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Research Article

The Impact of Sports Event Branding Using Edge Computing on Urban Marketing under the Background of Internet of Things

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The purpose is to explore the impact of sports event branding on urban marketing. Under the Internet of Things (IoT) background, the impact of sports events on the economy and culture of the host city is explored based on the idea of edge computing. In addition, the economic and cultural impact of the current highest level sports event—the Olympic Games—on the host country is also analyzed. The results show that the more large-scale events are held, the more they can promote the development of the high-end market of urban tourism. The hosting of the Beijing Olympic Games brought Beijing $3.127 billion in revenue and great changes in humanities, ecology, living environment, and other aspects. The higher the gross domestic product (GDP) of a domestic city is, the more events will be held in this city, and the two are positively correlated. Domestic competition resources are concentrated in these cities with strong economic strength. The total number of events held by the top 10 cities in GDP accounts for 64.1% of the top 30 cities. Geographically, among the cities that have hosted sports events, there are 89 cities in the east, with a total number of 1676 events, accounting for 64% of the national events, far exceeding the central and western cities, and even far exceeding the sum of the latter two. Therefore, it can be said that the holding of sports events reflects the comprehensive strength of a city and improves the city's exposure and popularity. The exploration provides a certain reference value for cities to enhance their influence with the help of events.

1. Introduction

Nowadays, the core position of social prosperity and development is the city, which is the carrier of further social development. The only choice for China to develop a market economy is to accelerate the process of urbanization. In the urbanization process, some carriers are needed to complete urban marketing. Sports events are one of them, which has an essential relationship with the problems existing in the city [1]. Cities in the process of modernization have created people's own independent spaces. People are isolated from each other, and the lifestyle becomes mechanical and monotonous. However, the emergence of sports makes up for the lack of this part [2].

Some foreign scholars point out that the primary purpose of urban managers' corresponding urban marketing is to carry out relevant changes such as urban planning to meet the needs of corresponding target customers. After the successful completion of urban marketing, it can positively affect the economic development and environmental optimization of residents in the city and attract foreign tourists. The hosting and marketing of large-scale sports events have become crucial ways for many cities to carry out overall marketing at this stage, especially in some cities facing transformation and image reconstruction. The holding of large-scale sports events usually needs to be combined with the overall planning strategy of the city [3]. At the end of last century, Europe's top football matches were successfully held in Britain, prompting policy changes. Combining the marketing of sports events with the brand image marketing of Britain has produced a good resonance, which has played a particularly important role in the development and image improvement of the city. In China, it is mentioned in some books that with the continuous progress of economic conditions, people pay increasing attention to physical and mental health. The broad masses of people will choose sports events

they are interested in for physical exercise and relaxation [4]. For example, the marathon has significantly promoted the improvement of the urban people's overall physical quality and civilization. The marathon can positively impact urban residents' pride, cohesion, and self-discipline in this process. Some scholars suggest that marathon-related events are the carrier of urban culture display. The research and analysis of the successful marathon in characteristic cities reveal that the urban marathon can reflect the host city's cultural heritage and cultural connotation. The successful holding of this kind of competition can significantly improve the city's cultural influence and fully present the city's strong cultural and historical characteristics [5].

Li et al. [6] pointed out that the rapid development and growth of the Internet of Things (IoT) field offers great potential for the healthcare sector. A fog-assisted computing efficient wearable sensor network in the sports health monitoring system based on the IoT was proposed, in which the data collected by the sensors was uploaded to the Ethernet module of the IoT system, and individuals were authorized to access the data through the Internet to track the health of athletes. The experimental results showed that the method was simple, reliable, and economical and could be used regularly. Zhou and Chen [7] believed that modern technology and sports had undergone rapid changes, affecting society and lifestyles. To improve the model of the existing university physical education (PE) platform, IoT technology, and wireless platform that are applied, relying on the original campus network, they put forward the design idea of building a new university PE platform system by IoT and mobile platform technology and provided a new model for the realization of information technology (IT) to assist PE teaching. Kim and Park [8] proposed a new, dynamic, and open sports network teaching platform design by using IoT technology, wireless network technology, combined with traditional campus network and IT means. The data collection, analysis, modeling, mining, display, feedback, and self-improvement of the original teaching activities of the design were expounded. At the same time, the realization technology of the model was discussed, and the experimental design of the combination of the platform and volleyball sports teaching was carried out.

The combing and analysis of relevant literature show that worldwide research has a certain similarity: large-scale sports events positively impact urban marketing, which has become a key topic in modern academic research. With the continuous progress of the urban economy, the improvement of urban modernization level can popularize and publicize large-scale sports events. Conversely, holding sports events can also promote the shaping of city brand image. However, the specific relationship between the two involves many interdisciplinary areas, covering more than a dozen disciplines such as sports and economics. Therefore, most studies only stay in the theoretical stage, with no specific data support. This thesis introduces edge computing to make the impact of sports event brands on urban marketing more concrete to provide strong data support for cities to enhance their influence with the help of events.

2. Summary and Research Route of Urban Marketing and Edge Computing

2.1. Operation Process of Large-Scale Events. Through the influence and cohesion of sports events, urban subjects can maximize the city's influence in the operation stage. It also requires urban subjects to combine each link of the game with the city brand to improve the city's brand image. The holding of large-scale sports events has high requirements for competition specifications, sports technology, and undertaking, so the preparation of events is critical. Figure 1 shows the division of the main operation stages of sports events.

Event bidding stage: at the beginning of the whole operation of sports events, scientific and effective management of sports event bidding can make the bidding work of sports events get twice the result with half the effort. At this stage, the city's main body needs a long time to plan and choose events suitable for the brand of urban development. Therefore, the time of this stage is relatively long, and the event organizers also need to effectively evaluate the ability level of the bidding city at this stage to determine whether the city can meet the standards of the event. After clarifying the bid intention and evaluation, the city will obtain the right to host the event to enter the next link.

Event promotion stage: it is the stage of external publicity of the city. At this stage, in addition to the promotion of normal competitions, relevant brands of the city will also be promoted. The city's own resources can be introduced into sports events to realize the perfect combination of sports events and urban characteristics to let the people know and get familiar with the city. The city's main body's desired effect can be achieved by matching the city's own characteristics and the value advocated by the sports events and binding the city's characteristics and sports events to attract a wider range of tourists and greatly improve the popularity of the city. Therefore, the host city should make good use of this favorable opportunity to deeply develop the connotation of the city itself. The concepts related to city image and the corresponding characteristic parts can be used in the corresponding promotion activities of the event.

Event holding stage: it is the whole process from the beginning to the end of the event. In this stage, both internal and external urban populations will flock to the venue to watch or participate in the competition. At this stage, the government's main body should present the city's social and cultural scenery, including the government image, urban highlights, living, and working environment in front of the spectators or contestants. It can make them act as the communicators of the city, form a good word-of-mouth effect, and improve the city's reputation. The effect of this move largely reflects the attraction of a city to the people, and it is also an important purpose for the city to hold events.

Event closing stage: it is necessary to summarize and evaluate the event effectively and complete all competitions. The main task of this period is to formulate a very detailed plan and complete a comprehensive performance evaluation,

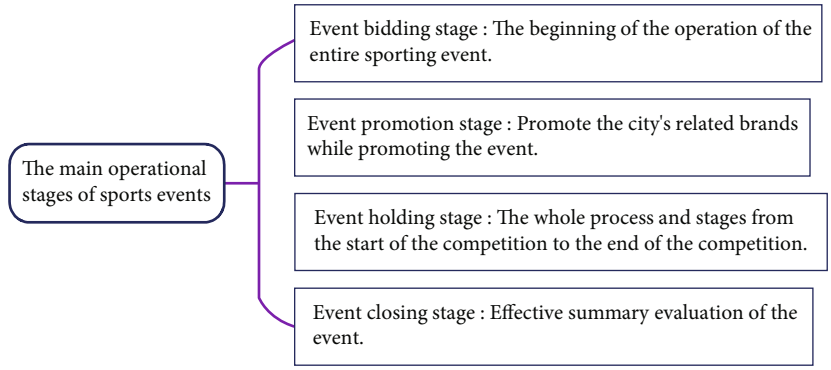


Figure 1: Division of main operation stages of sports events.

financial audit, asset disposal, summary, and commendation. The final stage of the event is the main aspect of improving urban loyalty and an important aspect of city brand communication.

2.2. City Brand Marketing. The proposal of city brand is based on the concept of commodity brand and its related theoretical basis. It is composed of the sum of the cultural characteristics, economic conditions, industrial distribution, geographical conditions, living conditions, government capacity and other elements of the city, and its overall impression and evaluation in people's hearts [9]. It is the representation of urban function, nature, and civilization and represents the comprehensive competitiveness of the city [10–12]. The city brand is the most important intangible asset and key resource of a city. It is also a strategic resource for a city to maintain and create a sustainable competitive advantage. Figure 2 shows the main factors of city brand formation:

The birth and development of modern sports events are inseparable from the development of cities. Sports events and urban economic and cultural development strategies affect each other. The two are interdependent and develop mutually. The involvement of various media makes the relationship between the two closer. According to the above description, the relationship between sports events and urban marketing can be summarized as shown in Figure 3:

2.3. Edge Computing

2.3.1. Edge Computing Concept. With the rapid progress of mobile Internet and the proposal and application of the IoT, mobile terminal equipment has become an indispensable part of people's daily work and lives. All intelligent devices that can be connected to the Internet will transmit a large amount of data to IoT every day, and people can also get all kinds of information they need from IoT. It contains information related to sports events and the development of various cities and cultures, so that people can understand the holding of sports events and the development of cities anytime and anywhere. However, with the explosive growth of the number of mobile devices, the amount and types of data in IoT are also increasing. While the amount of data is growing rapidly, the generation speed of data is also growing rapidly. Such a huge amount of data will lead to the traditional statistical computing mode, such as cloud computing, unable to meet the needs of current users. If the energy consumption and computing resources of network edge devices are insufficient, users' service quality cannot be guaranteed. In this case, edge computing technology appears [13, 14].

Edge computing refers to a new distributed computing architecture that performs computing at the network's edge. The core idea is that computing should be close to users. It mainly migrates the computing and storage tasks from the cloud to the network edge devices close to the data source by adding an edge computing layer. In this way, users can obtain the required information more efficiently. Figure 4 is a basic network architecture diagram of edge computing.

Figure 4 shows that the network architecture of edge computing is mainly composed of three parts: cloud computing layer, edge computing layer, and intelligent terminal layer.

(1) Intelligent terminal layer: it collects and uploads various original data and is composed of many IoT devices. As the layer closest to the user and physical environment, these devices are mainly responsible for sensing the characteristic data of objects or events and then transmitting data with the upper nodes through wireless access technology or wired connection [15]

(2) Edge computing layer: it is located at the edge of the network and is mainly composed of multiple edge nodes distributed between terminal device and cloud data center. When the edge node receives the local data from the terminal device, it will perform data preprocessing, redundancy removal, data cleaning, and filtering. Meanwhile, the edge node can also be connected to the cloud data center to transmit the processed valuable information to the cloud server for storage and further processing

(3) Cloud computing layer: it is composed of multiple high-performance servers and storage devices, providing various application services such as smart

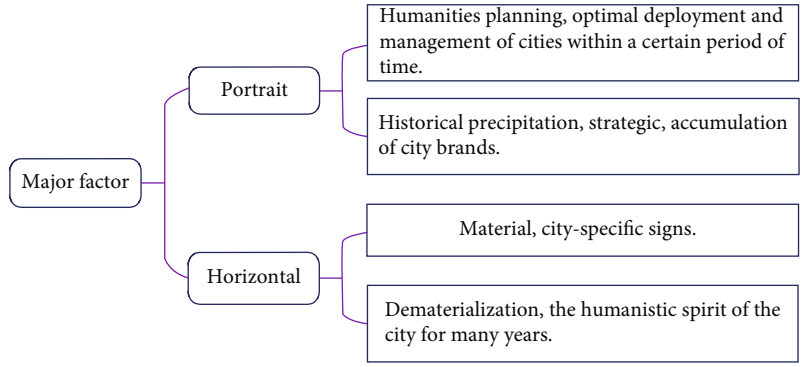


Figure 2: Main factors of city brand formation.

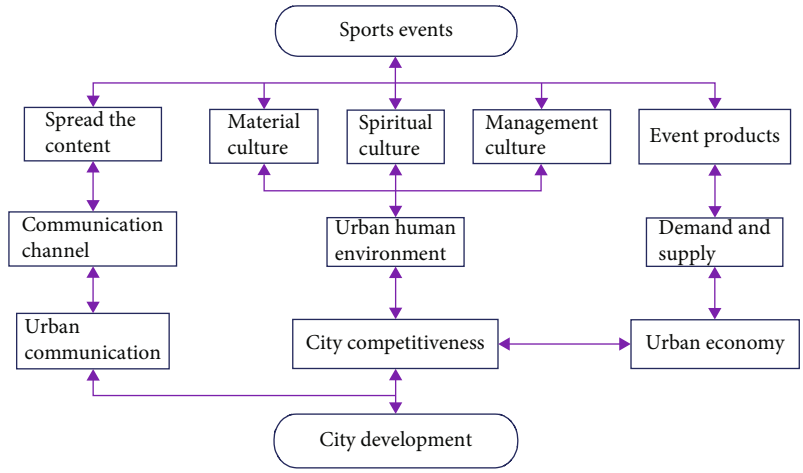


Figure 3: Relationship between sports events and urban marketing.

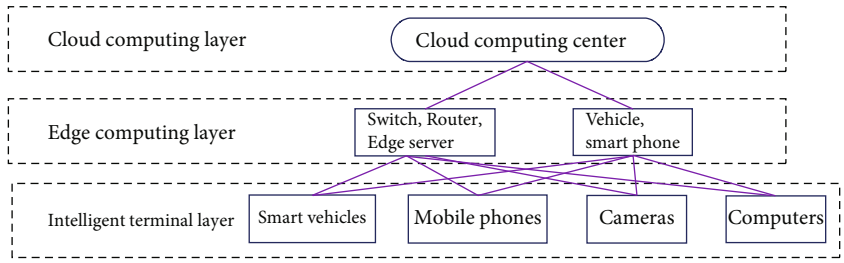


Figure 4: Basic network architecture of edge computing.

home, smart transportation, and smart factory. It has powerful computing and storage capabilities and supports a wide range of computing analyses and permanent storage of a large amount of data. However, different from the traditional cloud computing architecture, in edge computing, this layer only calculates and stores the valuable information uploaded through the edge node, rather than processing all tasks. According to the demand load, the cloud computing center can also dynamically adjust the edge computing layer through some control strategies to improve the utilization of cloud resources

2.3.2. Edge Computing Features and Application Scenarios. Edge computing has the following excellent characteristics because of its unique network architecture mode. The location is at the edge of the network, so the delay is low. It significantly reduces data movement on the Internet and provides fast and high-quality localization services supported by endpoints. The geographical location distribution is wide. The services and applications of edge computing adopt distributed deployment, which is composed of many distributed nodes. It can track and export the location of terminal devices to support mobility and save network bandwidth. Edge computing mainly processes the data between

the terminal equipment and the cloud data center, so most of the data does not need to be transmitted through the Internet, and only part of the data needs to be transmitted to the cloud. It supports liquidity. Edge devices can either move with users or be deployed fixedly in edge computing. Edge nodes can directly interact with users in real time without transmitting the massive data generated by the device itself or intermediate devices to the cloud. In this way, it can truly realize mobile data analysis, data security, and privacy protection. Because the edge server is close to the terminal equipment in edge computing, it has special advantages in data security and privacy protection [16–18].

Edge computing has the above advantages, so it has many application scenarios, as shown in Figure 5:

Edge computing is not to replace cloud computing, but to supplement and expand cloud computing. The edge cloud will not replace the central cloud, but part of it. Edge computing can make up for the lack of location awareness, mobile support, and other shortcomings of cloud computing. The preprocessing of data by edge computing is equivalent to the unconditioned reflex of nerve endings to external stimuli. The analysis and mining of data by cloud computing are equivalent to the brain's memory and logical processing function [19]. Figure 6 shows the difference between cloud computing and edge computing.

2.3.3. Edge Computing Architecture. For the computing model of edge computing, common computing operations include local edge execution, remote edge execution, and execution in the central cloud. The time required for these operations is marked [20, 21].

For local edge computing, there is only a local calculation stage. $f_{m,n}$ represents the computing power of task m on edge n. Meanwhile, different edge devices on the edge cloud may perform tasks at different clock frequencies. Therefore, it can be concluded that when the task m on the edge n is executed at the local edge n, its calculation execution time $T^{el}_{m,n}$ is the ratio of the calculation workload $L_{m,n}$ of the task to the calculation capacity $f_{m,n}$, that is,

$$T^{el}_{m,n} = \frac{L_{m,n}}{f_{m,n}}. \tag{1}$$

$L_{m,n}$ represents the calculation workload required to complete task m on edge n.

In addition, before the execution of task m, all direct predecessor tasks related to it must have been completed. Therefore, the waiting time $T^{wl}_{m,n}$ of task m is the maximum required completion time of all direct predecessor tasks distributed on the local edge, remote edge, and central cloud, that is,

$$T^{wl}_{m,n} = \max_{k\epsilon \mathrm{pred}(m)} \max \left\{ T^{cl}_{k,n}, T^{ce}_{k,n}, T^{cc}_{k,n} \right\}. \tag{2}$$

$\mathrm{pred}(m)$ represents the set of related predecessor tasks of task m. $T^{cl}_{k,n}$ represents the execution time of the local edge, $T^{ce}_{k,n}$ represents the execution time of remote edge, and $T^{cc}_{k,n}$ represents the execution time of the central cloud.

For remote edge computing or central cloud computing, the initial edge n unloads its computing task m first. Then, the remote edge or central cloud will perform the computing task and feedback the results to the initial edge. Specifically, this process has three stages:

Transmission phase: this phase is to transfer the data required by the task from the initial edge to the remote edge or central cloud. For the transmission time, it is the ratio of the input data $D_{m,n}$ of the task to the uplink data transmission rate R. R is R_e or R_c. Therefore, the transmission time $T^{te}_{m,n}$ of remote edge computing and the transmission time $T^{tc}_{m,n}$ of central cloud computing are, respectively,

$$\begin{aligned} T^{te}_{m,n} &= \frac{D_{m,n}}{R_e}, \\ T^{tc}_{m,n} &= \frac{D_{m,n}}{R_c} \end{aligned} \tag{3}$$

Calculation stage: similar to the calculation stage of local edge computing, the calculation execution time $T^{ee}_{m,n}$ of task m of edge n at the remote edge and the calculation execution time $T^{ec}_{m,n}$ in the central cloud are, respectively,

$$\begin{aligned} T^{ee}_{m,n} &= \frac{L_{m,n}}{f_{m,n}}, \\ T^{ec}_{m,n} &= \frac{L_{m,n}}{f_c}. \end{aligned} \tag{4}$$

f_c represents the computing power of the task on the central cloud.

Like local edge computing, remote edge or central cloud also needs to consider the waiting time of task m. However, it is also necessary to consider the time overhead required to transmit input data from the initial edge for these two waiting times. Therefore, at this time, the waiting time of task m is the maximum value of the completion time required in all direct predecessor tasks distributed on the local edge, remote edge, and central cloud and then the larger value compared with the transmission phase time. Therefore, the waiting time $T^{\mathrm{we}}_{m,n}$ of task m of edge n at the remote edge and the waiting time $T^{wc}_{m,n}$ at the central cloud are, respectively,

$$\begin{aligned} T^{\mathrm{we}}_{m,n} &= \max \left\{ T^{te}_{m,n}, \max_{k\epsilon pred(m)} \max \left\{ T^{cl}_{k,n}, T^{ce}_{k,n}, T^{cc}_{k,n} \right\} \right\}, \\ T^{wc}_{m,n} &= \max \left\{ T^{tc}_{m,n}, \max_{k\epsilon pred(m)} \max \left\{ T^{cl}_{k,n}, T^{ce}_{k,n}, T^{cc}_{k,n} \right\} \right\} \end{aligned} \tag{5}$$

Feedback stage: this stage is to feedback the processing result data of the task from the remote edge or central cloud to the initial edge. The feedback transmission time is the ratio of the output data $S_{m,n}$ of the task to the uplink data transmission rate R. R is R_e or R_c. Therefore, the feedback time $T^{re}_{m,n}$ of remote edge computing and the feedback time

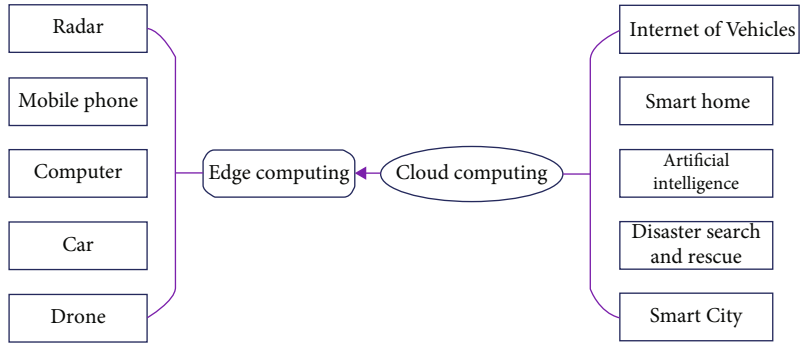


Figure 5: Application scenario of edge computing.

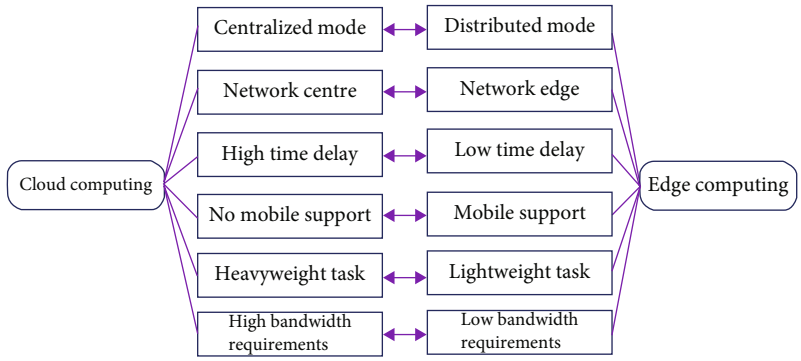


Figure 6: Differences between cloud computing and edge computing.

$T^{rc}_{m,n}$ of central cloud computing are, respectively,

$$T^{re}_{m,n} = \frac{S_{m,n}}{R_e}, \quad T^{rc}_{m,n} = \frac{S_{m,n}}{R_c} \tag{6}$$

2.4. Research Route. Based on the above demand analysis and algorithm research, the impact of sports events on urban marketing is mainly explored from the following two aspects: (1) the impact of the Olympic Games on the host city and (2) the impact of events held in different cities in different regions of China on local gross domestic product (GDP).

The time span of the economic impact of the Olympic Games can be as long as 14 years. The economic growth effectors are mainly in the following aspects: expanding total demand to stimulate economic growth, expanding employment to promote economic growth, improving the quality of workers to promote economic growth, promoting the optimization, and upgrading of industrial structure to promote economic growth. The data related to the five Olympic Games from 2000 to 2016 are selected to analyze the impact of the Olympic Games on the host city's income.

The relationship between the GDP of domestic cities and their event holding is analyzed from the event quantity and event influence. The relevant data of 2018 are selected. The per capita GDP of each city is calculated according to the regional gross output value and the results of the sixth general population survey. The ranking of cities is relatively stable, so one-year data can represent the comparison of economic strength among cities.

2.5. Configuration of Experimental Dataset and Experimental Environment. This experiment is based on the construction of the edge computing and cloud platform described above, and a cloud-edge integrated edge computing cloud platform based on Kubemetes is constructed for this purpose. Among them, the platform includes a central cloud and three edge clouds, and each cloud is composed of three terminals. Due to the tight resources of edge terminal devices, there is a higher demand for the number of edge clouds in the experiment. To this end, on the basis of the original three edge clouds, this project virtualizes the remaining servers to obtain multiple edge terminal devices, and then these virtualized devices obtain external IP addresses through the bridged network mode, and then multiple edge clouds are implemented to meet the needs of experimental variables.

When predicting the mirror cache strategy, the data of the Baidu Index is used as the experimental data. Beijing, Shanghai, Guangzhou, Shenzhen, and Hangzhou are taken as the respective scopes of the five edge clouds. Then, through the survey and statistics of the more popular images in the Docker image, 40 images with high usage are obtained. Therefore, the five regions of Beijing, Shanghai, Guangzhou, Shenzhen, and Hangzhou are obtained on the Baidu Index. Since January 1, 2021, the index data of these 40 mirrors has been used as a numerical basis for popularity and the number of mirror requests.

Table 1: Settings of model hyperparameters.

Designed model parameters			Comparing model parameters		
The name of the parameter	The function of the parameter	The value of the parameter	The name of the parameter	The function of the parameter	The value of the parameter
Optimizer	Optimizer	Adam	Optimizer	Optimizer	SGD
Loss	Loss function	MSE	Loss	Loss function	MSE
Learning_rate	Learning rate	0.01	Learning_rate	Learning rate	0.001
n_epoch	Number of iterations	50	n_epoch	Number of iterations	50
Batch_size	Batch size	64	Batch_size	Batch size	64

The settings of the hyperparameters of the output layer in the network model are shown in Table 1:

3. Experimental Result

3.1. The Impact of the Olympic Games on the Host City. Figure 7 shows the specific income of the host cities of the previous Olympic Games.

A successful large-scale event will create huge space and countless business opportunities for the city. With the 2008 Beijing Olympic Games as an example, from its successful bid in 2001 to its successful hosting in 2008, Beijing has undergone great changes in humanities, ecology, living environment, and other aspects. In addition, Figure 7 shows that in terms of economy, including Olympic business promotion, sponsor activities, advertising, ticket revenue, and rebroadcasting right revenue, the total revenue of the Beijing Olympic Games is $3.128 billion and the total profit is $170 million. It can be said that the event economy drives the development of the high-end market in urban tourism.

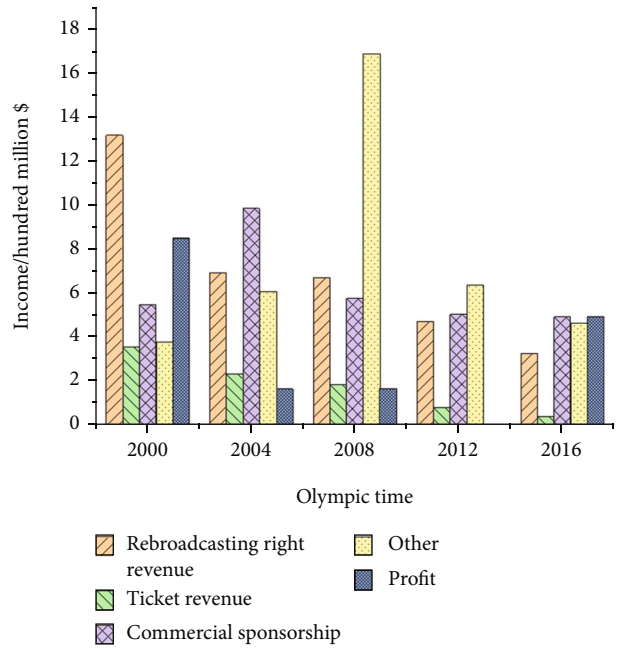


Figure 7: Income summary of previous Olympic Games.

3.2. Relationship between Major Events and GDP of Major Cities in China. Figure 8 shows the relationship between the total GDP of major cities and the number of events.

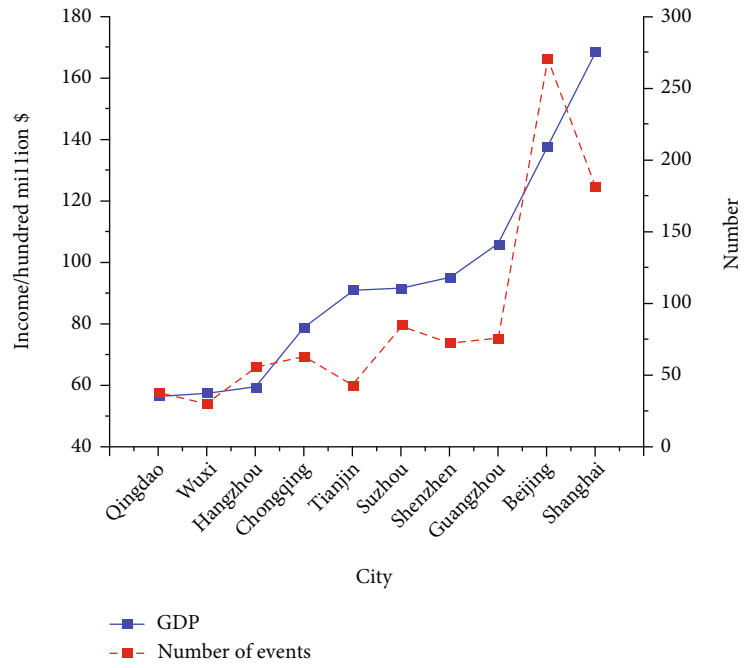
Cities are ranked according to GDP from high to low. Figures 8(a) and 8(b) show that the overall trend of the curve representing the number of events held is similar to that of GDP. It shows that the higher the total GDP is, the more the events are held, and the two are positively correlated. In Figure 8(c), the top 30 cities in GDP hold 1430 events in total. The top 10 cities in GDP account for 64.1% of the total number of events held by the top 30 cities. It reveals that China's event resources are concentrated in the cities with strong economic strength, and the impact of economic strength on sports events is obvious. Among all cities, Shanghai and Beijing are the only two cities with more than 100 events, with obvious advantages. In addition to the capital political advantages, with the Olympic Games as an opportunity, Beijing has built six agglomeration areas for the sports service industry. The agglomeration trend of the sports comprehensive service industry is formed. Besides, experience in hosting large-scale events has been accumulated. Stadiums, sports talents, and other related software and hardware facilities are relatively complete.

Figure 9 is an analysis of 27 provincial capitals.

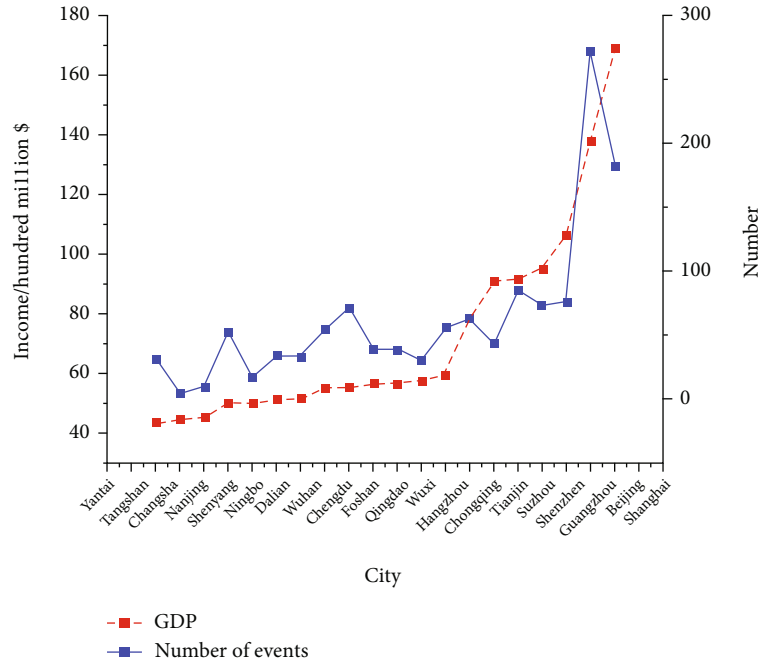
The 27 provincial capitals are ranked in order of GDP from high to low. On the whole, the curve representing the number of events held is consistent with the GDP curve, which is in line with the overall law described above. They are both provincial capitals, but the economic gap has led to a gap in the level of sports development between them. Several cities with large ups and downs in Figure 9 deserve attention. Among the cities with relatively low GDP ranking, Kunming, Nanning, Guiyang, and Haikou hold many events. These cities have a common feature. They are all tourist cities. They have unique natural scenery and cultural landscape, which is easy to attract events to settle down. Harbin and Changchun also hold many events, most of which are winter events. As winter projects have strict requirements on the natural environment, and few big cities in China can meet the requirements at present, enough opportunities have been created for them.

Cities are ranked according to the proportion of per capita GDP, the gross value of industrial output, and the total output value of agriculture, forestry, animal husbandry, and fishery. Figure 10 shows the comparison of the number of events:

Figure 10 shows that there is no obvious correlation between other groups of data and the number of events except the gross value of industrial output, but it also shows some characteristics. Figure 10(a) reveals that the per capita GDP

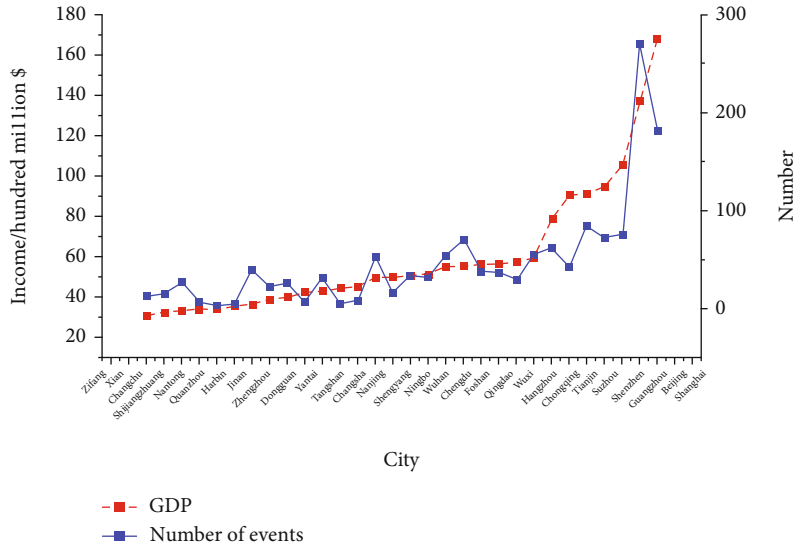


(a)



(b)

Figure 8: Continued.



(c)

Figure 8: Relationship between GDP and number of events. (a) The relationship between the GDP of the top 10 cities in terms of GDP and the number of events. (b) The relationship between the GDP of the top 20 cities in terms of GDP and the number of events. (c) The relationship between the GDP of the top 30 cities in terms of GDP and the number of events.

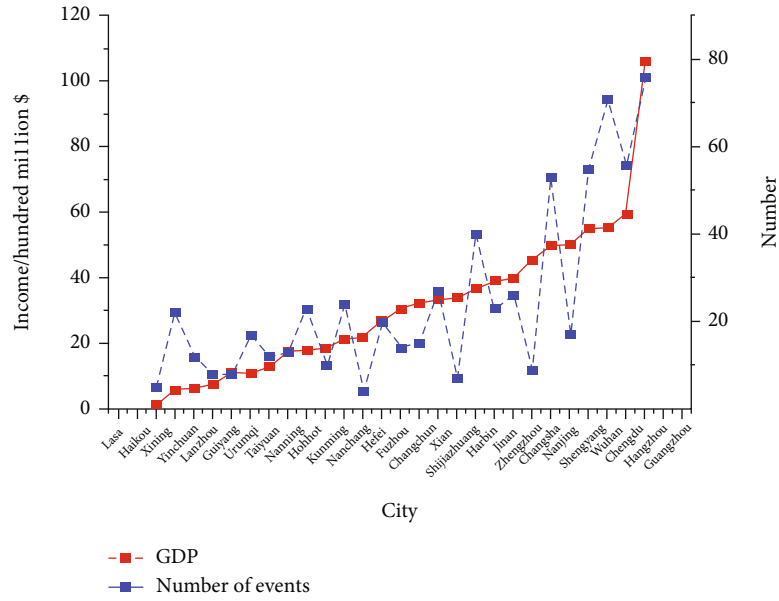
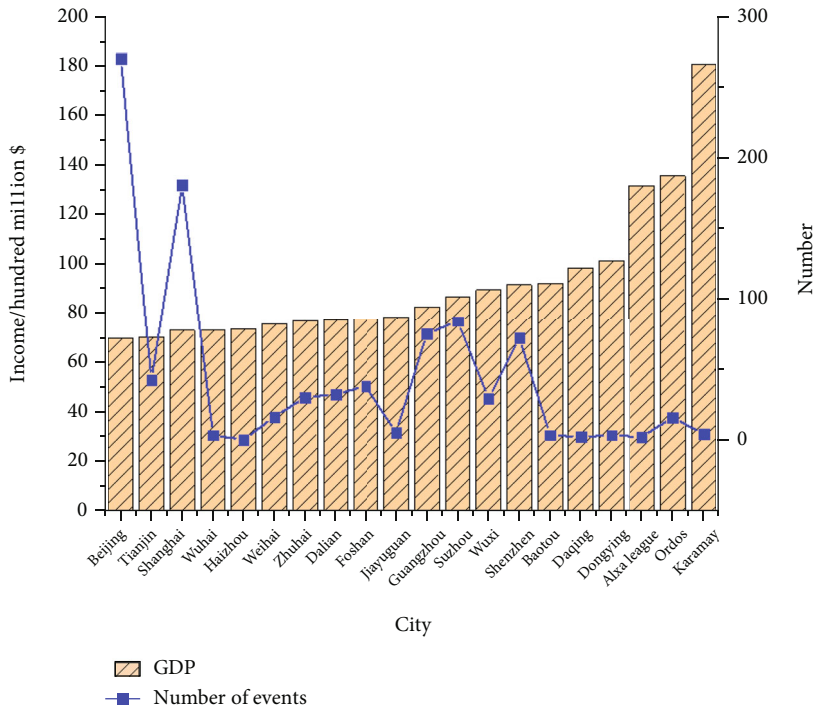
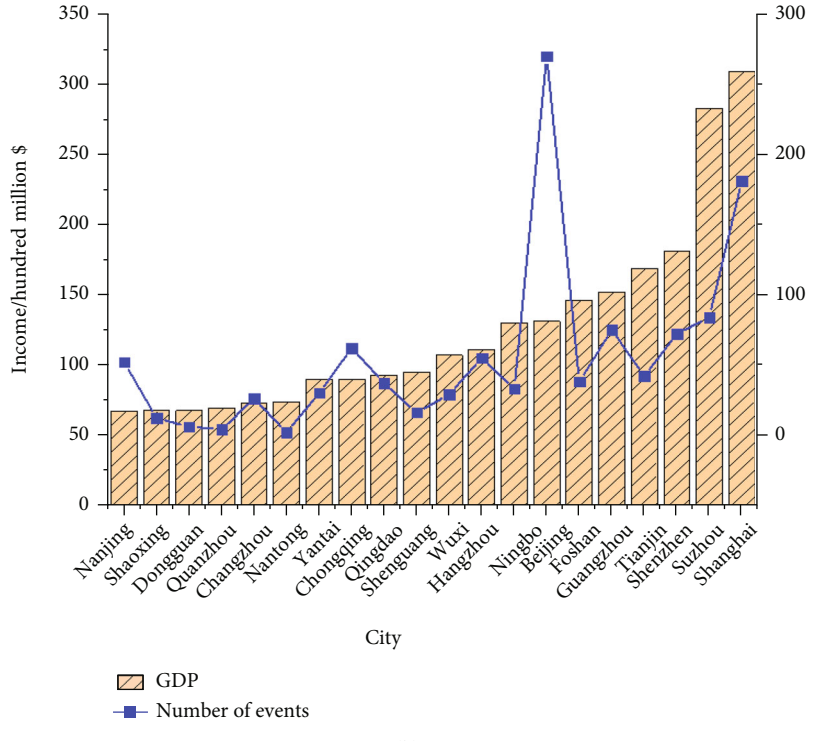


Figure 9: Relationship between GDP and number of events in provincial capital cities.

has no relationship with the number of events. The main reason is that the government mainly funds the events held in China, the residents of the host city often do not participate in the events held, and the events are often inconsistent with the cultural attributes of the host city. For example, the per capita GDP of some energy cities in China, such as Daqing, Ordos, Baotou, Dongying, Karamay, and Alxa League, ranks among the top six in the country. Rich oil, coal, natural gas, and other resources are the driving force for economic development and have also promoted the rapid development of six cities. Contrary to economic development, the number of events they hold is not large, because these cities have a short history and start from energy. Compared with those cities with a long history, they lack cultural accumulation and the cultural industry is relatively backward. The trend in Figure 10(b) is similar to that of GDP and the number of events, because the gross value of industrial output and GDP are directly related and are one of the main components of GDP. Figure 10(c) reveals that the total output value of agriculture, forestry, animal husbandry, and fishery is not related to the number of events. They are not the pillar industries of the modern urban economy. Hence, the data are not related to sports events representing urban culture.

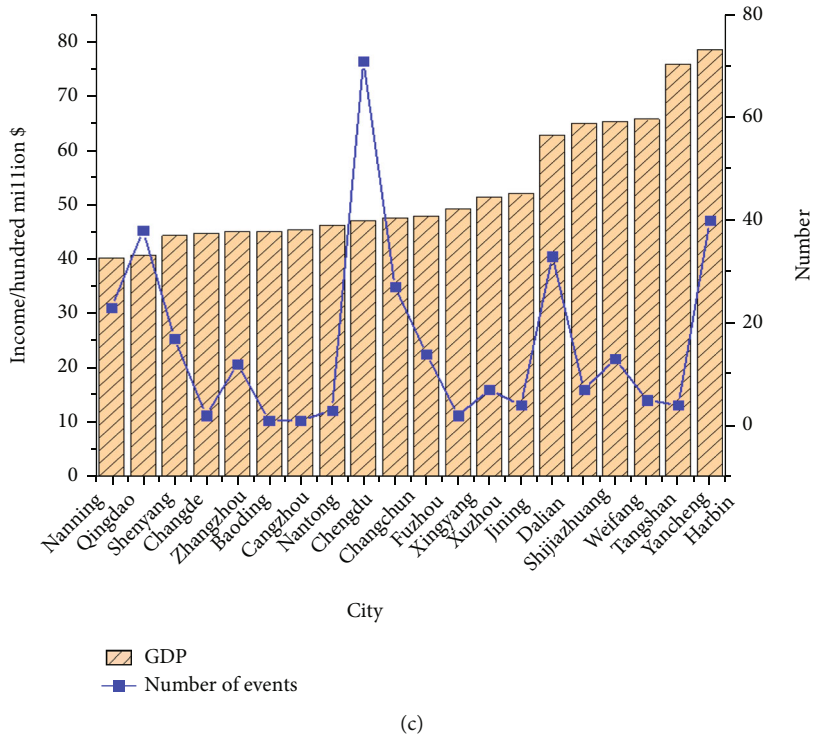


(a)



(b)

Figure 10: Continued.



(c)

Figure 10: Comparison between different reference values and the number of events. (a) Number of events in the top 20 cities with per capita GDP. (b) Number of events in the top 20 cities with the gross value of industrial output. (c) Number of events in the top 20 cities with the total output value of agriculture, forestry, animal husbandry, and fishery.

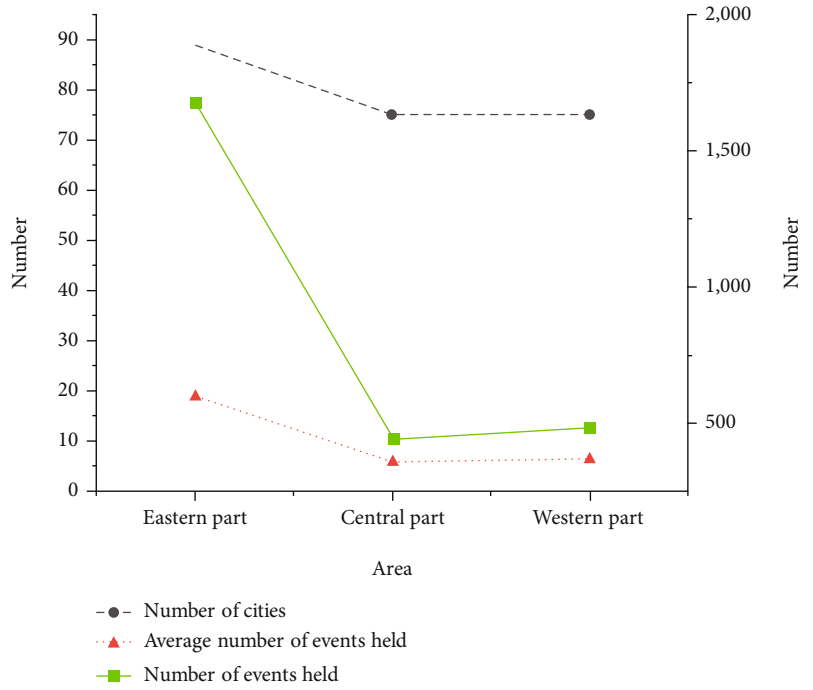


Figure 11: Comparison of the number of events held by cities in different regions.

Figure 11 shows the analysis of the number of events from different regions.

Figure 11 shows that among the cities that have hosted sports events, there are 89 cities in the east, with a total number of 1676 events, accounting for 64% of the national events, far exceeding the central and western cities, and even far exceeding the sum of the latter two. In addition, for venues, the number of stadium facilities owned by

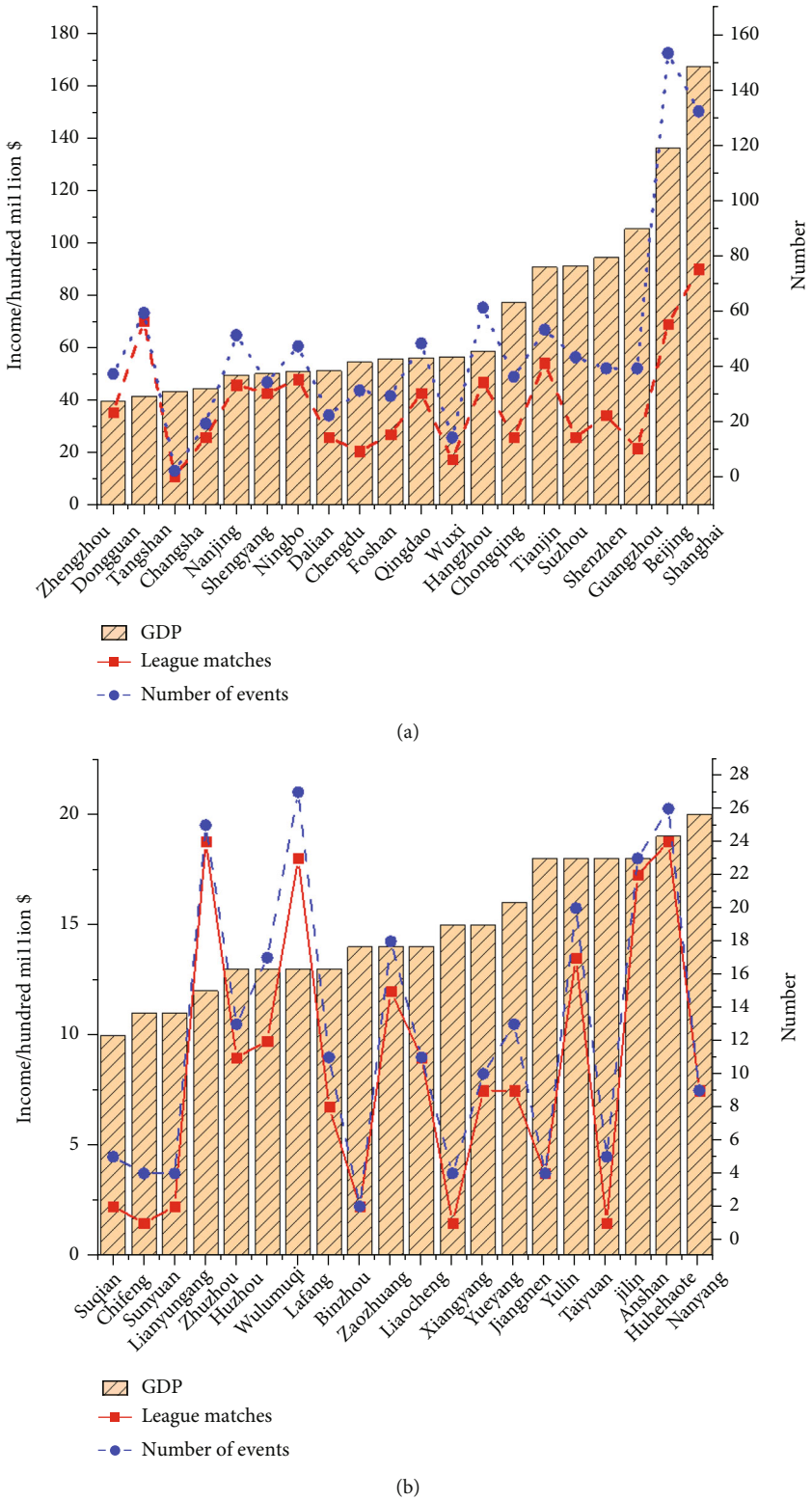


Figure 12: Comparison of the number of leagues and all competitions held by cities with league clubs. (a) Comparison of the number of leagues and all competitions held by cities with the top 20 GDP. (b) Comparison of the number of leagues and all competitions held by cities with the top 30 to 50 GDP.

provinces (cities) in the three metropolitan areas, namely, Beijing-Tianjin-Hebei, the Yangtze River Delta, and the Pearl River Delta, ranks first in the country.

Figure 12 is an analysis of the relationship between the number of league events held by the city and urban development:

In Figures 12(a) and 12(b), cities are ranked according to GDP. The overall trend of the curve of the number of league matches and the total number of events is similar to the economic trend. The overall GDP of the city in Figure 12(b) is not high, the total number of events is not high, and the data gap is not obvious. However, compared with the city in Figure 12(a), there is a big gap, which is in line with the overall law of the urban economy and the number of events. The two curves in Figure 12(b) are very close, indicating that most of the events held in these cities come from the league, while there are few other events.

The above analysis shows that cities with better economic development will hold more events. Sports events will get people's general attention when they are in progress. People will upload or obtain a large amount of related information through computers and mobile phones. It will easily lead to the reduction of cloud processing efficiency and congestion or even collapse of IoT. Therefore, the more developed cities should pay more attention to the use of edge computing technology to prevent and alleviate the emergence of network problems and enhance people's favor for the city.

4. Discussion

Compared with the method proposed by Wu et al. [22], the advantage of the designed method is that it takes urban marketing as a logical starting point and uses research methods such as literature and logical analysis. The urban marketing of sports events is analyzed from three aspects: improving the economic development level of the host city and brand image and driving the development of the host city's sports industry. On this basis, it points out the urban marketing strategy for sports events.

Today, with the gradual acceleration of the urbanization process, it can be found that the awareness of urban brand marketing in China has gradually awakened, and urban managers have begun to actively shape urban brands and build and spread the image of the city. However, due to the lag of many domestic management concepts and the limitation of management level, most of the brand marketing methods adopted are too fixed and traditional, which makes the homogenization of domestic urban brand marketing serious. The brand building of many cities mostly stays in the promotion of slogans or the production of city slogans, and it is difficult to locate the unique characteristics of the city. Meanwhile, the proposal of the development strategy of urban agglomeration makes some cities in the cluster constrained by the regional strategy, and the urban characteristics are covered up by the cluster, which cannot give full play to the advantages of the city. For example, in the integrated Beijing-Tianjin-Hebei region, many areas in Hebei have limited development characteristics, and their original value has been overshadowed by the two municipalities of Beijing and Tianjin. On account of the above-mentioned development background, the demand condition of urban brand marketing in China has changed from the promotion of city popularity to the development idea of combining urban development characteristics to create and enhance the city's popularity. The traditional economic-led development has been transformed into enhancing the comprehensive strength of the city. The important role of information and media has also been widely used in city brand marketing. The idea of marketing to promote development, from engrossing in infrastructure construction to fully integrating urban characteristic resources and amplifying their use, has created new competitiveness and increased influence for the city. There are many carriers to meet the needs of urban brand marketing. Among these carriers, there are very few carriers that can fully display urban culture, have a highly disseminated nature and positive content, and can drive the development of the urban economy and other industries. Sports events are the carrier that can meet the above-mentioned urban marketing needs. As one of the components of urban culture, the holding of sports events can drive the development of various core industries in the city, especially the tertiary industry that has been developed in recent years, which has well promoted the transformation of the city's industrial structure. City managers should recognize the development opportunities that sports events can bring to cities and should also consider them in city development strategies. If a city can well display a top-level event product and hold it for several consecutive sessions and can attract great attention from the media, then the city is bound to create a healthy, active, modern, and fashionable image to the outside world. City managers have realized that sports events can meet the needs of city brand marketing and have been integrating existing urban resources to formulate corresponding strategies. It can be said that modern cities cannot lack sports competition industry planning.

5. Conclusion

Based on edge computing, the impact of sports events on urban marketing is explored. In addition to studying the economic and cultural impact of the Olympic Games on each host country, the relationship between the economy of each domestic city and the number of events is analyzed. The more large-scale events are held, the more they can promote the high-end market development in urban tourism. The hosting of the Beijing Olympic Games has brought $3.127 billion in revenue and great changes in humanities, ecology, living environment, and other aspects to Beijing. The higher the GDP of a domestic city is, the more events will be held in this city. There is a positive correlation between the two. Domestic event resources are concentrated in the cities with strong economic strength. The total number of events held by the top 10 cities with GDP accounts for 64.1% of the top 30 cities. Geographically, among the cities that have hosted sports events, there are 89 cities in the east, with a total number of 1676 events, accounting for 64% of the national events, far exceeding the central and western cities, and even far exceeding the sum of the latter two. Therefore, it can be said that the holding of sports events reflects the comprehensive strength of a city and improves the city's exposure and popularity. Due to limited energy, the utilization of sports event heritage is not analyzed, which needs further research.

Data Availability

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

Ethical Approval

This article does not contain any studies with human participants or animals performed by any of the authors.

Consent

Consent was obtained from all individual participants included in the study.

Conflicts of Interest

All authors declare that they have no conflict of interest.

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