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The application of artificial: Intelligence and big data in sports industry

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***Abstract*---**In the era of advanced technology, intelligent and innovative sports events have transformed the global sports industry, reshaping how businesses operate. Traditional sports events are now enhanced with artificial intelligence, incorporating automatic tracking systems for real-time technical analysis of player movements in football, basketball, and other games. During event broadcasts, simulation technology and virtual-real integration are widely utilized, enabling live streaming on various audio-visual platforms. Consequently, leveraging big data analysis has become a critical factor in the success of professional teams and sports marketing companies. This research examines the classification and significance of big data analysis and artificial intelligence in sports by reviewing relevant literature. It aims to provide insights into the applications and importance of big data in the sports industry, highlighting its role in shaping future developments. Additionally, this study explores how the advancement of intelligent sports technology can help industry-related companies refine their strategic development, enhance Taiwan's global presence in sports, and showcase the research and innovation capabilities of Taiwanese sports enterprises on an international scale.

***Keywords*---**Artificial intelligence, Big data, Sports industry.

1- Introduction

As artificial intelligence (AI) undergoes widespread adoption and substantial evolution, its influence on sports events has garnered significant attention. AI and high technology have provided numerous advantages in the realm of sports, enhancing data processing, decision-making, and training strategies. AI enables teams and coaches to analyze large volumes of sports data for better strategic planning and performance optimization. Additionally, AI-powered video replay

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systems and referee assistance enhance the accuracy and fairness of sporting events. Beyond competition, AI contributes to personalized training, health surveillance, and injury prevention, improving athlete well-being and overall performance. However, several challenges remain, including optimizing AI-driven training methods for individual athletes and enhancing audience experiences with augmented reality and virtual reality technologies. This study explores the applications, significance, and development trends of big data and AI in the sports industry, offering insights into their potential for improving competitiveness and visibility in the global sports market.

In addition, AI technology is progressively becoming available to support referee judgment. AI technologies can aid referees in making more accurate decisions, minimizing disagreements and errors, through the use of video replays and data analysis. The goal of more research in this field may be to improve the accuracy and fairness of sporting events. While artificial intelligence (AI) has advanced the field of sporting events, there are still many uncharted territories, including more accurate athlete performance prediction, improved intelligent training equipment, and AI applications in a variety of sports. Future studies are therefore wellpositioned to explore these facets in greater detail in order to further the development and innovation of AI technology in the sports industry.

According to data from BWF, FIFA, Worlds athletes and past journals and articles, one applied literature review methodology and case study methodology to discover the application and development of Artificial Intelligence and associated high technology. And also through logical reasoning and the development of cause-and-effect relationships, one analyzes the impact of artificial intelligence technology and high technology in four aspects of the sports domain. They outline shortcomings within these four facets and propose solutions, aiming to further the application of artificial intelligence technology in sports (sporting events domain). The goal is to achieve further advancement, fostering a balance between technology and human intervention, enabling mutual assistance, and fostering interdependence.

2- Current Application Status of Artificial Intelligence in Sports Field:

2-1- Athlete’s Performance Analysis and Training Optimization:

Sports performance analysis involves examining skill, physical fitness, strategy, and tactics within modern sports. This assessment relies on human action recognition software to achieve its primary goal: identifying and optimizing athletes' talents, thereby informing competitive strategies. Sports like rugby and football, due to their high speed and close contact, pose notable challenges for analysis. However, these characteristics align well with AI capabilities. Computer vision, adept at measuring intricate metrics, benefits from the extensive footage available across various sports, aiding deep learning models. Although each video may vary slightly, all sports adhere to specific rules, enabling AI applications to refine their algorithms. Assessing a player's performance during live sessions necessitates evaluating predetermined game parameters, achieved through player tracking, event recognition, and real-time ball tracking. Coaches gain actionable insights into enhancing athlete performance and adapting to diverse playing

conditions through computer vision and optical sensors (Walsh, Johanna, 2025).

The comprehensive evaluation of athletic performance involves a holistic consideration of sixessential components: speed, strength, endurance, flexibility, agility, and skill. Central to the refinement of athletes' capabilities throughout their training regimen is the pivotal role played by advanced technology. This technological integration is instrumental in meticulously analyzing athletes'performance; thereby facilitating a more nuanced and optimized approach to their training methodologies. In the domain of badminton, the prevalence of smart serving machines has superseded manualserving methods across many nations where badminton enjoys popularity. During serving practice, these intelligent machines exhibit a remarkable precision in delivering the badminton shuttle to the four lowermost corners of the court, surpassing human capabilities. This precision ensures the shuttlecock remains within bounds while landing in close proximity to the court's periphery, thereby enhancing players' court awareness. Furthermore, the adjustable ballrelease angle enables precise control over the trajectory of the shuttlecock, aiding players in adapting to rhythm variations during gameplay and fostering muscle memory for shot returns.

In specialized techniques such as executing swift, flat blocks at the net, the smart serve machine outperforms human servers by delivering the shuttlecock at higher speeds and in more unpredictable trajectories. This challenges players to react swiftly to rapid, flat shots, thereby stimulating enhanced progress and skill development. Additionally, the machine's adaptable speed settings offer a structured approach to training. Athletes can gradually acclimate to serving speeds, starting at 200 km/h and progressively advancing to 250 km/h. This incremental adjustment surpasses traditional coaching methods, offering a more methodical and controlled progression for athletes.

In essence, the integration of smart serving machines into badminton training not only refines players' precision and adaptability but also provides a systematic and controlled framework for skill development, thereby augmenting overall performance. This is a discussion on how high technology initially optimizes athletes' performances.

Simultaneously, artificial intelligence collects data such as the recommended speed of the ball server, the arc of the ball, the distance of the ball, etc., and analyzes this data to produce corresponding analyses: about the athlete's speed, endurance, strength, sensitivity, flexibility, and skill data , such as the average time a player takes to move a ball of the same type to hit the ball; the average rate at which a player’s movement speed per unit time decreases; the average initial velocity, attenuation speed, and landing speed of a player’s ball of the same type; a player’s average pure ball reaction time; the average displacement length of a player's stretching action, etc. By feeding back these refined data to artificial intelligence for analysis, players' performance can be more accurately understood, allowing for further optimization of training.

Another fitting example is the application of artificial intelligence and high technology in the field of athletics. Similar to previous mechanisms, advanced cameras can record athletes in track and field (using 100-meter sprinters as an

example) from multiple angles. They capture starting reaction times, acceleration, maximum speeds, running posture, stride frequency, stride length, finishing postures, rest durations between training sets, heart rate monitoring related to these factors, breathing patterns, and more. Unlike traditional manual measurements, these data collected through high-tech means offer increased precision, allowing for more accurate assessments of an athlete's performance.

Similarly, by feeding this information gathered through high-tech monitoring to artificial intelligence for comprehensive analysis, AI can provide more precise evaluations of athletic performance, identifying inconsistencies and areas for improvement. Consequently, addressing these potential issues, in tandem with AI assistance, coaches and athletes can devise more direct and effective training optimizations—aligning with the Olympic spirit of striving to be "faster, stronger, higher" in athletic pursuits (Jianhang Chen, 2024).

2-2- Judgement and Referee Auxiliary:

Within the domain of sports officiating, advancements in artificial intelligence and associated high-tech innovations have significantly elevated capabilities. In 2009, the Badminton World Federation introduced a method termed the "Hawkeye Challenge" in refereeing, a classification aligning with high-tech applications. The Hawkeye Challenge system utilizes sophisticated multiangle cameras and computer image processing technology (figure 1).

It meticulously analyzes and verifies the trajectory of a badminton shuttlecock in relation to the boundary line, determining whether it lands within the designated court area or surpasses the bounds (Jianhang Chen, 2024).

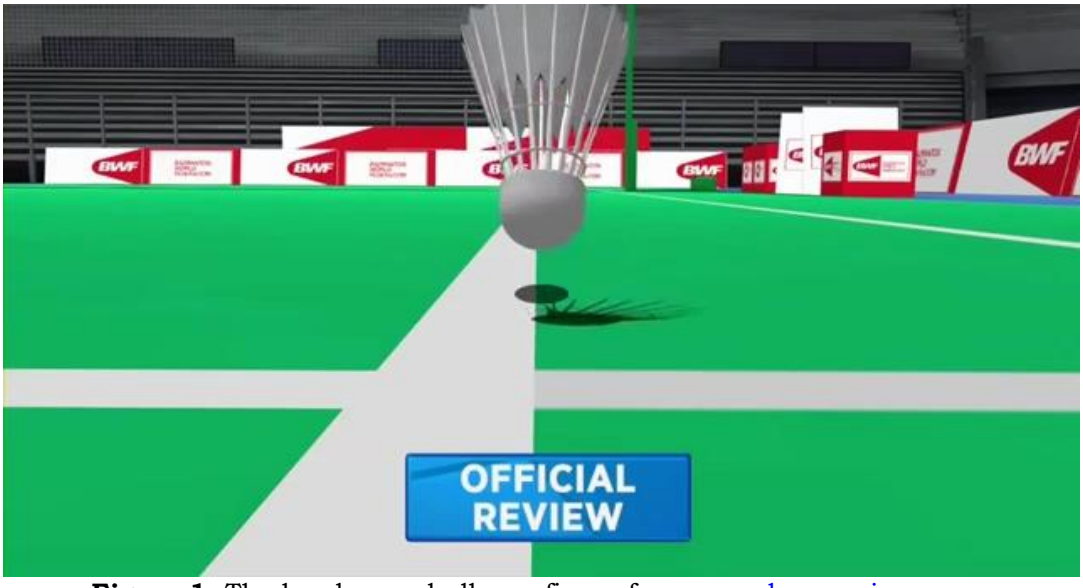

Figure 1: The hawk-eye challenge figure from www.kompasiana.com

Compared to conventional manual adjudication methods, this technology empowers players by allowing challenges to human decisions during sporting

events, which might otherwise be susceptible to fallibility or subjective biases. Moreover, the challenge procedure necessitates a mandatory pause in the gameplay, affording athletes supplemental intermission periods. Furthermore, the Hawkeye Challenge serves as an engrossing mechanism for spectators, regardless of the challenge's outcome, eliciting sustained interest. Audiences observe players and referees in contentious situations, within the confines of permissible regulations, occasionally witnessing athletes challenging decisions to award points to their opponents as a gesture toward fairness. This facet augments the spectacle of the sport, amplifying its commercial appeal and enhancing its entertainment value for viewers.

Additionally, a similar role is played by VAR (Video Assistant Referee) in football matches. In 2018, the International Football Association Board (IFAB) approved the use of the Video Assistant Referee (VAR) system in football matches. The technology was officially incorporated into the Laws of the Game for the 2018/19 season. FIFA evaluates the technical aspects of VAR systems through the FIFA Quality Programme for VAR Technology (Gasparetto, Thadeu, and Kirill Loktionov, 2023).

Currently, two types of VAR setups are permitted. The full VAR system utilizes a minimum of four cameras and can support an unlimited number, while the VAR Light system operates with four to eight cameras and requires direct control by the VAR official. To assist competition organizers in implementing the technology, FIFA and IFAB introduced the Implementation Assistance and Approval Programme (IAAP). This initiative ensures consistent standards when integrating VAR into new competitions, addressing implementation challenges, and providing training for those responsible for its operation.

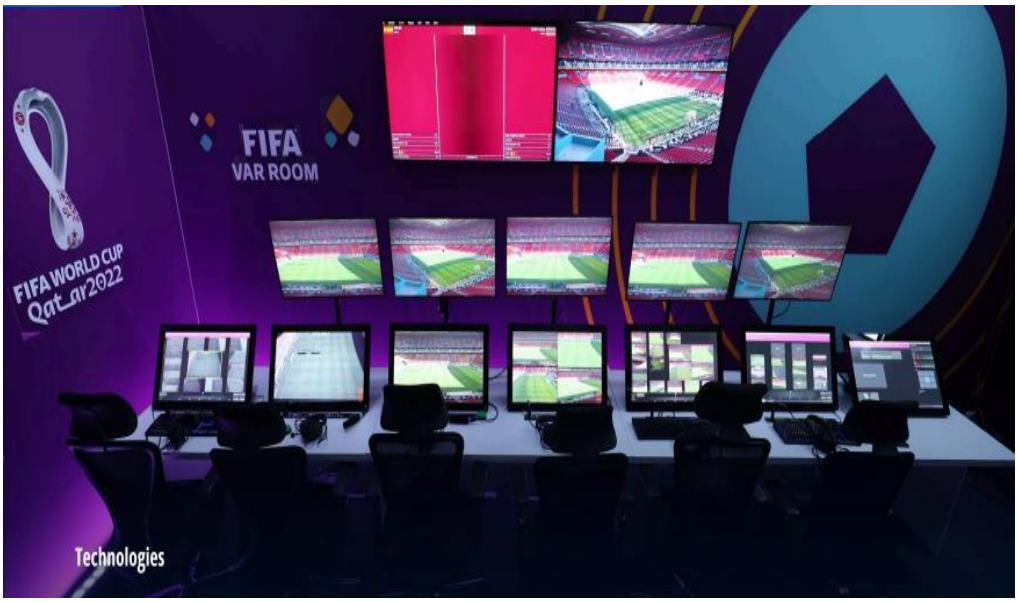

Figure 2: Video Assistant Referee Technology (www. inside.fifa.com).

2-3- Data to Help the Competition Strategy:

When artificial intelligence (AI) and advanced technology engage in comprehensive analysis of historical sporting data and live scenarios, they have the capacity to discern and summarize specific trends or patterns. These may include the success rates of particular teams employing specific tactical approaches or a player's consistent patterns of response to certain types of shots, indicating their performance advantages. Disseminating these insights and analyses to coaches and teams enables them to make more informed and targeted adjustments to their tactics and strategies, thereby optimizing their team's strengths to mitigate the weaknesses of the opposing team.

For instance, in a basketball match, if AI analysis reveals that the opposing team demonstrates a higher efficacy in defending against a particular player or a specific offensive strategy, the coach can adapt their team's offensive approach to circumvent the higher likelihood of effective defense.

Ver, the strength of AI and high-tech lies in their real-time adaptability and analysis of player information and game dynamics. Prior to the commencement of a match, AI can conduct an analysis of a team's historical data. During the course of the game and the accumulation of live data, AI can continuously process and provide ongoing real-time feedback and strategic advice. Coaches can leverage this up-to-the-minute information to adjust tactics promptly, leading to more precise decisions compared to traditional solely human-guided methodologies. This enables them to gain a significant edge in navigating the evolving dynamics of the game. During the 2021 Arab Cup tournament, a system dubbed the "New FIFA Football Language" was introduced for the first time (Shamih Iman, 2023).

This innovative approach blends data analysis and technical expertise to generate "new football intelligence," aiming to enhance the understanding of the game for all players involved. Managed by a team of 50 football analysts, data engineers, and scientists based in Newport, Wales, under the leadership of Chris Loxton, and supported by another team in Doha. Every member of this analyst team was tasked with monitoring and tracking the individual performance of players on the field. This involved observing player movements, both on and off the ball, the frequency of breaching defensive lines, the pressure exerted on opponents in possession, and various other key aspects. Through this extensive analysis, over 15,000 data points were gathered from each match. This comprehensive approach provides a fresh perspective for team analysts, coaches, players, media, and fans, aiding them in gaining a deeper understanding and appreciation of the game.

2-4- Injury Prevention and Rehabilitation:

Artificial intelligence (AI) and advanced technological applications serve pivotal roles in both injury prevention strategies and rehabilitation processes within the realm of sports. These technologies leverage sophisticated data analytics and machine learning algorithms to tailor personalized health plans and recovery regimens, aiding athletes in mitigating injury risks and expediting recuperation from injuries.

In the domain of injury prevention, AI analyzes extensive datasets encompassing athletes' skill sets, training regimes, and physiological markers to discern potential injury factors. Subsequently, during the rehabilitation phase, AI devises customized recovery strategies, aligning with the severity of an athlete's injury and their progress in recovery. By amalgamating individual athlete data with metrics specific to rehabilitation, AI forecasts recovery timelines and progression, guiding tailored training and therapeutic interventions, facilitating the athlete's prompt return to training or competition. Indeed, increasing evidence supports the utilization of deep learning and neural networks to enhance the screening, early identification, and overall outcomes related to cancer. Various applications demonstrate this, spanning AI systems designed for screening, triage, diagnosis, prognosis assessment, decision support, and treatment recommendations. Literature shows a growing body of evidence highlighting the potential of AI systems in screening for skin cancer, lung cancer, breast cancer, cervical cancer, and a wide array of other malignant and pre-malignant health conditions (World Health Organization).

Moreover, during competitive events, AI provides real-time monitoring of athletes' physiological states and performance metrics. Leveraging data acquired from wearable sensors capturing metrics like heart rate, exertion levels, gait analysis, and postural dynamics, AI promptly detects indicators of fatigue, excessive strain, or potential risks. This real-time monitoring empowers coaches and medical personnel to make instantaneous tactical adaptations or necessary interventions, thereby diminishing the probability of further injury occurrences during the competition.

Additionally, AI contributes to on-the-spot medical support. For instance, in sports like soccer, AI-driven systems aid medical staff in swift identification and assessment of probable injuries, like head injuries, expediting essential medical attention or player repositioning. This rapid response mechanism minimizes injury severity and maximizes athlete well-being during competitive engagements.

3- Moving toward the Era of Big Data:

In recent years, advancements in science and technology have enabled big data analysis and artificial intelligence (AI) to predict quantifiable outcomes with high accuracy. AI can learn, adapt, and automate complex tasks, reducing human effort. The rapid growth of data volume, lower storage costs, improved software, and cloud computing have transformed big data from a processing tool into a strategic business model. Defined by capacity, speed, and diversity (the 3V model), big data is now a crucial part of the $64 billion analytics market, attracting significant investment. Companies leverage big data to develop predictive models, enhance decision-making, and gain a competitive edge, aided by the Internet of Things (IoT) and extensive data storage. Governments and enterprises alike recognize big data as a transformative force reshaping technology and society. In the sports industry, AI and big data applications are set to drive significant growth and innovation (Jain & Bhatnagar, 2016).

4- Big Data Changes the Sports Industry:

In recent years, innovative technologies, including big data analytics, intelligent sports products, and advanced media services, have significantly transformed the sports industry. Professional teams, particularly in Europe and the U.S., utilize big data to assess player performance, develop strategic plans, and enhance fan experiences. At major sporting events like basketball, baseball, football, and tennis, data analysts play a crucial role in compiling statistics and generating insights to optimize athletic performance. This shift underscores the growing reliance on technology to reshape and modernize the sports industry (Spaaij & Thiel, 2017).

Data science helps analysts process raw data into mathematical and statistical models, improving the understanding of physical conditions and encouraging exercise motivation. The digitalization of sports data and automation of management systems have enhanced efficiency, convenience, and acceptance of technology in sports. However, the accuracy of big sports data is crucial, as misinterpretation can lead to incorrect performance assessments, potentially causing athletes to be overworked or mistakenly considered fatigued, leading to poor decision-making (Hung, Chang, & Chen, 2020).

Big data has significantly influenced decision-making, team performance, and athlete health in the sports industry. Wearable devices and AI-driven analysis enable coaches and players to gain deeper insights into on-field performance, improving strategic planning and enhancing competitiveness. As technology advances, data collection and analysis systems are transforming traditional sports, optimizing training, tactics, and overall sports management. The integration of big data into sports is revolutionizing strategy development and shaping the future of the industry (Patel, Shah, & Shah, 2020).

5- Data, capital, and ethics in the sport industry :

The rise of digital business models in the sports industry, particularly those involving Data-Driven Business Model Innovations (DDBMI), has led to an expansion of online platforms, supplementary devices, and streaming services. These developments facilitate the exchange of data, symbolic, and economic capital. This discussion begins with an in-depth example of DDBMI, illustrating how broadcasting partnerships between sports organizations and digital platforms contribute to power imbalances in the industry. Next, we explore how the integration of e-ticketing and smart stadium technologies encourages widespread data collection from fans. Finally, we examine the rise of digital fan tokens, which promote consumer spending on digital products without adequate transparency.

5-1- Sports Broadcasting:

Without live broadcasting rights, media companies generate revenue by repurposing recorded sports content with added commentary and highlights. Others use subscription models to license sports events, while streaming services like Netflix explore original sports-related content, such as documentaries. The increasing dominance of digital platforms is reshaping the sports broadcasting

industry, providing new ways to engage audiences and monetize sports content (Nieborg et al., 2022).

Major platform-based corporations, such as Alphabet, Amazon, and Tencent, exert control over data circulation by managing social networking, payment services, and streaming platforms (Van Dijck, 2021). This increasing reliance on digital platforms exacerbates power imbalances, as sports organizations seeking to broadcast content on platforms like YouTube or Amazon Prime must adhere to the rules set by these corporations. As "complementors" in multi-sided markets, sports organizations are subject to the governance of platform businesses that regulate data access, monetization strategies, and online content standards (Petersen-Wagner & Lee Ludvigsen, 2022). This dynamic reinforces the oligopolistic dominance of major digital platforms (Van Dijck, 2021).

Major tech companies have entered the sports broadcasting industry, providing digital and mobile viewing options to generate revenue through ads and subscriptions. However, their strategies go beyond content distribution, as they utilize consumer data for targeted marketing and additional services. For example, Amazon secures broadcasting rights not only to enhance its streaming platform but also to drive traffic to its broader e-commerce ecosystem, demonstrating the expanding influence of digital giants in sports media (Hutchins et al., 2019).

5-2- E-Ticketing and Smart Stadiums:

A key example of the power imbalances inherent in digital sports business models driven by data capital is the rise of forced technology adoption, particularly through e-ticketing (digital rather than physical tickets) and smart stadiums (Popp et al., 2021; Yang & Cole, 2022). While e-tickets offer benefits such as resale control, automated transactions, waste reduction, and most notably, fan data collection, their mandatory implementation raises ethical concerns regarding user autonomy.

A study by (Popp et al., 2021) on attitudes toward e-ticketing found that while nearly half of surveyed fans (48%) preferred digital tickets over physical ones or had no strong preference, (73%) of those who favored physical tickets were (45) years or older. Interestingly, ticket format preference did not impact fans' likelihood of attending events, suggesting that those who preferred physical tickets had little choice but to comply with digital alternatives in order to attend live sports (Popp et al., 2021).

The enforced adoption of e-tickets, particularly when combined with smart stadium technology, raises concerns about how freely fans can control their personal data. Given that user data is often monetized (Sadowski, 2019), a key ethical question is whether fans should be compensated for their data. While one might argue that users receive a service (e.g., access to an app or platform) in exchange for their data, sports fans using e-ticketing systems often lack alternatives, effectively removing their ability to opt out.

Smart stadiums, on the other hand, have been positioned as a tool to enhance fan experiences, increase sales, and collect consumer data (Melander, 2016). Through stadium apps and internet-connected sensors, teams and venue operators can monitor fan behavior, track purchases, record movement patterns, capture images, and even measure loyalty (Ferguson, 2020; Watkins & Lewis, 2014; Yang & Cole, 2022). The concern arises when these technologies are used in ways that prioritize commercial interests over fan privacy. The coercion of fans into using tracking-enabled stadium apps via e-ticketing systems means that personal data is continuously gathered, often without explicit consent, and may be shared with third parties for commercial gain (Watkins & Lewis, 2014; Yang & Cole, 2022).

Beyond privacy concerns, the normalization of such digital surveillance in sports settings contributes to a shift in power dynamics. The collection and monetization of fan data effectively converts digital capital into economic capital, reinforcing the influence of sports organizations and their technological partners. This process legitimizes and elevates digital products that rely on mass data collection, granting them symbolic capital within the industry. While some research has explored resistance to such technologies in sports settings (Hutchins, 2016; Uhrich, 2022), little is known about whether fans fully understand how their data is tracked, used, and traded, or if they are willing to exchange privacy and autonomy for enhanced digital experiences.

E-ticketing represents a technological convergence where hardware, software, digital platforms, and social media intertwine to create new avenues for fan data exploitation. Emerging wearable technologies, such as smartwatches and microchipped "attachables" integrated into mobile apps, are further intensifying this trend. These devices collect real-time personal data, from heart rate monitoring to predictive analytics that anticipate user needs, generating vast amounts of individualized data. Within a smart stadium ecosystem, the integration of such diverse data sources provides sports managers with an unprecedented level of insight into fan behavior and emotions, which can then be leveraged for targeted marketing and revenue generation.

5-3- Fan Tokens:

A growing trend in digital sports commerce is the adoption of fan tokens, which are digital assets sold to supporters via blockchain providers like Socios.com, a subsidiary of Chiliz. In recent years, cryptocurrency platforms have forged significant financial partnerships with major sports entities, securing naming rights, broadcast advertising deals, and shirt sponsorships. These collaborations grant symbolic capital to cryptocurrency companies, reinforcing their legitimacy within mainstream sport. However, as the Advertising Standards Authority (2021) highlights, cryptocurrencies are often misunderstood, volatile, and high-risk investments, raising concerns about their place in the sports industry.

A key issue in the integration of cryptocurrencies into sports lies in the lack of due diligence exercised by sports organizations when selecting official crypto partners. In some cases, partnerships have been formed without fully verifying the credibility of these companies (Guardian Sport, 2021). This raises ethical concerns about the potential for financial harm to supporters. While the issue of

power imbalances in digital sports commerce is not exclusive to cryptocurrencies or NFTs, their presence amplifies existing concerns regarding data collection and monetization. Many sports endorsements and sponsorship deals operate primarily as data-extraction mechanisms, wherein fan data is solicited, analyzed, and monetized in exchange for paid brand exposure.

Various professional clubs across European football, US basketball, and motorsport have embraced Socios.com's fan tokens, encouraging supporters to purchase club-specific tokens. These digital assets promise fans a say in club decisions, but only if they buy tokens using the cryptocurrency Chiliz (Socios, 2022). Theoretically, this offers an innovative way to boost fan engagement and participation in governance. However, in reality, fan tokens have been widely criticized for offering minimal actual influence, while also creating a speculative market where cryptocurrency traders who may have no allegiance to the club can profit at the expense of dedicated supporters (Football Supporters Europe, 2022). This effectively transfers economic capital from fans to digital platforms, leveraging the club's symbolic capital to fuel financial transactions.

Concerns over misleading advertising have also emerged. The British Advertising Standards Authority (ASA) upheld complaints against Arsenal Football Club for promoting fan tokens in a manner that downplayed the risks of cryptocurrency investment, targeted inexperienced consumers, and failed to disclose the full financial implications (Advertising Standards Authority, 2021). Additionally, some English Premier League clubs have faced fan protests against the commercialization of their loyalty through fan tokens. Many supporters argue that they should not have to pay to have a voice in their club's decision-making processes (MacInnes, 2022). For instance, West Ham United canceled its planned partnership with Socios after strong opposition from fans who viewed the initiative as exploitative. The fan token model exemplifies two major concerns:

- ✓ The potential for fan exploitation, as clubs capitalize on their supporters' deep emotional investment, facilitated by digital platforms that widen power imbalances.
- ✓ The erosion of trust, as clubs invite fans to engage with digital financial products that may not be in their best interest, undermining the traditional sense of inclusion and ownership in sports fandom.

This phenomenon aligns with the rise of the 'prosumer' fan a concept introduced by (Santomier & Hogan, 2013), which refers to modern digitally engaged consumers who both produce and consume content. Sports organizations use advanced data analytics to profile fans, tailoring offerings to those who exhibit risk-taking behavior or a willingness to make large purchases quickly. Moreover, fans themselves contribute to this digital ecosystem by generating niche content, discussing products like fan tokens, and encouraging further engagement. This self-sustaining cycle continuously transforms fan data into capital, fueling an unprecedented level of commercial exploitation in the digital sports industry.

6- Intelligent Technology Brings New Experience to Fans:

Sports today generate vast amounts of statistical data on players, teams, and games. Traditionally, sports science was reserved for experts, but organizations

now utilize data mining to extract valuable insights. Technological advancements, such as big data analysis and sensor-based tracking, enhance game fairness, improve user experiences, and provide innovative sports products. Wearable devices collect performance data, while AI-driven facial recognition helps gauge fan engagement. Digital platforms and apps allow fans to interact with teams, watch content, and participate in live events. Additionally, **VR technology** offers immersive viewing experiences, revolutionizing how fans watch, play, and train in sports (Keshtkar & Yamaghani, 2019).

7- Smart Wearable Devices:

Wearable devices, such as pedometers, chest straps, sports watches, and smartphones, play a crucial role in monitoring athletic performance. Manufacturers are increasingly investing in advanced sports technology to provide precise data analysis. These devices help coaches collect and analyze large-scale data, which is essential for optimizing sports training. Factors like an athlete's physical and psychological condition, weather, and venue environment all influence performance. Real-time data enables quick adjustments to game strategies, improving decision-making and increasing the chances of victory (Brzostowski & Szwach, 2018).

Traditional fitness equipment lacks data collection and analysis capabilities, making it difficult to optimize training. However, **smart somatosensory devices** now integrate fitness data, health records, and performance tracking, improving coaching quality through motion detection and auxiliary training. Wearable devices, sensors, and IoT technologies enhance training by reducing workload while maintaining or improving performance. Smart sports equipment, such as **running shoes, insoles, and socks**, provides real-time feedback, enabling users to record, share, and analyze their performance for better training outcomes (Kamišalić, Fister, Turkanović & Karakatič, 2018).

8- The Use of Artificial Intelligence (AI) in Professional Teams :

AI technology is rapidly advancing in sports analysis and has become a crucial tool in decision-making. Image-assisted decision systems help determine whether a ball is in or out of bounds, reducing human error in sports like football, baseball, and basketball. Deep learning is also being applied to predict match outcomes, particularly in Major League Baseball (MLB), though accuracy remains a challenge. To improve predictions, researchers emphasize the need for advanced machine learning models to analyze game data more effectively and enhance performance analysis (Huang & Li, 2021).

Statistical data analytics is transforming basketball by enhancing player selection and game management. By collecting and analyzing data on shooting performance, movement speed, ball control, passing accuracy, interceptions, and physical condition, coaches can make informed decisions about team line-ups and strategies. This data-driven approach improves decision-making speed and effectiveness. Additionally, scouts and coaches leverage big data analysis to evaluate player characteristics, optimize team performance, and gain a competitive edge (Zuccolotto, Manisera, & Sandri, 2018).

Big data analysis helps sports teams develop strategies, identify weaknesses, and enhance performance, ultimately strengthening football teams. Beyond improving gameplay, data-driven insights also increase fan engagement and enhance the viewing experience, contributing to the overall growth of the sports industry. Additionally, advancements in sports technology not only support player training but also generate significant economic benefits by boosting ticket sales and optimizing the operations of professional teams.

9- Discussion:

With the rapid advancement of sports intelligence technology, whether in large-scale professional events or personal fitness, the fundamental nature of sports remains focused on precision, efficiency, convenience, and enhanced enjoyment. Traditionally, an athlete's success depended primarily on their talent, effort, coaching quality, and data analysis. However, technology now plays a crucial role. For instance, before a game, advanced tools help coaches prevent injuries, customize training programs, maximize performance, and develop optimal strategies for players.

Smart technology has transformed daily life, attracting sports enthusiasts, professional athletes, coaches, and industry professionals. The adoption of AI-driven sports devices, platforms, and services has made sports product developers recognize the impact of AI on sports marketing, operations, and coaching. Consequently, AI is increasingly used to gain a competitive edge through improved sensors and algorithms that enhance game predictions and overall industry competitiveness.

In conclusion, the emergence of sports intelligence technology has driven the industry toward big data, IoT, and AI, fueling the growth of smart fitness equipment and wearable devices. Among these, platforms integrating sports gear with coaching software are expanding the fastest. As the global interest in sports continues to grow, the business potential and opportunities in smart sports technology are expected to surge in the future.

Conclusion:

With the continuous advancement of AI and big data technologies, the sports industry is undergoing a major transformation. AI-driven innovations enhance athlete performance analysis, referee decision-making, injury prevention, and audience engagement, making sports more data-driven, efficient, and interactive. The integration of AI in event management, broadcasting, and team strategy has already yielded significant benefits, yet further research is needed to refine AI applications and address ethical concerns related to data privacy and commercialization. The future of the sports industry lies in the convergence of AI, big data, and IoT technologies, driving the development of smart sports equipment, wearable devices, and interactive fan experiences. As AI becomes more sophisticated, its role in shaping sports strategies and improving overall industry competitiveness will continue to grow, fostering a new era of intelligent sports management and digital transformation.

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