Research Article

Analysis on Performance Development Trend of Track-and-Field Throwing Events Based on Blockchain and Mobile Big Data

Linpeng Liu

College of Sports and Health, Wenzhou University, Wenzhou 325035, Zhejiang, China

Correspondence should be addressed to Linpeng Liu; 00042006@wzu.edu.cn

Received 21 January 2022; Revised 21 February 2022; Accepted 5 March 2022; Published 22 March 2022

Academic Editor: Muhammad Arif

Copyright © 2022 Linpeng Liu. This is an open access article distributed under the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

To promote the development of sports, this study analyzes the results of track-and-field throwing events in a province of China using the methods of literature, comparative analysis, mathematical statistics, and grey prediction, and compares them with the results of track-and-field throwing events in China. The province has made brilliant achievements in track-and-field throwing events in history, but we can also find some problems behind these excellent achievements: the overall results of throwing events in the province are good, relatively outstanding in women’s javelin and men’s discus throw, but still at a low level in women’s shot put and women’s hammer throw. In recent years, the throwing events in the province have gradually lost their advantages, especially in women’s shot put and men’s hammer throw. Facing the current situation of throwing events in this province, we must clearly understand the characteristics of the performance development of track-and-field throwing events in this province, grasp the advantages of throwing events, and strive to make a breakthrough in other individual events. Only when we have a comprehensive and objective grasp of the development trend and law of achievements, we can fully understand where and how big the gap is with the highest level in China, and then find a breakthrough and catch-up.

1. Introduction

Track and field is the foundation of sports. It plays an important role in strengthening the physique, improving health, and laying the foundation for other events. The arrival of the era of big data has had a profound impact on the development of track-and-field sports. Based on the research on the impact of big data on track-and-field sports teaching, track-and-field sports training, track-and-field sports competition, and track-and-field sports, it is found that big data has changed the traditional teaching, training, competition, and activities of track-and-field sports, and has changed the prejudice against track-and-field sports, so as to bring new opportunities for the development of track and field. Throwing is a very technical event in track-and-field sports, and its history is long. Their origin is inseparable from human activities. They are the labor products of people conquering and transforming nature for a long time [1]. People summarize the experience of various activities in reproduction and activities, and gradually form shot put, discus, javelin, and hammer throws with the development of society. With the continuous development of competitive events, the throwing rule system has been continuously improved. The diameter of the throwing circle of shot put and hammer is 2.135 meters, and that of discus is 2.5 meters. A wooden toe board is placed directly in front of the shot put circle to prevent athletes from sliding out of the circle. The javelin throwing area is a runway with a width of 4 m and a length of about 30–36.5 m. In all throwing competitions, the landing area is a flat fan-shaped area composed of lawn or other materials that can leave marks. Each sector is separated by a 5-cm-wide white line. The fan angle of the landing area in shot put, hammer, and discus throw competitions is 34.92 degrees, and that in javelin throw competitions is about 29 degrees [2]. As a new computer application mode, blockchain’s core functions are distributed data storage, point-to-point transmission, consensus mechanism, encryption algorithm, etc., its technical mode and main work focus on establishing trust and security in the process of data storage and transmission, improving the effectiveness of data sets.
and enhancing the confidentiality and security of data transmission. Therefore, the big data era we are entering urgently needs the implantation and application of blockchain technology to improve the work efficiency and safety factor of big data platform and promote the innovation and application of data information technology, including sports big data. The four target groups of sports big data services such as professional clubs, sports media, sports fans, and sports gambling people are expected to enjoy faster, safer, and privacy guaranteed data services in the process of embedding sports big data in blockchain technology, so as to improve the efficiency and effect of their participation, watching games, news reports, and gambling activities. On this basis, the supply side innovation blueprint of sports big data will appear on the paper; especially, the main fields and directions of the sports industry, such as professional sports big data, national fitness and national health linkage big data, and sports industry core element resource big data, will become the main source of providing basic databases. The prospect of transmission, analysis, and utilization will be very considerable [3]. Figure 1 shows the application of blockchain in the sports industry.

2. Literature Review

Harding F. V. and others said that reviewing the development history of human society, they found that the most important reason why human beings can rise to dominate the Earth in species evolution is the establishment and continuous optimization of language-based communication, trust, and cooperation mechanisms. In a great sense, human civilization is a large-scale cooperation network based on trust and consensus [4]. Schoene R. B. and others said that the twentieth century was the most dramatic 100 years in human history. In the second half of the twentieth century, the emergence of the Internet greatly innovated the communication mechanism of human society, built a new large-scale cooperation network far beyond the past, greatly liberated social productivity, and improved communication efficiency [5]. Kim and others said that when we cannot live without the convenience brought by mobile Internet, the demand for network information security and encryption has become urgent and prominent, and the continuous outbreak of network information leakage has made mankind panic [6]. Lindqvist A. S. and others believe that using various technical means to encrypt the network transmission chain has become a common topic faced by information science and management science. How to build a new model of information trust and transmission suitable for large-scale and rapid promotion has become an important issue concerned by researchers [7]. Pavlovi R. and others put forward the encryption protection chain products of blocks and made continuous follow-up research. Relevant research ideas were quickly applied to the field of financial innovation. Until the concept of digital currency “bitcoin” was put forward and bitcoin was developed and launched, the research on blockchain remained in the embryonic stage [8]. Hyde A. and others said that in recent years, the issuance and market volume of digital currency represented by “bitcoin” have expanded rapidly, which has attracted extensive attention from the global financial community and governments. This kind of digital currency issuance and circulation system based on blockchain technology has caused many disputes and thoughts [9]. Gava P. and others pointed out that the machine trust based on blockchain technology is trust without trust, and its security and near-zero-cost characteristics will make a qualitative leap in the large-scale cooperative network of human society [10]. Kim and others believe that according to the concept recognized by the academic community, blockchain is a new application mode
of computer technology such as distributed data storage, point-to-point transmission, consensus mechanism, and encryption algorithm. Among them, the consensus mechanism is a mathematical algorithm to establish trust and obtain rights and interests between different nodes in the blockchain system [11]. Majchrzak K. and others said that the above definition of blockchain has opened a new idea of data transmission and security encryption, that is, changing the inherent mode of information integration and dissemination, optimizing and upgrading the storage, value mining, value dissemination, and exchange mode of big data, which will greatly improve the value and efficiency of information and the welfare effect of big data applications [12]. Extending from this, Dai B. and others believe that the potential fields of current blockchain applications mainly include smart contracts, securities trading, e-commerce, Internet of things, social communication, file storage, existence proof, authentication, and equity crowdfunding [13].

3. Method

3.1. Literature Method. Consult monographs and textbooks on the development process and changes of track-and-field throwing, as well as relevant official sports websites to collect the results of track-and-field throwing events. Read about dynamic analysis methods, grey system theory, advanced mathematics, system science, sports statistics, and other related disciplines. Study the relevant theories, viewpoints, and methods of sports performance prediction at home and abroad, pay attention to its research status, and systematically summarize the relevant data, so as to provide theoretical support for this study.

3.2. Comparative Analysis Method. This paper selects the track-and-field throwing results of a province in China and the national results; compares their competitive strength, medal strength, competition results, event groups, and events; and finds out the change law and dynamic development trend of track-and-field throwing results.

3.3. Mathematical Statistics. Using Microsoft Excel, the SPSS11.0 software makes statistical analysis on the collected data. In order to protect the privacy and tamper-proof performance of user data, it is necessary to encrypt the data and store its hash value in the blockchain. Encrypting data can prevent unauthorized users from accessing data, and storing the hash value of data in the blockchain can prevent information from being tampered with. If the encrypted data need to be jointly maintained by some parties, a certain number of participants are required to check the encrypted data. In this paper, we use the $(p,t)$, threshold Paillier cryptosystem. The private key SK is separated (expressed as $sk_1, sk_2, ..., sk_p$) and divided into $P$ parts. If one party wants to decrypt ciphertext $C$, at least $t-1$ other private keys need to be aggregated.

(1) According to

\[ c = E_{pk}(m) = g^{m \cdot r^a \mod n^2}. \]  

Plaintext $m \in Z_n$, public key $pk = (g, n)$, and $r \in Z_n^*$, $Z_n^*$ represent the multiplication group of reversible elements in $Z_n$, are randomly selected and privately owned by the user. Each user $k \in K$ encrypts $v_k$ and transmits the ciphertext $E_{pk}(v_k)$ to the data center.

(2) According to the homomorphism of the encryption system,

\[
E_{pk}(m_1 + m_2) = E_{pk}(m_1) + E_{pk}(m_2) = g^{m_1 + m_2} \equiv (r_1 r_2)^n \mod n^2,
\]

\[
E_{pk}(a \cdot m_1) = E_{pk}(m_1)^a = g^{a m_1} \equiv (r_1)^a m_1 \mod n^2.
\]

where $m_1, m_2$ represents the plaintext to be encrypted, $r_1, r_2 \in Z_n^*$ is randomly selected, and $a$ is a constant.

Cloud Computing formula is as follows:

\[ C = E_{pk} \left( \sum_{k=1}^{K} v_k \right) \]

\[ = \prod_{k=1}^{K} E_{pk}(v). \]

The cloud randomly selects $t-1$ users and sends $C$ to them.

(1) Each selected user $k'$ calculates part of the ciphertext $C_{k'}$ of $C$ based on Eqn (3) and sends $C_{k'}$ to the cloud.

(2) The cloud calculates the partial ciphertext $C_{datacenter}$ and then combines $t-1$ other partial ciphertexts obtained from other users to obtain sum $\sum_{k=1}^{K} v_k$.

3.4. Grey Prediction Method. Grey prediction is to establish the quantitative relationship between the present and the future on the (behavior) time axis and predict the development of things through this quantitative relationship (grey model). The growth of sports performance fluctuates and is a process of development and change in time series. There are many prediction methods of system sports state in time series. According to previous experience, the grey dynamic model is used to predict and analyze the performance of track-and-field throwing. All random variables in track-and-field throwing results are regarded as a time-related grey process varying in a certain range. The accuracy of prediction can be greatly improved by sorting the disordered original data into a regular generating series and comprehensively observing, analyzing, and predicting the development and change of the system using the continuous grey differential model. Therefore, this study uses the grey prediction method to predict the throwing results of track and field [14].
4. Results and Analysis

4.1. Performance Development Analysis of TT_hrowing Events

4.1.1. Overall Comparison of the Results of Track and Field TT_hrowing Events between a Province and the Whole Country

By consulting a large number of literature and books, this study collected the best results of a province and the whole country from 2000 to 2015, and analyzed the best results of track-and-field throwing events in China and a province using SPSS and Excel software. Through the fixed-base growth rate, the change of sports performance for a long time can be clearly shown. The calculation formula is as follows:

\[ F_d = \frac{(X - Y)}{Y} \times 100\% \]  

where \( F_d \) is the base growth percentage of the best performance of each project [15].

4.1.2. Comparison of Individual Results of Throwing Events between a Province and the Whole Country

(1) Javelin Achievements and Development Trend. Javelin throwing is a movement of handheld instruments requiring rapid explosive force. It enables the human body to obtain the maximum speed after accelerated running and then quickly complete the forced action in 0.2–0.3 seconds. As early as 1963, Jia, a famous female javelin thrower in the province, won the championship in the national track-and-field games with a score of 49.88 meters and broke the national record at that time. Since 1976, the province has entered a new period. During this period, Ding participated in the eighth Asian Games and won third place in javelin. In the late 1970s and early 1980s, the province took all-round development as the guiding ideology and achieved good results. Tang, a female javelin thrower from the province, won first place and seventh place in the Asian Track and Field Championships and the Second World Cup track-and-field competition, respectively, in 1981.

According to Figure 2, the best results of men’s javelin in a province of China and the whole country have increased significantly. From 2000 to 2014, the best result of men’s javelin in the province increased by 6.55 meters, with an average annual increase of 0.46 meters. The National Men’s Javelin showed a downward trend. From 2000 to 2014, the National Men’s Javelin performance decreased by 4.76 meters, with an average annual decrease of 0.36 meters. Chinese men’s javelin performance fell steadily. The results of men’s javelin in the province increased steadily from 2004 to 2014, but there was a rapid decline in 2003. In 2000, the province threw a best result of 71.84, a difference of 12.45 meters from Li’s throw of 84.29. At that time, there was a large gap between the provincial men’s javelin and the national level. However, the overall level of China’s javelin throw has declined, coupled with the continuous improvement of the training level of the province and the emergence of Qin and other excellent athletes, and the ranking of men’s javelin performance in the province has been rising. Qin, known as the rising star of Chinese men’s javelin, won sixth place in the men’s javelin of the 2002 World Youth Championships, the men’s javelin champion of the 2006 National Track and Field Championships, ninth place in the qualification of the 2007 World Championships, the men’s javelin champion of the National Track and Field Championships, and the men’s javelin champion of the National Track and Field Grand Prix. In 2011, Jiang also won honors for the province with a good score of 79.55 meters.

Looking at the women’s javelin in the province, according to Figure 3, the best results of women’s javelin in the province also show an upward trend. From 2000 to 2015, the best result of women’s javelin in the province increased by 6.42 meters, with an average annual increase of 0.45 meters. The National Women’s Javelin showed a trend of the first decline, then stabilization, and finally rapid rise. From

\[ F_d = \frac{(X - Y)}{Y} \times 100\% \]
2000 to 2015, the National Women’s Javelin performance increased by 2.21 meters, with an average annual increase of 0.13 meters. The performance of Chinese women’s javelin was relatively stable from 2000 to 2011 and fluctuated greatly after 2011. In 2000, Liang threw 59.33 meters, with a difference of 4.59 meters from Wei’s 63.92 meters. In subsequent years, the province’s women’s javelin has been at the forefront of the country. The results of women’s javelin in the province fluctuated steadily from 2000 to 2011. After 2011, because the best achievements of the province in this period can represent the best achievements in the country, the ups and downs are more obvious as the best achievements in the country. It can be clearly seen that the level of women’s javelin in the province has been close to the national level. It can also be said that women’s javelin has been an advantageous project in the province in recent years. In terms of achievements, the overall development trend of male and female javelin in the province in recent years is good, which has a great relationship with the province’s attention to this project and the investment of capital and science and technology. The results of women’s javelin are close to the highest in history, but we find that women’s events sometimes rely too much on a certain athlete, and the results decline significantly in the stage of Li’s injury. Therefore, it is necessary to continue efforts to train follow-up talents for connection.

(2) Development Trend of Shot Put Performance. Shot put is one of the track-and-field throwing events. It is an ancient sport. The men’s shot put weighs 7.257 kg. The women’s shot put weighs 4 kg. Men’s shot put has a long history. As early as the first Olympic Games in 1896, men’s shot put was registered as an Olympic event. The province’s outstanding shot putters appeared after the reform and opening up. With the provincial government’s attention to competitive sports and active reform, the shot put project of the province ushered in the spring 1985. Cong, a famous player of the province, won fifth and first place in the fourth World Cup track-and-field competition and the Asian Championship, respectively. He broke the Asian record with 18.55 meters in a track-and-field elite competition and then broke the Asian record again with 18.93 meters in a track-and-field invitational competition, and it was rated as China’s “top ten athletes in China.”

After 2000, the women’s shot put in the province showed a downward trend. From 2000 to 2015, the province’s women’s shot put performance in this project decreased by 3.62 meters, with an average annual decrease of 0.24 meters. Figure 4 can clearly show that the province’s women’s shot put best performance has declined significantly since 2000, especially from 2005 to 2007. The gap between the declining performance and the national best performance is becoming larger and larger. The National Women’s shot put is on the rise, with an increase of 1.02 meters from Yu’s 19.32 meters in 2000 to Gong’s 20.34 meters in 2015. The gap between the province and the whole country also increased from 0.1 m in 2000 to 4.64 m in 2014. The widening gap also fully shows that the women’s shot put project in this province has withdrawn at the forefront of the country and is gradually declining [16]. The famous general Cheng of the province has great strength such as the champion of the previous National Track and Field Championships from 1998 to 2001; second place in the 1998 Asian Games; fifth place in the 1999 World Track and Field Championships; and second place in the 2001 National Games. During this period, Chinese women’s shot put occupied a great advantage. However, the performance has declined significantly since 2005, which is related to the management system of the province and the inability of new and old athletes to complete a good alternation.

From above Figure 5, in terms of men’s shot put, the province showed a relatively good trend. From 15.63 meters thrown by Li, an athlete of the province in 2000 to 19.61 meters thrown by Wang in 2014, the score increased by 3.98
meters, with a relatively large increase range, with an average annual increase of 0.28 meters. Although there is a large gap between the level of Chinese shot put and that of the world’s elite athletes, and it is difficult for Chinese men’s shot put to do anything on the world stage, the overall performance of the country also shows an increasing trend, with an increase of 0.64 M from 18.97m in 2000 to 21.75m in 2008, and then to 19.61 M in 2014 [17]. The gap between the best results of the province and the whole country has also increased from the initial 3.34 meters to the final zero gap of the province’s king in 2014. The rapid rise of the results made the shot put of the province quickly enter the forefront of the country. At present, the province has made obvious progress in men’s shot put and looks forward to better play.

(3) Discus Achievement Development Trend. Discus originated from the stone-throwing activities of ancient Greeks from the 12th to the eighth century BC. It was listed as an event in the ancient Greek Olympic Games. The province is a traditional discus province. As early as 1963, the competitive sports of the province put forward the training principle of “highlighting the key points, treating them differently, less but better,” strengthened the training of physical quality and basic skills, focused on reducing injuries and strengthening prevention, and constantly strengthened the cultivation of athletes’ cultural knowledge. In the same year, Zhao of the province won the gold medal of women’s discus at the first emerging power games [18]. After putting things right, the province’s discus project has entered a new period. At this stage, the province’s women’s discus champion Jiao won first place in the Fifth Asian Track and Field Championships in 1983 and won the championship again at the Fifth National Games next year. In the Olympic Games held in the same year, Jiao won 11th place in women’s discus.

From Figure 6, we can find that the women’s discus performance in the province showed a large fluctuation from 2000 to 2014. From Luan’s 62.26 m score in 2000 to Su’s 64.27 m score in 2015, women’s discus has increased by 2.01 M, with an average annual increase of 0.13 M, and the rising speed is relatively slow. It can be clearly seen from the figure that the best results of women’s discus in the province fluctuated significantly from 2000 to 2003, and then developed steadily and at a high level in the whole transportation cycle from 2005 to 2009, close to the national level. In 2012, the province’s famous horse racing threw a good result of 63.91 meters, but with the decline of horse performance, the province’s women’s discus fell to the lowest point in 2013, only the worst result in the history of 54.94 meters. However, after this year, the province’s women’s discus project continued to reform and quickly caught up with the national level. Finally, Su ranked first in the country with a score of 64.27 meters in 2015 [19]. On May 14, 2016, in the 2016 IAAF Diamond League women’s discus competition, Su won fourth place with 64.45 meters, was directly promoted by throwing the best result of 65.14 meters in the Olympic women’s discus qualification in August 2016, and set a new personal best result. The national best result is from 64.53 meters thrown by Yu in 2000 to 64.27 meters thrown by Su in 2015. On the contrary, the gap between the best result of the province and the whole country is from 2.27 meters in 2000 to 0 in 2015, which can drop a little during this period. During this period, the two outstanding athletes who have been in the forefront of women’s discus events in the province are Xu he ma. The former threw the best result of 62.64 meters in 2002. The fluctuation of the results of the two athletes is also the main reason for the change of the best result of women’s discus in the province.

The province’s men’s discus has been the province’s track-and-field label project since 2000. The province has made great achievements in this project. First of all, in 2000, Li threw the national best score of 62.29 meters. By 2014, Tan, an athlete of the province, only threw 55.47 meters. The overall performance showed a downward trend, with an overall decrease of 6.82 meters and an average annual decrease of 0.48 meters. The national best score of men’s discus...
decreased by 4 meters from 63.29 meters of Li in 2000 to 59.29 meters of Wu in 2014, with an average annual decrease of 0.28 meters. The overall decline rate of men’s discus best results in the province is 1.5 times that of the whole country. Although they are all declining, the gap between the province and the national best performance has increased from zero to 3.82 meters in 2014. However, it can be seen from Figure 7 that the best performance of the province does not simply decline all the time, but has obvious fluctuations. It is not difficult to find that the four fluctuations are the characteristics of the whole transportation cycle, reaching the peak in 2000, 2005, 2009, and 2013, respectively. It can be understood that the province’s investment in preparing for the National Games is much greater than usual. Research and analysis of the province’s men’s discus project, on the current situation, on the development of men’s discus has entered a trough. Compared with the national strong track-and-field province, the province’s men’s discus started earlier and achieved brilliant achievements; especially, the discus throwing team led by Li, the champion of the three national games, has unlimited scenery. However, due to the obvious decline in the performance of the old team members and the situation of catching up with and surpassing the national first-class level for the time being, the men’s discus project in the province was in short supply, and the performance decreased significantly. While constantly expanding the national level, we should think about the alternation of new and old or other problems, further improve the province’s men’s discus throwing technology, explore the development road of the province’s men’s discus reserve force, look for existing problems, and strive for further brilliance [20].

(4) Development Trend of Hammer Scores. Hammer is one of the throwing events in track and field. The hammer ball is made of iron or copper with chains and handles on it. In 1900, hammer throw was listed as an event in the second Olympic Games. From the performance change curve over the years, the men’s hammer throw in the province developed late did not form a good development trend, and the overall level is not high.

From above Figure 8, in terms of overall performance, the best performance of men’s hammer throw in the province increased by 1.21 meters from 62.12 meters of Sun to 63.33 meters of Jiang in 2014, with an annual growth rate of 0.08 meters. From 63.64 m in 2000 to 72.45 m in 2014, the national best performance increased by 8.81 m, with an average annual growth of 0.62 m, far higher than the growth rate of the province. Therefore, the gap between the best results of men’s hammer throw in the province and the country also expanded from 1.52 in 2000 to 9.12 meters in 2014. Low level and large gap between the whole country are the characteristics of hammer in this province. In 2000, due to the low level of the province and the whole country, the gap was 1.52 meters, and then, the national performance remained at about 70 meters, which instantly widened the gap between them. However, during this period, some excellent athletes also emerged in the province, such as Zhao, won the championship with a score of 69.94 meters in the National Track and Field Championships and the preliminary competition of the 10th National Games in 2005, and broke the provincial record of 14 years. After the 10th National Games, Shandong hammer scores showed a downward trend. Zhai ranked 15th in 2007, and Hu ranked 16th in 2008. Until the 11th National Games held in 2009, Zhao, a famous player of the province, was brave again, threw 70.66 meters, and won third place in the Olympic Sports Center Stadium. After 2009, the performance of the province has decreased year by year, which is gradually far from the national level. Due to the outstanding decline in performance and the low overall level of performance, it is necessary to deeply reflect on the shortcomings of hammer events in the province [21].

From above Figure 9, the weakness of women’s hammer in this province is more obvious than that of men. This article refers to the results of the top 30 women’s hammer in China. However, in these materials, the results of women’s hammer in this province did not enter the top eight in 2001,
2003, 2007–2010, and 2013–2014, respectively. In rare years, women hammer players in this province have done little. From the king’s 52.25 meters in 2000 to the palace’s 54.75 meters in 2012, an increase of 2.50 meters. The average annual growth is 0.2 m. Although it shows an overall growth trend, there are too many middle faults to indicate the level of women’s hammer throw in the province. Nationally, Zhao threw 65.70 meters in 2000 and Zhang threw 76.33 meters in 2015. The gap between the province and the whole country has increased from 13.45 meters in the beginning to 22.14 meters in 2012, which is enough to show that the province has a great disadvantage in the women’s hammer event. In the national ranking, Zhang ranked 10th in 2002 and 14th in 2004; Liu ranked 19 in 2005 and 20 in 2006; too many data show that there has been no breakthrough in women’s hammer throw in the province in recent years, and the gap is becoming larger and larger compared with the national level.

4.1.3. Performance Analysis of Individual Male and Female Athletes in Track-and-Field Throwing Events in a Province of China

(1) Development Trend of Male and Female Hammer Scores in a Province of China. The best results of men’s and women’s hammer throw in Shandong Province are shown in Figure 10. The results show that the national level of men’s hammer throw in Shandong Province is higher than that of women, and the performance of men is relatively stable. The level of women’s hammer throw in this period was not only very low, but also the middle fault was obvious. Although the level of men is relatively low compared with the national level, the change of performance is relatively stable [22, 23].

(2) Development Trend of Male and Female Javelin Performance in a Province of China. The best results of men’s and women’s javelin in the province are relatively high compared with the national results, and the women’s events are more prominent. Compared with men, women’s events have less change and more stable development. Its characteristics are summarized as follows: from Figure 11 the overall performance of men and women in javelin is stronger, the performance of women is better, and the development is more stable [24–26].

(3) Development Trend of Male and Female Shot Put Performance in a Province of China. In the men’s and women’s shot put events in this province, it is not difficult to find from Figure 12 that the men’s and women’s achievements in shot put in this project are more outstanding than those of men, which is not only reflected in the high overall level of men’s shot put, but also in an increasing trend. Women’s...
4.2. Analysis of Favorable Conditions for Throwing Events. Looking back on history, the track-and-field throwing events in the province have achieved excellent results: Women’s javelin, men’s javelin, men’s discus, etc. The important reason for obtaining so many excellent results is that there are a number of excellent coach teams in the province. They proceed from reality, innovate boldly, practice bravely, and gradually form a series of theoretical systems; during this period, a group of excellent athletes also emerged. They worked hard, trained scientifically, studied seriously, and finally achieved excellent results; at the same time, it is inseparable from the strong support of the local government to strengthen the construction of sports facilities, strengthen capital investment, strengthen the cultivation of reserve talents, undertake various large-scale events, and strengthen management functions. In this project, our inherent advantages and geographical suitability are also important factors that we cannot ignore.

4.2.1. There Is a Group of Excellent Coaches. The survey data show that in terms of the educational background of track-and-field throwing coaches in the province, 84.2% have college education or above, and only 1.9% have junior middle school and senior high school education. Higher education level is an important prerequisite for coaches to master the training theory. The key reason why the province can achieve so many brilliant achievements in throwing events is that the province has an excellent coach team. It is also because of these excellent coach teams that the province’s track-and-field throwing events have been at the forefront of the country. The coach level largely determines the training effect. The provincial track-and-field throwing team has trained a large number of excellent coaches. They set out from reality, boldly innovate and practice, and gradually formed a series of theoretical systems. Most of the coaches in the province are transferred from athletes to coaches after retirement. These coaches have long-term training experience, plus regular vocational training every year, cultural knowledge, psychology, and other scientific and educational knowledge. The training level and professional level have been greatly improved, and the throwing coaches in the province have become systematic.

4.2.2. Focus on Developing Scientific Training. The provincial throwing team firmly establishes the awareness of “people-oriented and strong body through science and technology” and closely combines strengthening science with training, scientific training, strict management, and bold innovation, so as to improve the results of throwing events in the province. The provincial track-and-field management focuses on the idea of “highlighting the Olympic Games, based on the National Games, playing the Asian Games and running the Provincial Games,” scientifically arrange the training cycle, and strive for athletes to give better play to their sports achievements in the competition. During this period, the coaches of the province strengthened the ability training of athletes in all aspects. In the training, they not only emphasized the traditional large muscle group training but also paid more attention to the development of small muscle group strength. Throwing is a sport that combines strength and technology. If you want to throw far, you should not only have greater power and explosive power, but also master reasonable sports technology. The provincial throwing team pays more attention to details in training, accurately analyzes the movement technical advantages of national and even world elite athletes, and summarizes and makes use of them. In particular, the application of technical characteristics of men’s discus is more obvious. In combination with his own conditions, Li, a famous general of the province, has gradually formed the technical characteristics of large action range and obvious rhythm; especially, in the first half of discus throwing, the action is relaxed and the second half is suddenly forced, with very good results. At the same time, the biggest highlight in training is to add psychological intervention to the training process to strengthen the psychological quality of athletes. In terms of training time, it broke the traditional training method of separating physical fitness and technology, and changed to physical fitness training and special training.
interspersed with synchronous training, so as to improve physical fitness and skills at the same time. In terms of training time, change the rigid training mode of morning exercises, low load exercises and concentrated exercises in the afternoon. A reasonable cycle is formulated for the competition, and an appropriate amount of training content is arranged throughout the day, which is more conducive to adapt to the changes of time and weather in different events. Implement the training principle of "three requirements and one university" and the training method of "two districts" in the training. Gradually increase the number of training courses, improve the training intensity, increase the amount of sports training, and continuously improve the training level.

5. Conclusion

5.1. The Performance Development of Track-and-Field Throwing Events in a Province Shows an Upward Trend, And the Performance Development Trend is Good. After research, the results of track-and-field throwing events in the province are generally on the rise, especially in the results of women’s javelin, women’s discus, and men’s discus. The development speed of achievements is mainly shown as women’s Javelin > women’s discus > women’s shot put > women’s hammer, men’s Javelin > men’s shot put > men’s discus > men’s hammer.

5.2. The Results of Women’s Shot Put, Women’s Hammer, Men’s Hammer, and Men’s Discus in a Province Decreased Rapidly, Which Was Significantly inferior to the National Level. The province is in a weak position in the country in women’s hammer and women’s shot put. Women’s shot put has the best result and the fastest decline. From the leading level in the country, it is difficult to squeeze into the top eight in the country. Women’s hammer throw has become the biggest short board of throwing events in the province, and the gap between the best results in the country is widening. It is at a low level in the country and does not have strong competitiveness in the short term.

5.3. Men’s and Women’s Javelin, Women’s Discus, and Men’s Shot Put Are the Dominant Throwing Events in a Province of China. In the eight male and female throwing events, the male and female javelin, women’s discus, and men’s shot put are the main advantageous events in the province. The male and female javelin and women’s discus have achieved good results in recent years. The results of men’s shot put have increased rapidly since 2000, and the results of men’s shot put in the province have quickly entered the forefront of the country.

5.4. The Performance Development of Throwing Events in a Province is Unbalanced between Men and Women, And Shows an Obvious Phenomenon of "Whole Sports Cycle". The development of throwing results in this province shows that the stability of men is greater than that of women, including shot put and hammer. The results of men and women in the province are at the forefront of the country, while women’s results are better and their development is more stable. As the provincial government attaches great importance to the National Games, the results of throwing events in Shandong Province show the phenomenon of "National Games cycle," the development of results is serrated, and the change range is greater than that of the whole country.

5.5. The Echelon Construction of Coaches in a Province is More Reasonable, The Scientific Selection Needs to Be Further improved, And There is a Lack of Psychological intervention for Athletes in the Training Process. The echelon construction of coaches in the province is more reasonable, and the overall cultural level of coaches is high, rich theoretical knowledge and strong teaching experience. However, the current selection mechanism is not perfect, resulting in the shortage of athletes’ reserve talents; the psychological and intellectual intervention of athletes is not enough, and cultural training needs to be strengthened; and the government does not pay enough attention to vulnerable projects, leading to a vicious circle.

Data Availability

Data sharing is not applicable to this article as no new data were created or analyzed in this study.

Conflicts of Interest

The author states that this article has no conflicts of interest.

References

[1] K. Muramoto, “Development status of international standards on the rail track and the trend of the related research of rtri,” Quarterly Report of RTRI, vol. 59, no. 3, pp. 155–159, 2018.
[2] L. L. Wang, W. CaO, H. Pan, P. P. Xu, and Q. Zhang, “Analysis on the trend of physical development of children aged 7-17 years old in China from 1982 to 2012,” Zhonghua yu fang yi xue za zhi [Chinese journal of preventive medicine], vol. 54, no. 5, pp. 572–576, 2020.
[3] F. V. Harding, R. Salinas, and G. Salem, “Acl rehabilitation - track and field,” Medicine & Science in Sports & Exercise, vol. 34, no. 5, pp. 195-196, 2002.
[4] R. B. Schoene, K. Giboney, C. Schimmel et al., “Spirometry and airway reactivity in elite track and field athletes,” Clinical Journal of Sport Medicine, vol. 7, no. 4, pp. 257–261, 1997.
[5] J. W. L. Kim and J. Taek, “Analysis in the relationship between stress and self-confidence, performance strategy among track and field reserve athletes,” Korean Journal of Sport Science, vol. 19, no. 4, pp. 519–530, 2010.
[6] A. S. Lindqvist, T. Moberg, C. Ehrnborg, B. O. Eriksson, C. Fahlke, and T. Rosén, “Increased mortality rate and suicide in Swedish former elite male athletes in power sports,” Scandinavian Journal of Medicine & Science in Sports, vol. 24, no. 6, pp. 1000–1005, 2015.
[7] R. Pavlović, B. Petrović, M. Pupiš, and E. Bendikova, “Differences of results between women’s and between men’s finalists in the running, jumping and throwing disciplines of
the finalists of the world championships,” *American Journal of Sports Science and Medicine*, vol. 8, no. 2, pp. 60–68, 2020.

[8] A. Hyde, L. Hogarth, M. Sayers et al., “The impact of an assistive pole, seat configuration and strength in paralympic seated throwing,” *International Journal of Sports Physiology and Performance*, vol. 12, no. 7, pp. 1–21, 2016.

[9] P. Gava, H. Kern, and U. Carraro, “Age-associated power decline from running, jumping, and throwing male masters world records,” *Experimental Aging Research*, vol. 41, no. 2, pp. 115–135, 2015.

[10] K. K. Soo, u. h. baek, and H. Yeju, “An analysis on the morphological features of the excellent athletes of the field and track,” *The Korean Journal of Growth and Development*, vol. 16, no. 4, pp. 279–286, 2008.

[11] K. Majchrzak, M. Kamrowskanowak, and K. Byzdra, “Developmental tendencies of results in female heptathlon in the olympic games during the years 1984-2008,” *Baltic Journal of Health and Physical Activity*, vol. 2, no. 2, pp. 158–163, 2010.

[12] B. Dai, M. Mao, W. E. Garrett, and B. Yu, “Biomechanical characteristics of an anterior cruciate ligament injury in javelin throwing,” *Journal of Sport and Health Science*, vol. 4, no. 4, pp. 333–340, 2015.

[13] M. F. Piacentini, S. Comotto, A. Guerriero, M. Bonato, A. L. Torre, and G. Vernillo, “Does the junior iaaf athletic world championship represent a springboard for the success in the throwing events? a retrospective study,” *The Journal of Sports Medicine and Physical Fitness*, vol. 54, no. 54, pp. 410–416, 2014.

[14] L. W. Judge, D. Bellar, and M. Judge, “Efficacy of potentiation of performance through overweight implement throws on male and female collegiate and elite weight throwers,” *The Journal of Strength & Conditioning Research*, vol. 26, no. 7, pp. 1804–1809, 2012.

[15] H. Nukaga, T. Takeda, K. Nakajima et al., “Masseter muscle activity in track and field athletes: a pilot study,” *The Open Dentistry Journal*, vol. 10, no. 1, pp. 474–485, 2016.

[16] T. Miyamoto, H. Kobayasi, H. Mori et al., “Acupuncture for sports disorders in track and field events,” *Zen Nihon Shinkyu Gakkai zashi Journal of the Japan Society of Acupuncture and Moxibustion*, vol. 37, no. 2, pp. 111–119, 1987.

[17] J. S. Ko and H. W. Ko, “A research about physique and physical strength of track and field players,” *The Korean Journal of Physical Education*, vol. 22, no. 2, pp. 2195–2206, 1983.

[18] K. H. Kim, C. K. K. Jeong, and H. sook, “Comparison of isokinetic muscle strength among elite high school athletes in short-distance, long-distance, jumping, and throwing,” *Korean Journal of Sports Science*, vol. 23, no. 1, pp. 1113–1122, 2014.

[19] A. Meron and D. Saint-Phard, “Track and field throwing sports,” *Current Sports Medicine Reports*, vol. 16, no. 6, pp. 391–396, 2017.

[20] X. Zhang and Y. Wang, “Research on intelligent medical big data system based on hadoop and blockchain,” *EURASIP Journal on Wireless Communications and Networking*, vol. 2021, no. 1, pp. 1–21, 2021.

[21] J. Yang, J. Wen, B. Jiang, and H. Wang, “Blockchain-based sharing and tamper-proof framework of big data networking,” *IEEE Network*, vol. 34, no. 4, pp. 62–67, 2020.

[22] K. Rn and C. Valliyammai, “Blockchain-based secure big data storage on cloud,” *International Journal of Recent Technology and Engineering*, vol. 9, no. 4, pp. 37–45, 2020.

[23] W. H. Liu Zhaoliang and D. Wang, “Functional agricultural monitoring data storage based on sustainable block chain technology,” *Journal of Cleaner Production*, vol. 281, Article ID 124078, 2021.

[24] O. I. Khalaf and G. M. Abdulhaheb, “An improved efficient bandwidth allocation using TCP connection for switched network,” *Journal of Applied Science and Engineering*, vol. 24, no. 5, 2021.

[25] O. Ibrahim Khalaf, M. Sokiyana, Y. Alotaibi, A. Alsufyani, and S. Alghamdi, “Web attack detection using the input validation method: dpda theory,” *Computers, Materials & Continua*, vol. 68, no. 3, pp. 3167–3184, 2021.

[26] G. Suryanarayana, K. Chandran, O. I. Khalaf, Y. Alotaibi, A. Alsufyani, and S. A. Alghamdi, “Accurate magnetic resonance image super-resolution using deep networks and Gaussian filtering in the stationary wavelet domain,” *IEEE Access*, vol. 9, pp. 71406–71417, 2021.