijing, and Rio Summer Olympic Games venues as examples. In the post-match development and utilization of the Olympic venues, fully consider the diversified use of the venues after the games at the early stage of the construction and planning of the Olympic venues, and control the scale and cost of the construction of the venues, and integrate the construction of the Olympic venues into the Olympic Games. In the urban development and renewal of the venue, the public-private operation model maximizes the allocation of resources, while paying attention to the development of the intangible assets of the Olympic venues.

When the above conditions are met, better development and utilization of Olympic venues can be achieved, avoiding the host city from falling into the "post-Olympic economic trough" after the Olympics, and the city's economic development is slow or even stagnant.

8 Research evaluation and gain

8.1 Research evaluation and gain

In this thesis research, I can understand the history, current situation and characteristics of Barcelona, Sydney, Beijing, and Rio Olympic venues construction and post-match development. Clues or plans for the construction of Olympic venues and post-match development. Based on the above, suggestions are made from the perspectives of the initial positioning of venue construction, post-match management mode, operation management, cultivating new urban industrial chains, and attention to the intangible assets of Olympic venues, and put forward suggestions for the development and utilization of Olympic venues in the past and the future.

However, this paper also has shortcomings. For example, the pre-match construction, humanistic environment, economic conditions, etc. of Barcelona, Sydney, Beijing, Rio Olympics, and other venues are just a brief background and data analysis. If I still have the opportunity to study this topic in depth in the future, I hope to break away from traditional thinking and study the history, current situation and characteristics of more Olympic venue construction and post-match development, and analyse the background and data in depth to provide more information. Creative ideas and solutions, such as creating a new IP through the Olympic venues. This IP can be a combination of the Olympics and the host city, or a new Olympic city's urban culture.

8.2 Thanks

In 2020, the new crown epidemic is raging all over the world. It can be said that it is everywhere and pervasive. Its spread and the resulting impact have led to an unprecedented global crisis.

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