# A Better Strategy for Hosting Olympics

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**Abstract.** The Olympic Games is the largest comprehensive games in the world. Recently, however, the organizers have experienced all kinds of negative effects. How to reform the Olympic Games and make them play a positive role is of great significance. The existing theories are often limited to the surface discussion, lack of in-depth analysis, or limited to a specific country's hosting of the Olympic Games analysis. This paper proposes the IPP model, discusses the influence of the Olympic Games and finally gives the corresponding strategy. The IPP model is divided into three core technologies. First, we evaluate the impact of hosting the Olympics. It was found that the economic, social and international influence are 38.001%, 46.224% and 15.775% respectively. Secondly, we studied preparations for hosting the Olympics to evaluate whether a country can play a positive role in hosting the Olympic Games, and it is found that the most suitable countries for hosting the Olympic Games are the United States, China, Germany and France. Thirdly, we discussed and simulated the strategy that the International Olympic Committee(IOC) can adopt, and the best strategy to hold the Olympic Games is concluded as: divide Olympics into four quarters and hold it in fixed locations in 2023-2079, divide Olympics into two quarters and hold it in fixed locations in 2080-2136, divide Olympics into four quarters and hold it in fixed locations after 2136.

**Keywords:** Olympic Games, IPP Model, entropy weight method, policy simulation

## 1 Introduction

Olympic Games is the world's largest comprehensive sports event. However, the number of the country biding for the Olympics is decreasing in recent years because of the high cost but low return of hosting the Olympics.[1] The existing researches tend to focus on the influence of a certain Olympic Games on the host country, which can not fully understand the influence of the Olympic Games. Therefore, we adopt a new method to identify the impact of the Olympics and finally help the Olympics out of its current predicament.

In order to help revitalize the Olympics, we set up a more scientific strategy for the Olympics by establishing the IPP model. We first evaluate the impact of hosting the Olympics. We select indicators in the aspects of economic, social, and promotion of world unity.Then we studied preparations for hosting the Olympics to evaluate whether the Olympics can have a positive influence on the host country by the entropy weighting method. Finally we discussed and simulated potential policies that the IOC can adopt.

The contributions of this article are as follows: we are the first to propose a comprehensive analysis on the impact of the Olympics in the aspects of economic, social and international

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impact. We are also the first to discuss and simulate the policies that the IOC can adopt, which greatly improves the reliability and persuasion of the strategies we recommended.

## 2 IPP Model

IPP Model includes 3 parts. We evaluate the impact of hosting the Olympics, study preparations for hosting the Olympics, discuss and simulate potential policies that the IOC can adopt. The whole modeling process can be shown as Fig. 1.

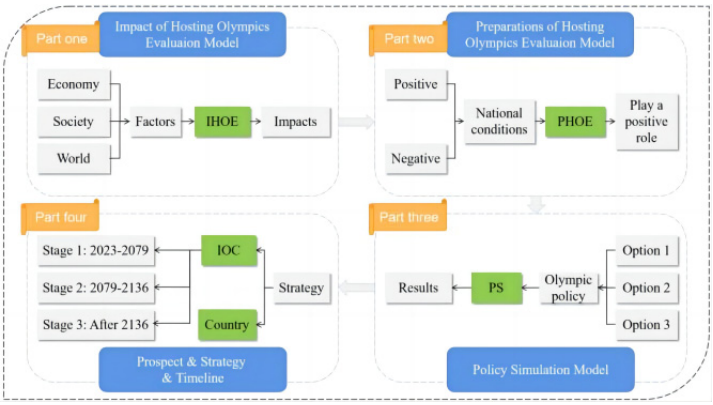


**Fig. 1.** Overview of our work

### 2.1 Impact of Hosting the Olympics

We consider 3 aspects of the impact of hosting the Olympics: economic, social and international impacts.[2][3][4][5] The construction of various supporting facilities for the Olympic Games creates many occupations. The Olympics have generated a lot of revenue. It also increases the reputation of a city, leading to the potential development of the tourism industry. Thus we select the indicators of economic impacts as: employment, tourist numbers, and GDP. Hosting the Olympics promotes the development of local sports, stimulate the construction of a city's infrastructure and transportation system. Thus we select indicators of social impact as: military cost, number of sports facilities, railway passenger volume, carbon emissions, and land resources. In addition, the Olympics promotes international cooperation. Thus, we select indicators of international impact as: the proportion of foreign trade to the total GDP.

These indicators doesn't follow a normal distribution or appear in pairs, so we use the Mann-Whitney test method to test the significance of the differences in these data before and after the Olympic Games. The magnitude of the difference between two sets of data is represented by the value of Cohen's d ,so we selected this value as the degree of impact before and after hosting the Olympic Games. So we use Cohen's d value of different countries as database and use the entropy weighting method to determine their weights. The result shows how much each aspects of impacts dose hosting Olympics have for the hosting country.

### 2.2 Preparations for Hosting the Olympics

We evaluate the situation of a country to determine whether the Olympics can bring positive effects in that country. The number of sports shoes to a certain extent reflects the popularity of sports and Olympics in a country. The number of Olympic medals reflects the sports capacity and reputation of a country. GDP reflects the economy of a nation, and the amount of railway passenger traffic reflects the development of transportation system, both of which are required by hosting the Olympic Games. Military expenditure reflects to a certain extent a country's stability. Besides, a certain amount of available land and a better ecological environment is required to host the Olympics.

Thus we select indicators that can reflect the positive impact of the Olympics, including the number of sports shoes, the number of Olympic medals, GDP, railway passenger traffic, military expenditure, population density, and carbon emissions. Then we use the entropy weight method on these data. The weights shows the significance of each indicator is and the score of each country shows whether the Olympics can bring positive effects in that country.

### 2.3Policy Simulation

First we discuss potential strategies IOC can formulate. In this article, we only discuss possible strategies of hosting Olympics in the dimensions of time and space. The Olympics can be held at different or the same locations, and held every season or just in summer and winter. Historically, holding the Olympics at different location in 2 seasons has exhausted the IOC. Therefore, only three strategies remain: hold the Olympics in summer and winter at fixed locations, hold the Olympics in every season at fixed locations, and hold the Olympics in every season at different locations.

Then we discuss the process of holding the Olympics and simulate them. Holding the Olympics every season reduced the scale of the Olympics, so its impact naturally diminishes. We express this mathematically as equation (1) and equation (2).

$$I' = \alpha \cdot I \tag{1}$$

$$P' = \beta \cdot P \tag{2}$$

Where $I'$ and $P'$ refers to the evaluation score of the IHOE model and the PHOE model when hold the Olympis in every season. $\alpha$ and $\beta$ indicates the reduction coefficient. $I$ and $P$ refers to the evaluation score of the IHOE model and PHOE model when hold the Olympis in summer and winter.

Hosting of the Olympic Games itself will have an mutual impact on both the IHOE model and the PHOE model. The factors of the IHOE model include economic impact, social impact, and international impact. The economic impact of the Olympic Games stimulates the growth of GDP, while the social impact of the Olympic Games stimulates the development of other variables. Besides, higher score in the PHOE model means hosting Olympics has greater positive impact on this country.Thus, we construct the following relationship equation (3) and equation (4).

$$y_i' = W_j \cdot \gamma_{ij} \cdot y_i \tag{3}$$

$$W_i' = W_i \sum_{j=1}^{9} k_{ij} y_i \tag{4}$$

Where $W_j$ (j=1,2,3) means the economic, social and international impact in IHOP model. So $y_i$ (i = 1,2,...,9) and $W_j$ (j=1,2,3) are indicators in PHOE model and IHOP model when hold the Olympics in summer and winter. $y_i'$ (i = 1,2,...,9) and $W_j'$ (j=1,2,3) are the same indicators when hold the Olympics in every season. $\gamma_{ij}$ and $k_{ij}$ (i=1,2,...,9, j=1,2,3) are the coefficients.

## 3 Experiments and Analysis

### 3.1 Results of IPP Model

We obtained the data for all indicators of all countries from the reference literature [6], [7]. We obtained the following results.


**Fig. 2.** The degree of impact of hosting the Olympics on each indicator

We can see that the main impact from Fig. 2 of hosting the Olympics is on economic and society,while the impact on international impact is relatively weak. This suggests that we need to focus on the impact of the Olympics on the economic and society aspect in order to maximize the effectiveness of the Olympics.

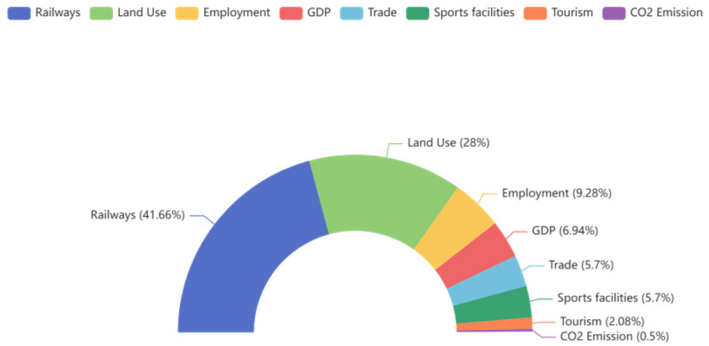


**Fig. 3.** Impact of each indicator on the adaptability to hosting the Olympic Games

From the Fig. 3, we can see that to make the most of the Olympics, the host country should have a good transportation system.

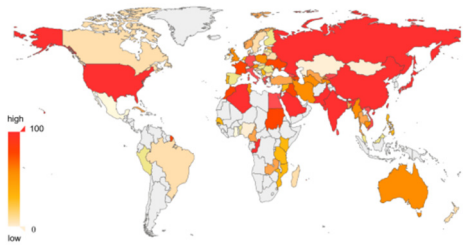


**Fig. 4.** The distribution of scores for countries around the world

We can see from the Fig. 4 that the ability to successfully host the Olympics is mainly concentrated in East Asia, Europe and North America.

Based on the analysis of literature data, we estimated the parameter values of the model and simulate the following results:

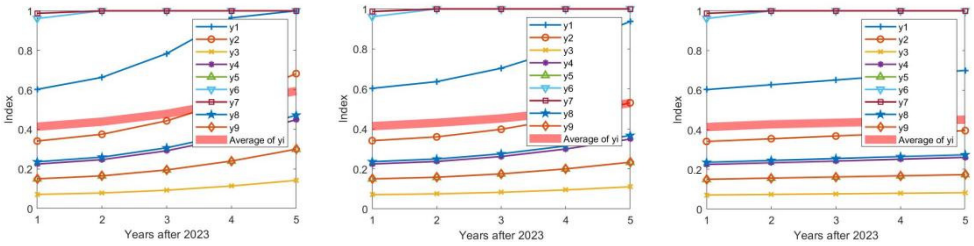


**Fig. 5.** The simulation result of PS model when host Olympics in summer and winter in permanant location, in every season in permanant location, and in every season in none-fixed location

From the Fig. 5, we can see from the left graph that when host Olympics in summer and winter in permanant location, the world is clearly showing a trend of polarization. The selected hosting countries make significant progress, while others countries are standing still, which is very detrimental to global unity.

We can see from the middle graph that when host Olympics in every season in permanant location, the world also shows a trend of polarization, but the momentum is much weaker than the first strategy. The selected hosting countries make great progress, while other countries do not show significant changes.

We can see from the right graph that when host Olympics in every season in none-fixed location, the world shows a trend of multi-polarization. The progress of countries around the world in the PHOE model is very even. This indicates the Olympics effectively promoting world integration. However ,the hosting countries make relatively less progress.

### 3.2 Strategy & Timeline

According to the results of the IPP model, hosting the Olympics in permanent country generally is extremely beneficial to the host country, but unable to promote world unity. And hosting the Olympics in none-fixed country generally is less beneficial to the host country, but able to promote world unity. And hosting the Olympics in every seasons weaken both the benefit to the host country and the world unity. So we suggest the following strategy to make full use of hosting the Olympics. We simulate the policy and obtain the following timeline shown in Fig. 6.

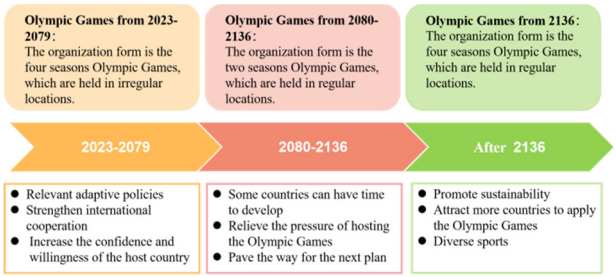


**Fig. 6.** Strategy of IOC and its implementation timeline

In the initial stage, we suggest IOC to split the Olympic Games into four smaller events, and hold the Olympics in none-fixed locations. In the middle stage, we suggest IOC to hold the Olympics in summer and winter in fixed locations. In the later stage, we suggest IOC to hold the Olympics in every season in fixed locations.

## 4 Conclusion

This paper proposes the IPP model, which is made up of IHOE model, PHOE model and PS model. And wu use Mann-Whitney test method and entropy weighting method and other innovative method to bulid these models. It was found that the economic, social and international influence are 38.001%, 46.224% and 15.775% respectively. From the PHOE model we found that the most suitable countries for hosting the Olympic Games are the United States, China, Germany and France. Eventually we present a strategy to revitalise the Olympic Games: the Olympics should be divided into four quarters and fixed sites in 2023-2079, the Olympic Games should be divided into two quarters and fixed sites in 2080-2136, and the Olympic Games should be divided into four quarters and fixed sites after 2136.

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