The Current Situation and Future Trends of Sport Science and Technology in the "Technology-Empowered Olympics" After the Beijing Winter Olympics

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Abstract. The purpose of this paper is to scientifically summarize the development status of the Winter Olympics, inherit and carry forward the scientific and technological heritage of the "Scientific and Technological Olympics", and conduct targeted research and discussion on the future development trend of sports science and technology. The study systematically discusses the development status, science and technology, and technological heritage of the Beijing Winter Olympics, and explores and interprets the connotation and significance of the "Science and Technology Olympics". Behind the competition of Olympic Games is the competition of science and technology, the history of 100 years of Olympic Games is also the history of sports science and technology development, "science and technology" and "Olympic Games" promote each other and mutually beneficial symbiosis; the scientific and technological Olympics have Chinese characteristics and Chinese wisdom, and the innovation of sports science and technology will play an important role in digital sports, intelligent sports and sports limit breakthrough. Sports technology innovation will play an important role in digital sports, intelligent sports and sports limit breakthrough; Technology Olympics will certainly help intelligent training venues, intelligent equipment, sports data, championship models, electronic judges, viewing experience and Olympic preparation. This shows that under the background of China's "national system", applying the latest science and technology to sports practice, insisting on independent science and technology innovation, and vigorously developing the road of science and technology for athletics and mass sports can better carry forward the "spirit of Beijing Winter Olympics" and continue to bring the advanced technology of "Science and Technology Olympics" to the world. The advanced concept of "Science and Technology Olympics" will be carried forward.

Keywords: Beijing Winter Olympics · Technology-empowered Olympics · Sports Science and Technology · Future Trend

1 Introduction

Since the reform and opening-up, China's science and technology has been developing continuously, standing at the forefront of the world in many aspects, the vitality and

power of science has shown an unstoppable trend, to burst out the huge potential of China's scientific and technological innovation. Science and technology is the primary productive force. "Technology-empowered Olympics" since 2008, the measures have been on the ground, adding fuel to the development of China's sports, so that Chinese sports have a good development.

Nowadays, the Olympic Games is not only a window to show the Olympic spirit and the strength of sports, but also an important platform to show the achievements for science and technology in China, behind which is inseparable from the strong support of the policy and the joint efforts of science and technology related workers [1]. There are countless blackbox Technology in the 2022 Winter Olympics, such as robots in the underwater torch relay, the opening ceremony screen integrated intelligent broadcast control system, carbon dioxide trans-critical direct cooling ice production system, sports integrated training wind tunnel, the development of intelligent ski training equipment, etc. TV broadcast, 2022 Beijing Winter Olympic Games appeared new applications of signal production, new services of digital media, new functions of transmission technology and new capabilities of cloud broadcast services, applied AI time slice 3D playback, motion data tracking, multi-camera position playback system, drone motion filming transmission and virtual graphics technology points and other special application scenarios and technologies [2]. With the application of "AI time slice" technology, the technical actions of the athletes at different moments of the competition are presented on the same screen in the form of bilocation, so that the audience can have a more intuitive and clear viewing experience in the ski jump competition (Fig. 1 AiLing Gu time slice technology), with the help of "time slice" technology, the audience can visually watch the Olympic athletes as if they have "bilocation" through video playback. Time slice is the application of sports video panorama technology on television broadcast. Sports video panorama is one of the tools for coaches and athletes in sports to study and analyze sports techniques, as well as one of the best tools for tactical analysis. The key phases of multiple consecutive technical movements of an athlete are extracted in a single frame in the same background to synthesize a complete technical picture. It is convenient to observe and analyze the continuous change process of sports technical characteristics more clearly in the same background, or study the structural characteristics of a technical action completely.
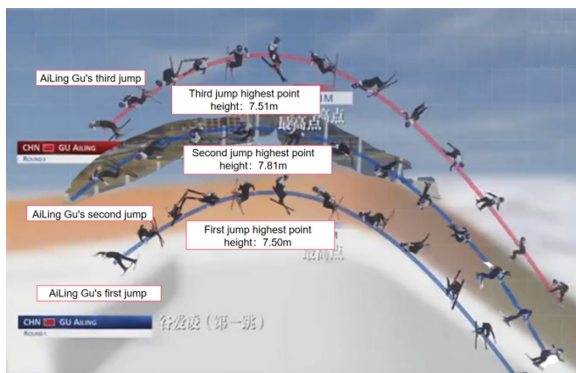

Fig. 1. Illustration of AiLing Gu's time slice

The connotation and significance of "Technology-empowered Olympics".

The connotation of "Science and Technology Olympics", in a narrow sense, is the mature science and technology mosaic, applied to the Olympic Games; in a broad sense, it is a special science and technology, social development strategy, is an important part of the development of science and technology [3, 4]. The Olympic Games is like a huge source of scientific and technological creativity, promoting the development and innovation of science and technology in China, and likewise scientific and technological innovation also injects fresh vitality into the Olympic Games, and "science and technology" and "Olympic Games" influence each other and coexist for mutual benefit. The essence of "Science and Technology Olympic Games" is the organic unification of Olympic Science and Technology and Science and Technology Olympic Games [4]. The "Science and Technology Olympic Games" can be further refined into "Olympic Science and Technology" and "Science and Technology Olympicization". The "Olympic Science and Technology" is the application and mosaic of modern science and technology in the Olympic Games, and triggers another innovation of the Olympic concept; the "Olympic Science and Technology" refers to the development and innovation of science and technology to the Olympic Games according to the needs of the Olympic Games and the guidelines of scientific innovation.

The competition behind the Olympic Games is essentially a competition of science and technology among countries. The results of history confirm the correctness and necessity of the "Science and Technology Olympics" proposed at that time, and also confirm the important supporting role of highly advanced science and technology in the process of holding the Olympic Games [5]. The planning and implementation of the "Science and Technology Olympics" has promoted the industrialization and internationalization of science and technology in China, enhanced the national capacity for independent innovation, promoted the construction of an innovative country, and is of great significance in improving the economic and social benefits of the country [4].

2   The Development Status of "Technology-Empowered Olympics"

Modern technology has changed our lives, and the continuation and deepening of the "Technology Olympics" for 14 years since 2008 has also changed the situation of sports development in China. 2022 Beijing Winter Olympics is designed around the needs of "zero-emission energy supply, 5G sharing, smart spectator, sports technology, and safe running of the games". The 2022 Beijing Winter Olympics is designed around the needs of "zero-emission energy supply, 5G sharing, smart spectator, sports technology, and safe event", and other aspects, with the means of science and technology to coordinate the running, participation and viewing of the games, providing a solid guarantee for the Beijing Winter Olympics to be a "simple, safe and wonderful" event [6].

2.1 Application of Modern Technology, Event-Related Security Construction and Other Material Heritage to Show the Power of Science and Technology in Our Country

Beijing Winter Olympic Games three major competition areas, 26 venues completely using 100% green electricity supply; "Snow Ruyi" in the installation of Beidou micro-base station positioning system, the first time to achieve indoor sub-meter level accurate positioning; "Water Cube" to "ice The transformation of "Water Cube" to "Ice Cube" is a successful example of reuse of China's Olympic venues under the concept of sustainable development. With the concept of "green, shared, open and clean", China has delivered an excellent answer to the world and left a lot of Olympic legacy.

This year's Winter Olympics will use 14 Olympic legacies left over from the 2008 Beijing Olympic Games, and will build on them to create a "double Olympic legacy" in the "Double Olympic City". The transformation of the "Water Cube" in 2008 to the "Ice Cube" in 2022, the "Ice Basket Transformation" in Wukesong Sports Center, the "Hockey Stadium" and the "Archery Stadium" built on the temporary venues of the 2008 Beijing Summer Olympics. The "Ice Ribbon" built on the "Land Heritage", etc.

2.2 With the Application of Modern Technology, the Methods and Means of Judging Sports Events Have Become More Accurate and Fairness Has Been Further Guaranteed

Electronic refereeing is one of the applications of video image processing technology in sports to guarantee the fairness of sports competitions. Electronic referees are used in many scoring events and show a trend of replacing manual ones. Electronic referees mainly apply video cameras to objectively judge the performance of athletes, which can truly and objectively reflect the competition situation and results. At present, Fujitsu Fujifilm video processing company in Japan has conducted the development of electronic judges for the artistic gymnastics competition of the Tokyo Olympic Games, and has achieved good application results. In addition, Eagle Eye technology, VAR technology and video replay technology also play the role of electronic auxiliary judging-judging [7]. These referee assistant technologies enable global monitoring and feedback of athletes' technical and tactical situations for the purpose of global monitoring and evaluation of the game. Exploring the winning rules and building championship models of sports in the context of big data.

2.3 The Application of Modern Technology, Event Viewing Style and Spectacle Has Been Enhanced

In this Winter Olympic Games, CCTV practiced the concept of "Technology Winter Olympic Games", using HD broadcasting, virtual reality, artificial intelligence and other technologies to provide comprehensive and multi-dimensional tracking and broadcasting of the event. 4K/8K became the standard configuration of this broadcast; relying on 5G technology to bring a faster and richer viewing experience and coverage of the event. The company has also achieved technological innovation in the viewing experience.

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2.4 Applying Modern Technology, the Equipment of the Athletes is Constantly Updated to Help Them Win Medals

Short track speed skating clothing using drag reduction fabrics, clothing fabrics with strong anti-cutting ability to help athletes capture the critical 0.01 s on the field; short track speed skating helmets made of full carbon fiber, carefully sculpted in the structure, while meeting the requirements of drag reduction, safety, comfort, aesthetics and so on. The domestic snowmobile uses the T800 grade carbon fiber composite material used in aircraft, and also uses a wind tunnel to conduct wind resistance test research on the clothing. Cross-country skiing project, China's first passive thermal snow technology interconnection technology to create a three-dimensional structure of the snow face protection to protect the athlete inhaled air than the outside environment 20° higher, to protect athletes from air irritation [9].

2.5 Applying Modern Technology, the Science of Competitive Sports Preparation Has Been Fully Reflected

The application of modern equipment and methods to monitor the athletes' training status and physiological indicators in all aspects is an important guarantee for our athletes to achieve excellent results. On-site video image rapid feedback and analysis system, digital strength training apparatus monitoring, resistance training apparatus, segmented timing speed monitoring, heart rate and sleep health, fatigue index monitoring, blood routine monitoring, etc. are all methods and means to help athletes train scientifically [10]. The application of sports technology products to digitally monitor the technical movements of outstanding athletes is an irreversible development trend and direction for the future, and relying on the power of modern technology to more accurately and scientifically guide the training of athletes is a must for future competitive sports.

The wind tunnel is the most widely used tool in aerodynamic research and experiments. Previously, wind tunnels were mainly used to simulate the air flow of flying machines and verify their air resistance, among other things. Wind tunnels can provide training conditions for athletes by simulating water flow and airflow conditions. In preparation for the Winter Olympics, wind tunnels provide athletes with simulated training

and resistance testing of equipment; similarly, in preparation for the Tokyo Olympics, wind tunnels support athletes in rowing, swimming and other events in preparation for the games [11].

2.6 Establish a Large Database of Outstanding Athletes and Build a Championship Model to Provide More Scientific Support for the Development of Competitive Sports Training

The establishment of the world champion model was carried out on the video image processing technology. In establishing the champion model of 110 hurdles champion Liu Xiang, personal big data such as morphological video model, anatomical characteristics of body structure, nerve type, nerve-muscle conduction rate, excitation-inhibition model of impulse, muscle strength quality, explosive power quality, acceleration ability quality, rhythm rate between hurdles, as well as scientific training contents, methods, means, arrangements, plans, etc. of Liu Xiang were To collect, summarize and dig out the laws of big data, and explore the models and laws of championship growth in the massive information of individual growth and cultivation of Liu Xiang, the Olympic champion and world record holder [12, 13].

The application of modern technology to upgrade sports-related industries and the application of the concept of sports to develop and create modern science and technology is the core of the "Science and Technology Olympics" and one of the irreversible trends in the development of modern society.

3 Future Trends of "Technology-Empowered Olympics"

3.1 Technology to Help the Future Trend of Olympic Training

Fundamental research at the high level needs to be emphasized. The relationship between lower limb joint force and movement speed, power and special performance in sports; the critical standard of optimal basic strength; the effect of maximum strength improvement on coordination and movement speed; the effect of one-time high-intensity endurance training on physical function and sports performance of non-specialized athletes; the special mechanics and kinematic characteristics of optimal technical condition can be developed in the future for deeper and broader level research.

It is necessary to increase the investment in convenient research equipment and focus on data collection and model construction in training. (1) Gym-ware, Vmax-pro and other equipment in physical training to monitor the changes in indicators such as strength-velocity-power of different training movements, statistical, generalization and analysis of data from different training phases in annual training, and the establishment of macroscopic evaluation criteria. (2) Apply Hawkin dynamic portable force measurement platform to establish peak force ratio measurement in knee isometric hard pull and reverse jump to evaluate athletes' power balance problems, and build a high-level athletes' physical fitness evaluation system while collecting data conveniently.

Emphasis is placed on the construction of an intelligent integration platform for training data. Integrate all aspects of competitive ability training indicators into one

platform, plus background data processing to provide weekly, monthly and annual training competitive ability indicator changes, simplifying and making it clear at a glance. The platform can also be used to provide the most cutting-edge training trends released.

The application of modern technology results in the ability to establish a more scientific training system. The application of modern technology for systematic tracking and monitoring of training, training teams, training groups can be more scientific, efficient and timely set and release of annual training plans, weekly training plans, physical training plans, skills training technical movement details, daily training load statistics, class training best intensity statistics.

3.2   Future Trends in the Scientific Training of Sports

Develop sports-related disciplines and attach importance to the application of the results of sports science. The application of sports science results has become a consensus abroad, and the mystery of the success of competitive sports lies in the respect for science. Empiricism is still desirable at the low-level competitive level, but the high-level competitive level has become a thing of the past. How to improve the conversion rate of scientific research results is a problem that must be faced and a key point to achieve a breakthrough.

The use of modern sports science and technology can help develop research in areas such as sports selection and sports IQ, help build a scientific training system. The issue of training system for high-level athletes is still one of the much debated issues in modern sports science. Some voices believe that sports training is individual, and it is desirable to propose individualized training programs for athletes in response to the differences in individual differences. The innate conditions determine to some extent the direction and depth of individual sports development, so the training of athletes should be individualized according to the differences in individual circumstances. What are the conditions for determining the laws and characteristics of sports intelligence? How to train athletes more scientifically according to different innate conditions? These are all questions that can be explored. The other part of the voice is just the opposite and believes that individual differences only capture a certain point in the law of project winning to make a certain athlete, which is one of the reasons why the experience of personalization cannot be promoted. The vast majority of athletes' individuality is brought about by early single training, and their successful experience is not desirable. Therefore, according to the premise of the idea of balanced development of athletic ability, respecting individual characteristics and compensatory effects, establishing standardized training procedures, establishing a system of training contents corresponding to body, technique, combat, mind and intellect in different training stages (basic training, special improvement, optimal competition and competitive maintenance stage), and realizing an assembly-line production mode will be a way to improve the overall competitive level.

3.3   Future Trends in Sports Equipment Development

The application of video image processing technology in sports can also be more widely and deeply developed. Sports and AI artificial intelligence can be deeply integrated and innovated. Develop related hardware and software products to provide an integrated and

comprehensive solution for evaluation, analysis and training of human sports. There-fore, according to the premise of the idea of balanced development of athletic ability, respecting individual characteristics and compensatory effects, establishing standardized training procedures, establishing a system of training contents corresponding to body, technique, combat, mind and intellect in different training stages (basic training, special improvement, optimal competition and competitive maintenance stage), and realizing an assembly-line production mode will be a way to improve the overall competitive level.

4   Inspiration from the "Technology-Empowered Olympics" After the 2022 Winter Olympics

The role of science and technology in competitive sports is becoming more and more prominent, and behind the high level of competitive sports is also the competition of scientific and technological power between countries. To build a strong sports coun-try, to achieve a high level of self-reliance and self-improvement in sports science and technology is the road that must be maintained [14, 15].

The application of AI technology to sports-related fields has become an irreversible development trend, bringing greater flexibility and scalability to sports event broad-casting, scientific preparation, sports equipment development, and sports event judging through AI algorithms in the future. The application of artificial intelligence in sports will continue to be expanded in the future, and will gradually play an increasingly important role.

From "One World, One Dream" in 2008 to "Together for the Future" in 2022, China has been actively participating in the Olympic movement, carrying out the Olympic spirit and being an uncomplaining pursuer of the Olympics. Through the Olympic Games, China's influence has been expanding, its comprehensive strength has been shown on the world stage, and its technological power and development potential have been seen by the world. In the future, China will continue to let the "fire of science and technology" continue to burn on the land of China, bringing the warmth of Chinese power to a broader part of the world.

5   Conclusion

The "Technology-empowered Olympics" explains that the history of the Olympic Games is also the history of science and technology development, behind the competition of Olympic strength is the competition of sports science technology strength, sports science and technology is a powerful force behind the decision of Olympic competition and guarantee factors; the breakthrough of the limits of human sports is also achieved and completed with the help of science and technology.

Therefore, to apply the latest science and technology to sports practice, adhere to independent science and technology innovation, and vigorously develop science and technology to promote athletics and popular sports, in order to better promote the "Bei-jing Winter Olympics spirit" and continue to carry forward the advanced concept of "Technology-empowered Olympics".

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