

**UNIVERSIDADE DE LISBOA**

**FACULDADE DE MOTRICIDADE HUMANA**

## **SPORTS IN DIGITAL ERA**

**Dissertação elaborada com vista à obtenção de Grau de Mestre em Gestão do  
Desporto**

**Orientadora:** Ana Maria da Silva dos Santos, professora auxiliar da Faculdade de  
Motricidade Humana da Universidade de Lisboa

**Júri**

**Presidente:**

Doutor Carlos Alberto Rosa Ferreira, professor auxiliar da Faculdade de Motricidade  
Humana da Universidade de Lisboa

**Vogais:**

Doutor Fernando Manuel da Cruz Duarte Pereira, professor auxiliar da Faculdade de  
Motricidade Humana da Universidade de Lisboa

Doutor Rui Jorge Bértolo Lara Madeira Claudino, professor auxiliar da Faculdade de  
Motricidade Humana da Universidade de Lisboa

Doutora Ana Maria da Silva dos Santos, professora auxiliar da Faculdade de  
Motricidade Humana da Universidade de Lisboa

**Tânia Sofia Esteves Gonçalves**

**2022**

## **Agradecimentos**

Agradeço desde já à Professora Doutora Ana Santos por ter aceite ser minha orientadora e por todo o apoio e orientação durante o processo desta Dissertação.

Agradeço também aos meus pais e irmã por todo o apoio incondicional apesar da distância que nos separa.

Por ultimo mas não menos importante, ao Dr. Amr Kandil pelo seu incentivo para a finalização do grau de mestre, por sempre acreditar em mim e todo o apoio que me deu. Esta dissertação não seria a mesma sem os seus ensinamentos.

### **Abstract**

The thesis's primary purpose is to demonstrate the growth of the digital era on the sports industry for awareness and better management. Moreover, it aims to explain the digital technology revolution and its effect on physical activities and sports. The paper presents a social analysis of sports regarding the effects of the IV Industrial Revolution, driven by an unprecedented level of development in materials sciences, digital technology, and biology. The future views on the evolution of the sports industry and options for the sports manager in the phase of digital transition are illustrated. The conclusion summarizes the implications and represents the direction of the sports industry.

### **Resumo**

O objetivo desta tese é demonstrar o crescimento da era digital na indústria desportiva para a consciencialização e uma melhor gestão. Além disso, visa explicar a revolução tecnológica digital e a sua influência na atividade física e desporto. O documento apresenta uma análise social do desporto em relação aos efeitos da IV Revolução Industrial, impulsionada pelo sem precedente nível de desenvolvimento nas ciências materiais, tecnologia digital e biologia. O futuro da evolução da indústria do desporto e as opções dos gestores desportivos na fase de transição do digital. A conclusão resume as implicações e reflete a direção da indústria do desporto.

*Keywords:* sports digitalization, e-Sports, exergames, Industry 4.0, sports manager, wearables, Artificial Intelligence, sports applications, future of sports, digital health, Virtual Reality

## Table of Contents

<b>1. Introduction</b>	5
<b>2. Overview of Sports in the Digital Era</b>	5
<b>3. Convergence of Sports and Digital Cultures</b>	44
<b>4. Biological Advances in Sport</b>	56
<b>5. New Directions in Sports Marketing</b>	65
<b>6. Future View</b>	77
<b>7. Innovative Future Sports Trends</b>	88
<b>Conclusion</b>	94
<b>References</b>	97

## **1. Introduction**

Notably, technology has become an inseparable part of various industries in the modern world, including sports. Essentially, the impact of digitalization on the evolution of sports is profound. Digital innovations are used in all segments of the sports industry, for instance, training, competitions, and performance control, as well as organizing, conducting, and broadcasting tournaments and competitions via social media. Digitalization influences sports games viewing improvement, particularly enhancing the fans' experience at the stadium and home in front of computer screens. Innovative digital technologies and discoveries allow athletes to reach new heights in sports, analyze, modify, and personalize training techniques and approaches to set new records every day.

The sports industry has developed handheld devices that conduct real-time research and analysis during training and competition. It is essential to add that recently automated systems have been actively used to control an athlete's actions in team sports. All data collected with the help of technologies and sensors help optimize athletes' activities and find the best means and methods for restoring and increasing sports performance. Modern technology helps athletes feel better during training and rest. Different categories of resting options are combined using information systems based on the needs of each athlete, allowing faster recovery physically and mentally, which makes it possible to train more often and more efficiently. Technology affects how athletes train and compete, how fans attract and consume content, and how world-class venues are built. For years, technology has been transforming the world of sports, and today new sports are created based on technological enhancements, and the popularity of e-Sports continues to grow dramatically. In this thesis I intend to make a systematic review over the changes in Sports due to the Digital Era and how can sports managers adapt to this new era.

## **2. Overview of Sports in the Digital Era**

The digital revolution demonstrates a fundamental impact on the way people live and is becoming more visible in various spheres of the economy and society. Digitalization as a

phenomenon is the introduction of modern digital technologies that lead to dramatic changes. Dexeus (2018) states that the digital revolution, or digitalization, includes new and innovative technologies, such as artificial intelligence, blockchain, robotics, virtual and augmented realities, cloud service, and nanotechnology, among others. Consequently, the digital era is characterized by new rules, where the world is made of bits instead of atoms, while information refers to raw material. Dexeus (2018) informs that society has the enormous technological capacity and flexibility to reach industrial, cultural, economic, educational and even sports sectors in the digital era. In addition, Internet development and usage are growing significantly and influencing the broader economy.

Moreover, the digital revolution which is currently shaping society is called Industry 4.0. Loureiro (2018) suggests that the evolving technologies integrated into Industry 4.0 change the traditional ways and offer new opportunities. Kaur (2019) informs that digitalization shifts sports' perception towards digital, tech-savvy, health, and image-conscious modes. For instance, coaching sessions are organized online, running times are shared and displayed on social media, and wearable sports tech evolves to facilitate the connection between a coach and a customer.

Furthermore, the digital era is characterized by the evolution of Big Data. Tian (2020) discusses the influence of the data-driven reality on sports and its geography. The author agrees that data plays a crucial role in the development and growth of modern sports. According to Tian (2020), modern sports developed intensively from the end of the 20th century due to science and technology involvement. New sophisticated systems and applications help to collect sports data and analyze it with the highest level of precision. Tian (2020) emphasizes that software and hardware, for instance, intelligent wearable sensors and various mobile applications, became an integral part of lives and dominates the games on the field as well as provides necessary information and interprets the obtained data in order to emphasize athletic levels (Tian, 2020). Moreover, Big Data assists in assessing sports fans' sentiments, emotions, and behaviors and analyzes reactions.

Important to note, that Big data has emerged as a fundamental technology for leading the cross-border sports sector and strengthening the sports industry. In the age of Big Data, the sports industry's development strategy is founded on the idea of big data sharing in the sports business (Wang, 2020). According to Wang (2020), for the advancement of sports modernization, the integration of Big Data technology and the sports field is an unavoidable decision. Sporting activities are complex and nuanced, and data collecting is challenging. Athlete training and the tracking of real strategies are perhaps the most critical data to acquire in professional sports (Wang, 2020). Therefore, Big Data technology combined with real-time information transfer via sensors will undoubtedly boost training development. Moreover, these data transmission outcomes will be able to give data assistance for training decision-making. Essentially, Big Data can actualize the best combination of sports resources, stimulate industrial structure advancement, and drive the cross-border convergence of the sports sector (Wang, 2020). Nevertheless, the development and application of big data in the sports business are still in their early stages.

Significantly, the relationship between sports and daily routines and environments is called sports geography (Tian, 2020). Thus, due to the rise of advanced technologies and data analytics tools, the paradigm shifts incrementally. Sports are evolving and changing because Big Data is “profoundly impacted across the sport-landscape and initially strikes us as precisely dynamic, bringing an enhanced level of intelligence to the field of play in elite and professional sport” (Tian, 2020). Additionally, Big Data also contributes to sports analytics development.

Furthermore, sports analytics became a powerful tool in the sports industry. Xiao et al. (2017) acknowledge that worldwide digitalization, especially sports analytics, are crucial development trends in sports. One of the brilliant examples is Billy Beane, the lead coach of Oakland Athletics, who decided to apply analytics to organize the team according to evidence-based decisions. Caya and Bourdoun (2016) add that professional baseball was the initial sport where sports analytics was used to “enhance both player selection and on-the-field strategy” (p. 1062). Xiao et al. (2017) emphasize

that the use of digital technologies in sports is more penetrating in the current time. Analytical technologies contribute to performance improvement; for instance, during the 2014 FIFA World Cup, SAP was used to support the steps, actions, and strategies of the German National Football Team in order to assist in performance enhancement and learning rivals' approaches (Xiao , et al., 2017). In addition, Caya and Bourdoun (2016) mention that SAS is successful cooperation with “the Toronto Maple Leafs, Hawk-eye ball-tracking technology for professional tennis, cricket and football (soccer), and the interactive data visualization provided by SportVision during NFL games, Baseball games, and Nascar races” (p. 1062). Essentially, SAS software facilitates the decision-making process in competitive sports. Therefore, sports analytics and statistical software aim to create higher value for athletes.

The development of Industry 4.0 encourages the creation of sports applications. For instance, Various mobile applications, such as RefLIVE, allow referees to improve performance through recording and evaluating match details (Tian, 2020). Allen and Hopkins (2017) mention that Microsoft Sports Performance Platform Leverages supports deep-learning algorithms to refine football players' performance. NBA fans may access easy-to-use statistics on their digital screens and analyze the game through offered digital tools to boost the fan experience (Tian, 2020). Krzanich (2016) states that the evolving digitalization affected and modified the terms sports exist. Nowadays, technological advancement allows athletes to tailor nutrition plans, sleep habits, and opponents' strategies to achieve the best possible results.

For instance, every movement in a sport can be interpreted as a piece of data. Athletes play any sport based on their feelings; nonetheless, digitalization can help apply precise data behind the emotions through biosensing technologies with the critical goal of training and performance improvement (Krzanich, 2016). Tian (2020) claims that the combination of smart sensors and mobile application software resulted in the introduction of Runkeeper and RaceRunner applications. Therefore, the applications are using GPS to “track and map running, hiking, cycling as well as other



fitness activity data” (p. 162). The users can obtain the data on their healthy metrics, such as heart rate, calories burnt, and exercise pace (Tian, 2020). Caya and Bourdoun (2016) suggest that digital technologies assist remarkably in sports teams’ management and organization by providing access to sports information explanation and understanding. Moreover, digitalization helps to reveal new opportunities, tools, and strategic plans in sports.

Today, technology is already having an impact on reforming the sports industry. Based on Hamari and Sjöblom (2017), digitalization introduced a completely new type of sport, namely e-Sports. Hamari and Sjöblom (2017) determine e-Sports as “a form of sports where the primary aspects of the sport are facilitated by electronic systems; the input of players and teams, as well as the output of the e-Sports system, are mediated by human-computer interfaces” (p. 213). Hilvoorde and Pot (2016) agree that the e-Sports creation led to major consequences in the sporting industry. Thus, the growing number of online games and broadcasting technologies impacted the evolution of e-Sports.

To conclude, sports and fitness are effective ways to avoid serious health problems; in the future, more applications, gadgets, and other smart technologies will be created to develop sports and fitness. Also, it is essential to add that more competitions will take place online, as E-Sports will become an irreplaceable part of the sports industry. In the future, people will use artificial intelligence instead of sports coaches since it will be able to select physical exercises and the necessary load in more detail and more reliably based on personal health indicators. Virtual and augmented reality will help create the feeling and atmosphere of being on the sports ground during the game. Also, virtual reality will help athletes practice complex game elements and sports stunts in a controlled environment, choosing the level and setting the conditions. Thus, the game analysis will be improved with intelligent statistics; athletes will be able understand their mistakes during the game better and practice the exercises to achieve excellence.

## **Social Analysis of Sports: The Effects of the IV Industrial Revolution**

The industrial revolutions in the history of humankind have significantly influenced the change in life, economy, production, and other crucial areas. The fourth revolution, which is occurring nowadays, is associated with a complete transition to automated digital output, the use of innovative technologies in all spheres of society, and the growth in the utilization of artificial intelligence. Lavopa and Delera (2021) emphasize that the term Fourth Industrial Revolution was introduced and explained by Klaus Schwab. He is a representative, founder, and executive chairman of the World Economic Forum, briefly WEF. Moreover, the Fourth Industrial Revolution refers to the convergence between virtual and physical worlds, advanced nanotechnology, material sciences, and digital production technologies. Additionally, the Fourth Industrial Revolution is also known as Industry 4.0; it includes the evolution and rise of various innovative technologies such as Artificial Intelligence, the Internet of Things, Virtual and Augmented Reality, Drones, 3D printing, among others. In addition, Industry 4.0 is called a Smart Factory because it allows continuous adaptation, learning, and optimization of processes (Lavopa & Delera, 2021). Importantly, humankind experienced three industrial revolutions before reaching the Fourth Industrial Revolution.

Consequently, the First Industrial Revolution occurred in the eighteenth century and dramatically influenced human lives. Lavopa and Delera (2021) state that the steam engine was invented during the First Industrial Revolution. Schulze (2019) acknowledges that the revolution occurred in Britain around 1760; the invention of the steam engine introduced new manufacturing processes and allowed people to create factories. Therefore, the production processes improved significantly based on these advanced for that time technologies.

The Second Industrial Revolution happened in the nineteenth century and was characterized by the introduction and widespread distribution of electrification. Schulze (2019) informs that during the time of the Second Industrial Revolution the mass production in entirely new industries such as oil, electricity, and steel was introduced. Essentially, the significant inventions of that time include

the light bulb, the telephone, and the internal combustion engine (Schulze, 2019). Thus, people accessed new and improved ways of living, working, and interaction. Consequently, the Third Industrial Revolution was triggered by advancements in computing. Lavopa and Delera (2021) note that the revolution occurred in 1960 and introduced computers and the internet. Schulze (2019) emphasized that the Third Industrial Revolution is also famous for the invention of the semiconductor. Significantly, the third revolution is called Digital Revolution, when people started to use the benefits of internet connection and personal computers.

Nowadays, humankind is experiencing the Fourth Industrial Revolution, which is characterized by the fast development of technologies. Schulze (2019) asserts that Klaus Schwab explained the critical aspect of the Fourth Industrial Revolution in his book published in 2016. The author investigated the phenomenon and emphasized that the revolution has almost erased the borders between digital, physical, and biological areas. Therefore, the gap between these three areas is decreasing steadily with the help of new innovative technologies. Lavopa and Delera (2021) claim that the technological advances are developing, machines start to communicate with one another through the Internet of Things, intelligent algorithms empower various processes in different industries and sectors, and bidirectional interfaces facilitate real-time communication between humans and mechanical procedures. Therefore, the Industry 4.0. has offered brilliant opportunities to people to achieve their ambitious goals and improve their ways of living.

Thus, Industry 4.0 connects people and automated machines, robotics, and digital technologies. Lavopa and Delera (2021) state that Industry 4.0 offers a unique way of combining software, hardware, and communication in order to create a seamless interconnection between physical and virtual dimensions and enhance extensive data collection and analysis. Nowadays, sensors help reveal particular actions, processes, and situations and forward this information to Artificial Intelligence, allowing fast evaluation of big data and correction (Lavopa & Delera, 2021). The digital technologies of Industry 4.0 rearrange, examine, and optimize the processes, for instance,

in the manufacturing field, which significantly saves time, minimizes errors, and provides higher efficiency. Industry 4.0 is also distinguished by globalization, which means that the technological revolution will affect every organization and industry sooner or later, including the sports industry.

Essentially, the fundamental question arises if Industry 4.0 will replace humans with intelligent machines. According to Lavopa and Delera (2021), scholars argue that Industry 4.0 may result in widespread unemployment and an enormous gap between various socio-economic groups. Nonetheless, Schulze (2019) highlights those innovative technologies, for instance, artificial intelligence, will impact the reduction of some jobs while creating entirely new workplaces and formulating demand for new skills. Therefore, Schwab (2016) ensures that humans are the priority, and they are managing, shaping, and directing the technological revolution because people create digital tools for people (Schwab, 2016). Thus, it is crucial to remind managers, leaders, and citizens that humans are in charge of the revolution and not the machines. New technologies and their rapid development provide opportunities for developing countries to skip some intermediate stages of industrialization (Lavopa & Delera, 2021). Countries' economies can benefit from the revolution if they have the availability and access to technology, and they can correctly integrate this technology with skills and production functions.

Modern times are driven by the desire of countries, governments, organizations, and citizens to sustain the pace of technology development and adapt to rapid change. Schulze (2019) argues that today digital technologies are very closely integrated with many industries and various types of business, and they also cover social and economic aspects. Every year it becomes more challenging to separate technology from non-technology because digitalization has become an essential part of modern lives.

Therefore, nowadays, humans are shaping the evolution of Industry 4.0 by significantly changing the ways of living, communicating, and interacting. According to Schwab (2016), the changes are happening every day; humans already interact with intelligent robots, self-driven

vehicles, mobile applications, advanced commuters, and even genetic modifications. The Fourth Industrial Revolution allows to improve connectivity between billions of people globally via widespread digital networks, modify the organizations to achieve better results based on big data and analytics, and even protect the environment by enhancing the regeneration through innovative technologies and promoting sustainability (Schwab, 2016). Modern time is full of promises and opportunities to create a better future for humankind.

The Fourth Industrial Revolution affected the sports industry by raising available sports technologies and applications. Nowadays, Artificial Intelligence, Augmented Reality, the Internet of Things, and autonomous machines have significantly merged within the sports industry (Ross & Maynard, 2021). Many brilliant examples are involved in the transformation of the sports industry, starting from mobile applications and virtual assistance to cybersports and self-driven cars. Ross and Maynard (2021) argue that the technologies humans currently experience were considered futuristic and unreal five years ago. Thus, it was almost impossible to imagine how the sports industry would develop and expand.

Notably, the ways of perceiving and managing work change under the influence of digitalization and large-scale intelligent ecosystems. According to Ross and Maynard (2021), organizations should focus on balancing technological enhancements with new concepts, practices, and values. The Fourth Industrial Revolution emphasized the fundamental modifications of workplaces and organizational strategies. The most outstanding example of Industry 4.0 influence is the reorganization of workflows, schedules, and flexibility during the coronavirus pandemic. Ross and Maynard (2021) argue that the times of lockdown and social distancing demonstrated that people could work and communicate relying on technology. For instance, employees had no other option than move their offices to home and start working by sharing information with colleagues online. In addition, the sports industry included the development of many applications and online training that helped maintain a healthy lifestyle without leaving home. Consequently, video technologies, virtual

interaction, and remote network access empowered people's daily routines, enabling them to work from anywhere and providing better flexibility.

The Fourth Industrial Revolution, similarly to the past three industrial revolutions, is moving society toward a complete societal shift and radical transformation. Ross and Maynard (2021) suggest that, currently, humans should embrace technological changes and focus on shaping inclusivity, a human-centric and purposeful world. Currently, people are responsible for setting the rules, behaviors, communication based on the digital transformation. Digitalization enables society to shape the future, "unite global communities and build sustainable economies" (Ross & Maynard, 2021). In order to demonstrate the speed of the Fourth Industrial Revolution, Ross and Maynard (2021) mention that it took approximately seventy-five years for one hundred million users to accept and start using the telephone in daily life. In contrast, the social media site Instagram signed up one hundred million users in two years, while the inter-active mobile game Pokemon Go had one hundred million players in just one month (Schulze, 2019). Thus, the future will surprise humans with even more innovative technologies and possibilities.

Nowadays, organizations operate faster because they can evaluate vast amounts of data in a limited time with the help of digital platforms. Algorithms, Artificial Intelligence, and connected interfaces precisely predict each individual's "cultural interests, preferences, and health tracking" (Ross & Maynard, 2021). Thus, the organizations have access to personalized data and provide better products, services, and offerings for each target market. Significantly, the sports industry is remarkably impacted by technological evolution; organizations offer more value for customers through personalized applications and training.

Digitalization leads to an increase in the economic value of the sports industry. Global Sports Innovation Center [GSIC] (2019) states that new broadcasting formats and sponsorship impact the overall industry growth as the crucial contributors. Without a doubt, technologies will reshape the future of sports due to digital transformation's opportunities. Despite the industry's growth, the

organization will have to adopt new innovative technologies and realign its business models in order to keep pace with industry trends. Technological advances have made it easier for people to access information and products or services across different digital channels.

The fans' awareness is growing every year and thus leads to the formation of more stringent consumption requirements. Digitalization has provided access to almost any information; thus, fans have become more critical in their decisions and choices. GSIC (2019) argues that the main challenge for the sports industry that must be solved by 2025 will be to increase fans' involvement and strengthen the relationship with them. The digital era has brought together the two industries, sports, and entertainment, to form 'Sportainment' (GSIC, 2019). Organizations now have more room to grow and develop their businesses, but they will need to build valuable expertise to face intense competition from other entertainment formats.

### **Critical Review on the New Emerging Types of Sports**

#### **Exergames**

Exertion games or exergames have become popular recently in the sports industry. Older adults illustrate physical and cognitive deterioration; thus, they experience difficulties participating in various sports activities. Nonetheless, exergames are engaging applications that provide accessible and easy physical activity for aging people (Kappen et al., 2018). According to Kappen et al. (2018), exergames encourage physical activity incorporated with game aspects, for instance, various challenges and achievements. Mura, Carta, Sancassiani, Machado and Prosperin (2018) state that exergames are characterized by the "bi-dimensional virtual reality environment of the video game, through the use of the player's selected virtual shape" (p. 451). Exergames are especially admired among older adults because they help maintain good health and achieve wellness goals. In addition, exergames provide older adults "with effective rehabilitation mechanisms" (Kappen et al., 2018). Thus, exergames are games that also offer various exercises. Players do not need to touch the screen

or keyboard in order to play; the game is controlled with the body's movements. Significantly, the primary purpose of these games is to motivate players to be physically active, prevent sedentary lifestyles, and perform play tasks for health purposes.

It is essential to add that the current situation with the pandemic has significantly reduced people's physical activity. Sedentary lifestyles are harmful because they are characterized by various chronic diseases, "including mental comorbidities, systemic hypertension, metabolic dysregulation, and cancer" (Costa, et al., 2019). New fitness solutions and home workouts have been developed that incorporate gamification elements to address this challenge. For instance, the Finnish company Physilect, specializing in distance rehabilitation solutions, has tackled people's immobility and low physical activity by developing a series of exergames (Movesense, n.d.). Essentially, Physilect launched its first game, namely Pottery Fitness, in June 2021. The game has a Movesense sensor as a controller in order to estimate the player's hand movements (Movesense, n.d.). In addition, Physilect introduced an Android SDK to facilitate the connection to the Movesense sensor. Consequently, Pottery Fitness was developed to provide enhanced training for players' wrists, forearms, and hands and encourage physical activity among people who demonstrate a sedentary lifestyle.

Exergames are beneficial for office workers because they provide opportunities for exercising directly at the workplace. Moreover, exergames not only assist in boosting physical exercise motivation but also offer entertainment and healthy solution for office workers that spend the whole day at the desk (Healthy Games, 2021). Significantly, office workers often experience health issues related to their sedentary lives, such as back and muscle pain and tunnel vision. One of the major reasons for a sedentary lifestyle is the lack of motivation; thus, exergames help increase stimulation in order to start healthy habits (Costa, et al., 2019). Therefore, Physilect offers games that assist in improving office workers' physical health. For example, the game Nature Walk stimulates an imaginary walk-in nature, while the player has to hold the sensor and move (Healthy Games, 2021). The Plate Crusher is developed by Physilect as well in order to eliminate stress from working routine



by allowing players to crash plates, move, and receive immediate relaxation (Healthy Games, 2021). Thus, exergames are an ideal and entertaining solution for improving physical and mental health and mood in general.

Furthermore, exergames are promising for children's and adolescents' health. Andrade, Correia and Coimbra (2019) reveal that exergames help fight low self-esteem, obesity, and overweight in children and adolescents. For instance, after playing exergames on a regular basis, overweight children demonstrated better self-confidence, increased motivation in physical exercising, and reduced sedentary behaviors. Andrade et al. (2019) state that achievement of new skills has positively impacted self-esteem; exergames provided a greater sense of satisfaction in comparison with playing sedentary video games or doing traditional physical activities such as walking. Andrade et al. (2019) informs that children and adolescents with overweight or obesity enjoyed playing exergames more than children and adolescents with average weight. Thus, exergames illustrate a significant potential to attract overweight or obese children and adolescents. Nonetheless, the practice of exergames is not sufficient to solve the obesity problem completely; however, it helps to increase motivation to practice sports. Therefore, the studies show that exergames increase motivation and connection to physical practice in adolescents and children with overweight or obesity issues and improve self-efficacy and self-esteem dramatically.

The research in the field shows that exergames are beneficial for cognitive and motor development. Costa, et al. (2019) suggest that exergames stimulate brain activity by increasing the generation of motor and cognitive responses. According to Mura, et al. (2018), exergames are a powerful tool to enhance "not only motor function, but also cognitive abilities, by promoting processes of learning and experience-dependent plasticity" (p. 451). Costa, et al. (2019) emphasize that recent findings in neuroscience prove that physical exercise contributes significantly to "the treatment of neurodegenerative and mental diseases" (p. 18). Consequently, exergames are good for health because they illustrate reduction of lower limbs' spasticity, improvement of blood flow and

oxygenation, and solving postural balance issues (Costa, et al., 2019). In addition, playing exergames are crucial in decreasing cardiac diseases, obesity, and neurological issues (Mura et al., 2018). To conclude, exergames are safe and efficient in providing captivating training for maintaining physical activity and treating various health problems.

### **E-Sports**

E-Sport, or, in other words, cybersport, has become one of the most important types of digital sports in the 21st century. Jenny, Manning, Keiper and Olrich (2016) emphasize that eSports' synonyms are "electronic sports, cybersports, gaming, competitive computer gaming, and virtual sports" (p. 1). Nowadays, E-Sports are equal to traditional sports; gamers are recognized as athletes within society (Jenny et al., 2016). Hamari and Sjöblom (2017) indicate that e-Sports are pro or amateur video gaming where players compete by leagues in different tournaments. Recently, cybersports became one of the "most rapidly growing forms of new media driven by the growing provenance of (online) games and online broadcasting technologies" (Hamari & Sjöblom, 2017). Consequently, e-Sports are distributed through digital broadcasting, and the industry is computer-mediated.

Every year, cybersport involves more and more people and becomes not just a computer hobby but a full-fledged sports activity. Cybersport is a new phenomenon developing progressively and rapidly, forming new computer tournaments and competitions. Jenny et al. (2016) suggest that competition is a crucial basis of e-Sports because the industry is focused on the competition entirely. Essentially, e-Sports can be defined as the virtual reality of competitive games (Jenny et al., 2016). Jenny et al. (2016) highlight that South Korea became a primary country where e-Sports gained enormous popularity; the country has a television channel dedicated to e-Sports' development and news. Moreover, e-Sports has gained popularity by engaging people in cyber tournaments that present a unique atmosphere and fair competition between players or teams.

The critical difference between traditional sports and e-Sports is that e-Sports represent an interconnection between various digital platforms (Jenny et al., 2016). Additionally, the authors add that e-Sports refer to a combination of gaming, computing, sports, and media. Nonetheless, it is crucial to differentiate sport video games, SSVGs, and e-Sports. Jenny et al. (2016) mention that SSVGs include video games that simulate real-life sports, such as FIFA 15, NHL 15, The Snow, among others. These sports games are based on football, hockey, and snowboarding accordingly. In contrast, e-Sports do not relate to a specific professional sport because they represent fantasy worlds (Jenny et al., 2016). Hamari and Sjöblom (2017) state that eSports are usually complicated; thus, players need to concentrate and use analytical skills to play games. One of the brightest examples is League of Legends, LoL, where players compete in an imaginary world.

Therefore, a critical benefit of participating in e-Sports is the development of analytical thinking. Games require cybersports players to develop strategies, make the right decisions, and analyze opponents' actions. Hamari and Sjöblom (2017) acknowledge that e-Sports include particular genres, "such as multiplayer online battle arenas (e.g., League of Legends, Dota 2), first-person shooters (e.g., Counter-Strike: Global Offensive), real-time strategy (e.g., Starcraft 2), collectable card games (e.g., Hearthstone)" among others (p. 212). According to Hamari and Sjöblom (2017), fans of traditional sports claim that e-Sports cannot belong to the sporting industry. The main reason is that "players' skills and competencies are not evaluated based on "physical prowess or finesse as the eSports athletes appear to be simply sitting riveted to their chairs" (Hamari & Sjöblom, 2017). Nevertheless, the authors suggest that the fundamental difference between traditional sports and e-Sports is that game outcome in traditional sports happen in reality while e-Sports is concentrated on virtual worlds, namely computer-mediated environments, where players play online. Moreover, e-Sports help improve reaction speed, analytical skills, stress resistance, and quick adaptation based on new game tasks and the behavior of other players.

E-Sports are becoming viral, and recognition is rising in society. Based on Internationale Fachmesse für Sportartikel und Sportmode [ISPO] (n.d.) the digital association Bitcom conducted a survey in Germany for sixteen and older respondents in order to understand if people perceive e-Sports as a real sport. Results showed that one in three entirely agree that e-Sports should belong to the sporting industry. Essentially, thirty-eight percent of people who play computer games stated that e-Sports is a sport, and one in four gamers, namely twenty-six percent, informed that they want to become successful e-sportsmen (ISPO, n.d.). Thus, the survey results illustrated that e-Sports are becoming more accepted.

The development of e-Sports can be confirmed and demonstrated by the increasing popularity of streaming services. For instance, games videos are presented in twenty-eight languages and watched by millions of people daily on the Twitch service established by Amazon (ISPO, n.d.). Hence, the platform offers different content and attracts more gamers to stream and view videos. Viewers especially admire video games that are streamed in real-time.

Notably, the history of e-Sports started in the middle of the 20th century. For instance, computer games such as OXO, Tic-Tac-Toe, and chess appeared in the 1950 (ISPO, n.d.). ISPO (n.d.) informs that the first computer game was created by William Higinbotham and named Tennis for Two. Important to add that the most famous game which gained international acceptance and success was Pong (ISPO, n.d.). These games are similar to the modern computer game because they include a crucial factor, namely competition.

Moreover, the first e-Sports leagues were created at the end of the 20th century. Some of the e-Sports teams created in the 90s still exist, for instance, the British 4Kings and the German SK Gaming (ISPO, n.d.). ISPO (n.d.) emphasizes that the first cybergames were conducted in Seoul, South Korea, in 2000. Significantly, it was followed by the first E-Sports World Cup organized in France in 2003. Afterward, in 2007 the first Championship Gaming Series was organized with the one million dollars award. The e-Sports industry was developing with high speed; approximately ten

thousand gamers watched the LoL final in 2013 (ISPO, n.d.). Nowadays, millions of people watch live game streams, and e-Sports pro gamers compete in many tournaments.

The most popular e-Sports games attract people who want to play them professionally or as a hobby. Petermeier D. (2020) illustrates five of the most popular e-Sports games in 2020: Counter-Strike: Global Offensive, League of Legends, Fortnite, Dota 2, and Overwatch. Counter-Strike: Global Offensive by Valve Corporation studio is a team-based tactical first-person shooter. Players can choose sides; they can play as special forces or terrorists (Petermeier D. , 2020). The main idea of Counter-Strike: Global Offensive is to conduct a counter-terrorist operation in a separate location. Terrorists must detonate a bomb, hold hostages, or shoot the special forces, while the special forces must prevent the terrorists from carrying out their plans. The game has many unique maps, modes, and a large selection of authentic firearms.

Players need to complete missions in their team of five, complete missions and receive medals and exclusive weapons. Petermeier D. (2020) describes two possible Counter-Strike: Global Offensive scenarios, such as Bomb Defusal and Hostage Rescue. In the Bomb Defusal scenario, players-terrorists have a mission to place a bomb at a particular area and not allow special forces to stop the operation. On the opposite, special forces or anti-terrorists mission is to shoot the terrorist team before they can place the bomb and prevent the explosion by any means. According to the second scenario, namely Hostage Rescue, terrorists hold two motionless people hostage. Special forces aim at freeing them or saving the life of at least one hostage by bringing them to the hostage rescue zone. Players who move with hostages lose their shooting functions, and their movements become slow. Essentially, victory is also possible if special forces team eliminates all terrorists or vice versa.

The second most widespread e-Sports game is League of Legends. Important to mention that League of Legends is a competitive computer game in the MOBA genre, which stands for Multiplayer Online Battle Arena, including strategy features (Petermeier D. , 2020). LoL includes a vast selection

of champions; players can choose between around one-hundred-fifty various characters. LoL is one of the largest e-Sports games hosts many tournaments and competitions between e-Sports players. At the beginning of the game, players need to select one of the characters, the so-called champions. Each champion has unique skills and appearance; hence, the game provides five roles, such as Toplane, Midlane, Jungler, Support, Attack Damage Carry (Petermeier D. , 2020). Competitive action strategy allows gamers to play with friends or alone. Therefore, In the game, teams of five gamers are formed to reach and destroy the enemy base, namely another team of five.

Consequently, the League of Legends is followed by Fornite, the third most famous e-Sports game. Epic Games and People Can Fly studios created the game in the Battle Royale genre (Petermeier D. , 2020). According to Petermeier D. (2020), the rules are straightforward; a total of one hundred gamers should compete against each other on a vast map. Hence, the winner of Fornite is the last player who managed to survive in the battles. The game offers various resources and building structures that help gain a competitive advantage when fighting against rivals.

Dota 2 is one of the first five in popularity in the e-Sports industry, striking with its considerable number of fans. Dota 2, similar to League of Legends, is a multiplayer team game created in the MOBA genre by the Valve Corporation (Petermeier D. , 2020). In Dota 2, two teams of five each, one for good and another for the evil side, fight each other in an online battle arena. Moreover, each player controls one character, namely a hero, with unique abilities and a particular style of play. Significantly, Dota is one of the fundamental e-Sports disciplines, where tournament prize pools reach tens of millions of dollars; Petermeier D. (2020) adds that the game scores the highest prize money among other games. One vital factor that makes Dota 2 a core discipline is applying analytical thinking and focusing on the players' skills. During the game, players can gain experience to boost their level, earn gold, purchase and collect items that enhance powers, or provide additional abilities. According to Petermeier D. (2020), the game provides approximately one

hundred various heroes. The crucial goal is to win over the enemy team by deciding on tactical strategy and selecting suitable heroes.

Finally, *Overwatch* by Blizzard Entertainment Studio scores fifth in the most admired e-Sports games. The game successfully connected first-person shooter and MOBA genres (Petermeier D. , 2020). *Overwatch* is a team-based game with unique cartoon characters, both good and evil. Therefore, the players have a possibility to select the hero from the massive pool of characters with their distinctive background, weapons, and four various skills. Petermeier D. (2020) informs that the game runs in the first-person perspective; hence, players should tactically assess the situation and use their abilities in a clever manner to solve issues and challenges. To conclude, the game is engaging; the various tournaments are organized regularly, proving that *Overwatch* is one of the most popular e-Sports games.

Notably, the most successful example of the International Federation's involvement in e-Sports is FIFA. Association of Summer Olympic International Federations [ASOIF] (2019) suggests that the FIFA series is "the first sport-centric game to have an official license from FIFA, the world governing body of football" (p. 8). The goal of the FIFA organization was to create a simulated game that would help establish a top position in the e-Sports industry. Moreover, World Sailing, briefly WS, is another successful leader in e-Sports. ASOIF (2019) emphasizes that WS initiated the first e-Sailing World Championship in 2018. Consequently, more than sixteen thousand gamers from seventy-four countries joined the competition. Nevertheless, the e-Sports field remains questionable regarding its status in the sports industry.

Many traditional IFs consider e-Sports as an innovative digital field with many benefits. ASOIF (2019) adds that the present-day situation of IFs' engagement and interest in e-Sports illustrates the 'Diffusion of Innovation Theory,' "which indicates that adoption of a new idea, behavior, or product does not happen simultaneously in a social system; rather it is a process whereby some people and organizations are more apt to adopt the innovation than others" (p. 9). Thus, the

digitalization of sports, especially the spread of e-Sports and its acceptance in the industry, will not happen immediately but rather steadily.

Important to add that many IFs declined the possibility of being involved in e-Sports for fundamental reasons. According to ASOIF (2019), some sports' difficulties in digitizing and adapting to an electronic game and the lack of investments are significant reasons. ASOIF (2019) received answers from twenty-six federations regarding the potential challenges for launching an e-Sport project, and the two most common words were cost and budget. Therefore, technological and financial issues are obstacles to the e-Sports industry. Hence, the e-Sports industry requires an organization to invest considerable amounts of money in order to use and apply advanced technology that is not affordable.

The games' development, implementation, and promotion are expensive for many international federations. ASOIF (2019) argues that some games require "higher budgets than blockbuster movies because of the level of complexity and depth that games these days could reach" (p. 16). Nevertheless, the majority of international federations and organizations want to enter the e-Sports market and create their e-Sport platforms despite that they remain at the early stage of digitalization and have limited budgets. The E-Sports market is promising and may bring profit to federations in the case if they analyze the risks and opportunities precisely. One of the primary aspects before creating a game is to take into consideration not only traditional sports visualization but also the visual effects and know-how. Therefore, before searching for sponsors and investing in e-Sports, federations should determine if the game will become popular and admired by assessing the current market trends and needs. But will it be ethical and fair for the traditional sports if IF's will be involved in E-sports?



## **Impact of Technology on Sports and Fitness**

Internet of Things and Artificial Intelligence have impacted the industry of fitness and sports. According to Digiteum (2021), the fitness and sports industry is gradually filling with various applications, smart trackers, and wearables. For instance, advanced and revolutionary wearables with innovative functions allow athletes to enhance their sports routines. Digiteum (2021) presents an example of smart glasses introduced for cyclists in order to create and demonstrate routes instantaneously. Another shining example of a unique wearable is swimmers' intelligent goggles that gather crucial data and metrics when the athlete is swimming. Digiteum (2021) adds that special advanced shoes with sensors assist football players and runners in monitoring their statistics, including speed, motion, stamina, and resistance. Moreover, full-body wearables were invented to coordinate athletes' performance and health indicators, improve training with the help of virtual and augmented reality. Essentially, these wearables are suitable not only for professional athletes but also for sports enthusiasts and people who need rehabilitation.

Advanced wearables are just a few of the innovations in the sports industry. The Internet of Things and Artificial Intelligence will influence and transform infrastructures such as stadiums (Digiteum, 2021). Consequently, it will also be possible for fans to interact deeply with the game and improve the overall viewing experience through virtual and augmented reality solutions. Notably, Artificial Intelligence and the Internet of Things will motivate innovative solutions and affect the sports industry from different perspectives. Notably, 5G technologies are already improving speed and connectivity between people, and the combination of 5G with other technological innovations will present new horizons for sports.

The popularity of telefitness will grow among population groups of all ages. Telefitness solutions will be beneficial for the elderly and those who cannot go to gyms or work out for specific reasons (Digiteum, 2021). Many programs and applications have already been created that allow

people to perform exercises without leaving their homes. Therefore, telefitness has a positive impact on the health and well-being of people and will gain momentum in the future.

Sports equipment has undergone changes due to technological development. The increase of technology use in equipment relates not only to the traditional items' modification; it refers to the creation of entirely new and unseen products. Digiteum (2021) demonstrates a few examples, such as intelligent workout equipment, connected gear, enhanced sports areas, and athletes tracking systems. Consequently, smart workout equipment helps improve efficiency and reduce injuries because it is enhanced with sensors that provide valuable performance data. Connected gear term can be used to describe intelligent helmets, glasses, and other tools that are crucial to refining athletes' training and sports routines. Enhanced sports areas include modified stadiums, football fields, and racing tracks, among others, which involve modern technologies and can be identified as smart and sustainable spaces (Digiteum, 2021). Such technological areas aim to provide the best possible experience during sports events for both athletes and audiences.

Athlete tracking systems utilize statistics and personalized health metrics to reshape game tactics and training accordingly. Digiteum (2021) presents an example of an athlete tracking system called STASTports. Nowadays, many successful and famous football clubs use this system for their athletes, such as Liverpool and Arsenal. Thus, tracking systems are brilliant sports tools to evaluate performance, analyze possibilities, adjust training in order to achieve athletes' goals.

### **Sensors and Wearable Technologies in Sport**

Nowadays, sensors and wearable technologies are widely used in sports. James and Petrone (2016) discuss the application and the usefulness of sensors in their book 'Sensors and wearable technologies in sport: Technologies, trends, and approaches for implementation.' The authors state that sensors are crucial because they allow to obtain new information in a laboratory context and offer

better sporting equipment, which, as a result, assist in improving athletes' performance. James and Petrone (2016) emphasize that micro-sensors are used by many mainstream companies working in the sports, gaming, and telecommunication sectors. The crucial goal of micro-sensors is to enhance the equipment design, analyze essential data, improve athletes' performance, and impact the sports' evolution.

Thus, the use of sensors is growing because of the various benefits sensors offer to the sporting industry. In addition, a new discipline appeared, namely Sports Engineering, which "once mainly the province of materials and mechanical engineers but has now come to also include, through the rise of technology, the electronics and computer engineering disciplines" (James & Petrone, 2016). Consequently, technological progress impacted the advancement of microelectronics; thus, nowadays, engineers can make a mechanism, which is compact and light to be used for sporting and clinical purposes. Sensors and unique wearables are created to analyze an athlete's health and performance indicators immediately; the data can be shared to the data cloud (James & Petrone, 2016). Sensors are beneficial for retrieving and processing the data needed for athletes' activities.

Essentially, there are various sensors used in the sports industry nowadays. James and Petrone (2016) discuss load and pressure, inertial, optical, angle and displacement, and garment and apparel sensors. First, the authors inform that the measurement of forces is widely used in sports, especially in manufacturing game-based sports items. For instance, load cells and strain gauges are used in sporting equipment like chainrings and cranks for professional bicycles. Thus, sensors can measure precisely the crank force. Significantly, the cycling power is shown on the handlebar's display (James & Petrone, 2016). Additionally, force and load measurements assist in evaluating sports materials used for producing and manufacturing high-quality sporting equipment, such as sports shoes, baseball bats, and hockey sticks.

Another technological advancement available in the sports world is pressure sensors. James and Petrone (2016) describe pressure sensors as tools for illustrating the forces transmitting between

bodies' interactions. For instance, pressure sensors demonstrate the contact between athlete's shoe and foot, head and helmet, racquet and ball. As a result, the devices calculate the pressure distribution between surfaces in touch to provide vital data on whether the load is expected. Moreover, this information will help manufacturers or researchers to examine the comfort and safety of sports items.

Inertial sensors are widely used in various sports because the capabilities of the sensors meet the needs of these sports. James and Petrone (2016) acknowledge that inertial sensors are "widely applied to the kinematics of a body where they can be used as biomechanical markers of the body activity or to derive linear or angular velocities and thus displacement and angles" (p. 16). Moreover, inertial sensors are widely used in running sports. For example, sensors help analyze oxygen consumption when an athlete is running at different speeds, as well as overall monitoring of the body's energy systems. Moreover, the sensors located in the athlete's shoes help accurately determine the running speed.

Additionally, another sport where athletes use inertial sensors is swimming. James and Petrone (2016) argue that swimming is characterized as a low-impact sport; hence, the sensors have the ability to analyze body movements. Inertial sensors installed on the athlete's wrist, for instance, on a wristband, analyze and evaluate arms movements and possibilities of arm strokes. Inertial sensors are widely applied in a variety of sports balls in order to investigate crucial factors. James and Petrone (2016) state that in order to investigate flight, speed, and release phases, "inertial sensors have been built into bowling balls, baseballs, cricket balls as well as flying discs" (p. 19). Athletes can use sensors to measure jump height; consequently, when combined with other sensors, inertial sensors can be applied in skiing.

The third type of sensor technology used in sports is optical sensors. They measure light directly or indirectly and allow to measure athlete's movements (James & Petrone, 2016). The optical sensors are used via specialist photography and light gates. According to James and Petrone (2016), light gates are beneficial in measuring and monitoring an athlete's speed. For instance, light can be

used to provide information on stroke visually to a swimming athlete. One of the optical technologies is to measure the time of flight and radio waves to evaluate speed (James & Petrone, 2016). Thus, optical sensors are used in numerous sports, for instance, skiing and swimming.

The fourth type of sensor technology includes angle and displacement sensors. Significantly, displacement sensors are based on contact or contactless technologies. The most affordable and standard displacement sensors applied in the sports industry, according to James and Petrone (2016), are "the "Draw-wire Sensors": these sensors measure linear movements using a highly flexible steel or polymer cable" (p. 21). Consequently, displacement sensors are utilized in order to discover displacement and speed "in highly constrained 1D movement in rowing applications for seat, oar and trunk movement" by using resistive materials as an accelerometer for joint angles (James & Petrone, 2016). Therefore, the displacement sensors help evaluate and measure an athlete's speed and distance. For instance, angle and displacement sensors are used in various sports such as snowboarding, where sensors are attached to ankle joints.

Another significant type of sensor technology used in sports refers to garment and apparel sensors. These sensors have a vast range of applications, isolated wired temperature to absorbable multi-frequency body temperature sensors (James & Petrone, 2016). For instance, in skiing, athletes use tiny wired temperature and humidity sensors in order to identify the temperature and humidity environmental influence on ski boots' performance. In addition, athletes apply textile technology in different sports and even in health science by wearing textile-based sensors to measure body environment patterns.

The development, improvement, and implementation of sensors occupy a large part of the sports culture of modern society today and represent the potential for further development in the future. Further development of sensors demonstrates the creation of new innovative trends in sports. Fundamental trends include minimizing technology tools, increasing the availability of sports wearables for sports enthusiasts, and converging technology and physical sports and applications in

related disciplines such as human health (James & Petrone, 2016). Wearable technology combines sportswear with technology. In the 21st century, all sportswear elements include modern gadgets such as wristwatches that measure heart rate, maintain a healthy lifestyle, and track athletic performance. Moreover, wearable technologies also include heart rate sensors and personal electronics. In the near future, special attention in sports will be given to the development of new materials from textiles. Therefore, they will contribute to the maintenance and proper functioning of technologies such as sensors.

It is important to add that the concept of wearable technology is not new. Nonetheless, due to digitalization and sports convergence, the phenomenon is firmly entrenched in the fashion of the sports industry. Wearable technology and sensors are driving the growth of sports and interest in the sports and health sectors. Improved sportswear and innovative equipment help reduce injuries and improve athletes' performance in a sports context. Thus, special sportswear equipped with technology and sensors helps analyze athletes' physical condition, muscle mass, heart rate, and movement frequency. Obtaining such data will assist in analyzing athletes' endurance and identifying possible weaknesses. If the athlete is physically injured during training, the smart suit will help track the rate of recovery and optimize rehabilitation. As mentioned earlier, sensors are incorporated not only into wearable technologies but also into sports equipment, such as soccer balls, skateboards, and tennis rackets, in order to track the progress of an athlete and improve game techniques.

### **Sporting Femininities**

Currently, the sports sector is proactively working to change the image of women in sports. According to Toffoletti, Thorpe and Francombe-Webb (2018), people live in exciting times in which the neoconservative cultural and political atmosphere has fostered a plethora of feminist goals, methods, and collaborations aimed at reforming the gender-power relations impacting women's rights and social debate. Fundamentally, digitization has impacted new forms and dimensions of femininity,

feminist action, and politics. Sport's gendered politics have permeated national discussion, getting entwined with broader arguments about uneven pay, sexual discrimination and violence, racial inequality, and sexual objectification, to mention a few concerns (Toffoletti et al., 2018). Consequently, feminist seeds of change have been pushed through the historical frames of misogyny and suppression that define the sporting media industrial complex and traditional patriarchal structure. The new media channels, such as social media, have played an essential role in increasing the visibility of women's endeavors, successes, and interests (Toffoletti et al., 2018). Thus, various social media publications call attention to persisting systemic difficulties and everyday obstacles faced by women.

Although postmodernism celebrates diversity, its outlines are projected onto existing uneven power structures of race, religion, and ethnicity (Bramham & Wagg, 2016). Bramham and Wagg (2016) proved an example of unfairness in sports which happened in 2003. The women's football match was scheduled at Keilor Park in Australia between Melbourne Women's Soccer Club. Before the match could begin, the referee barred one of the female participants from entering the field of play. The athlete in issue was dressed in a hijab, a headscarf used by Muslim women. The player in question, Afifa Saad, refused to remove her hijab at the referee's request, and as a result, the football match had to be postponed (Bramham & Wagg, 2016).

For many decades, Muslim sportswomen have competed in the Olympics, functioning as genuine role models and heroes for their communities in various ways. Despite that, they have always been positioned as suspect, victimized, and oppressed in sports (Toffoletti et al., 2018). Nonetheless, Toffoletti et al. (2018) state that nowadays, there is "a positive representational shift in the cultural framing of Muslim women, especially hijab-wearing Muslim sportswomen" (p. 96). According to Bramham and Wagg (2016), Muslim women have developed their narratives and rituals to validate their rights in general and in connection to sports in particular. Their personal and political beliefs develop due to their perspectives on multicultural politics and critical relationships with modern

feminism (Bramham & Wagg, 2016). In addition, digitalization affected the dramatic change in media and resulted in the modification of human perception and acceptance of diversity in sports.

Social media's different advantages and functions assist women athletes in controlling conflicting pressures from society to show themselves as empowered in sports environments. Female athletes use social media to project a physically powerful and efficient body "as well as in a postfeminist gender landscape that rewards engagement in feminine aesthetics and other forms of affective labor" (Toffoletti et al., 2018). Consequently, for example, Instagram provides an image-centered online environment for female users to convey their feminine side via images demonstrating their health and wellness choices and preferences. Toffoletti et al. (2018) add that personal websites and affiliated blog sites enable users to express athletic identity and share information about one's story through first-person narratives. Essentially, Twitter and Facebook are intended to facilitate community-oriented engagement and foster social connections through communicating via messages and updates on life happenings (Toffoletti et al., 2018). Thus, social media networks and tools are influential in promoting female athletes.

In addition, social media networks promote the diversity of female athletes and sports enthusiasts. For instance, when a spectator navigates throughout athlete social media sites, it implies that there is no set pattern describing how female athletes should appear, enabling analysis of these photographs as manifestations of an athlete's particular organization, choice, and inclinations (Toffoletti et al., 2018). Hence, the range of pictures available can also be interpreted as an indication of the rapidly changing landscape of gender in specific sports, bolstering claims that internet platforms may serve as locations for increased visual diversification for minorities. Moreover, online self-representations help females raise the issues they experience in the sporting industry and allude to the critical choices that socially disadvantaged females undertake in order to succeed in discriminatory social systems (Toffoletti et al., 2018). Thus, the digital era impacted the integration of diversity and inclusion into humans' lives.



Humans live in a world that is becoming more diverse and dynamic characterized by globalization, new communication technology, and, especially, expanded women's rights. Furthermore, the rise of health trends has impacted the number of women participating in sports. Thus, fitness corporations profited by depending on disciplinary power technologies that produce a rational, health-seeking "entrepreneurial" subject who desires to enhance their body via self-discipline (Toffoletti et al., 2018). According to Toffoletti et al. (2018), 'Activewear' for women has become a significant retail segment and sports apparel sales. This increase can be linked to 'athleisure,' a clothing category described as a trendy combination of sports and leisure items used in the gym and at home. According to marketing statistics, women's brand choices shift toward sports firms since they upgrade in style and materials. Therefore, sports companies started to consider the female audience crucial for brands' success and are trying to attract more women to the sports industry. However, is this shift from sports companies to attract more women with new 'Activewear' a way to transform the competition of women sexier so it will be more attractive to watch?

### **Data Analysis in the Sports Industry**

Essentially, the digital era inspired the development of several valuable technologies for data analysis in sports. According to O'Donoghue and Holmes (2015), sports performance data may be analyzed utilizing elementary statistics in the same way that data from other fields are assessed and evaluated. O'Donoghue and Holmes (2015) acknowledge that descriptive statistics may be used within a reductive quantitative approach to calculate averages for performance indicators such as means and medians, and also "to describe sample variation around these averages using standard deviations, ranges, or inter-quartile ranges" (p. 3). Additionally, correlation methods can be used to analyze relationships between numerical performance metrics.

Various sports performance studies offer data on the basis of event frequencies and the proportion of activities that are successfully completed. This type of analysis does not give essential

information on the temporal ordering of activities during sports tournaments (O'Donoghue & Holmes, 2015). Consequently, temporal analysis can be used to explore such event orderings, enabling sequences of behavior to be analyzed and offering details on techniques and alternatives utilized by professional-level performance athletes in various scenarios. Notably, linear regression can be used in athletic performance prediction modeling. O'Donoghue and Holmes (2015) demonstrate that the primary distinction between linear regression and discriminant function analysis is that discriminant function analysis restricts match outcomes to wide result groups, such as win, draw, or defeat. Thus, numerical variables, such as goals or point margins of winning, are calculated via linear regression.

Sports performers can be classified based on their gender, position, professional level, and age. Likewise, sports performances may be characterized by factors such as location, playing surface, match significance, and opposing strength (O'Donoghue & Holmes, 2015). Nevertheless, some groups of performances and performers are challenging to differentiate according to immediately measurable factors. For instance, the score line may impact various athletes' strategies in diverse manners (O'Donoghue & Holmes, 2015). Therefore, cluster analysis is used to identify non-obvious groups of players and performances in such cases.

Notably, digitalization offers software commonly used for game analysis that deals with significant situations in sporting events. O'Donoghue and Holmes (2015) provide examples of the digital packages that are often utilized in sports, such as "Focus X2, Nacsport, Sportscodel, Dartfish, and Observer Pro" (p 23). Hence, the primary analytical procedure of such programs is cross-tabulating data to generate frequency patterns, namely profiles. O'Donoghue and Holmes (2015) claim that other software, such as Silicon Coach, are utilized for method analysis during shorter-term competitions; these technologies' primary analytical capabilities are distance and angle estimate algorithms. Specific programs, namely Dartfish and Focus X3, may be utilized for both game and athlete's technique evaluation and assessment (O'Donoghue & Holmes, 2015). Therefore, these digital tools are crucial in the sports industry because they facilitate the analysis of games and results.

Another efficient tool for processing data that was introduced in the digital era of sports is Excel. Excel offers various valuable functions and features to manipulate and manage data from performance analysis packages. The use of basic arithmetic, logical operators, text processing, and conditional functions are all covered. Excel allows data and the functions that process them to be included on the same worksheet, and spreadsheets can be formulated as a series of worksheets. Essentially, Excel covers fundamental mathematics, logical operators, text analytics, and conditional functions. Consequently, the tool enables users to incorporate data and the methods that analyze it on the same worksheet; thus, spreadsheets can be constructed out of several worksheets (O'Donoghue & Holmes, 2015). In addition, Pivot tables are immensely beneficial in performance assessment and may accelerate the processing of Event Lists generated by commercial packages (O'Donoghue & Holmes, 2015). Thus, Excel is applicable to evaluate, organize, and interpret sports data.

Notably, digitalization introduced various athlete tracking technologies widely applied in the sports industry. Certain technologies are primarily autonomous, whereas others demand minimal human data verification engagement (O'Donoghue & Holmes, 2015). Consequently, the precision of technologies ranges, and although some could be beneficial for sports like sailing and orienteering, they are not suitable for competitive games conducted on a narrow playing field. Thus, the sports industry offers a massive range of player tracking systems. According to O'Donoghue and Holmes (2015), some technologies may be used indoors, but others can only be applied outside. This statement is undoubtedly relevant when considering GPS systems. For instance, "commercial systems, such as Prozone3 (Prozone Sports Ltd, Leeds, UK)", have already been utilized to offer a plethora of information on strategic and physical elements of motion (O'Donoghue & Holmes, 2015). As technology advances, the precision of systems improves dramatically.

## **Digital Health, Fitness, and Sports**

New digital technologies are a universal cure to many medical, well-being, and public health issues that society faces today. Lupton (2018) suggests that digitalization and healthcare gamification via various applications and software affect how humans perceive health, interact with doctors or trainers, and respond to organisms' needs. Digital health is a term that connects with a vast scope of digital technologies aiming at providing necessary data and healthcare, assisting people in sharing their experiences with one another, enhancing training and education. Digital health innovations are "helping people with chronic illnesses to engage in self-care and encouraging others to engage in activities to promote their health and well-being and avoid illness" (Lupton, 2018). In modern media, digital health innovations are frequently presented in favorable terms. For example, digital technologies can provide solutions to patients, athletes, and experts and explain how these solutions can be used to improve healthcare delivery, increase people's health and well-being, and avoid illnesses and chronic diseases.

Moreover, various technologies are related to digital health and can be used for medical purposes. Lupton (2018) emphasizes that email, digital audiovisual interaction, applications, and group chats are utilized for improving the connection between patients and healthcare practitioners or between well-being promoters and target audiences. Online search engines are utilized to discover health and medical content. Digital gadgets can be used to administer medications or regulate/improve biological functioning, for instance, "cochlear implants, cardiac monitors, insulin pumps, digital pills" (Lupton, 2018). Besides, self-monitoring and patient-care equipment, smartphone applications and accessories, and 'smart' devices integrated with electronic nanosensors that record extensive data on human organisms are all examples of digital health objects. Consequently, medicine and wellness websites, discussion boards, blogs, software solutions, and social media platforms provide individuals with facts, assistance, guidance, services, and products, as well as chances for improving professional-to-professional interaction.

Telemedicine has the essential potential to improve access and the effectiveness of healthcare in various ways in sports medicine. Rigamonti, et al. (2020) state that telemedicine might assist in classifying patients with sports-related injuries between appointments to “emergency departments, orthopedics, sports physicians, and general practitioners,” or it could even help resolve some mild issues immediately (p. 159). In addition, telemedicine can be effective for the first medical examination of injuries in amateur team sports since team physicians are rarely present, as opposed to high-level games. In the same way that high-level athletes or sports teams have their physicians supporting them during competitions, telemedicine allows amateur athletes to have their familiar health professional online who will assess the situation and provide necessary recommendations (Rigamonti, et al., 2020). Therefore, the crucial field of telemedicine is the possibility to unite athletes and healthcare professionals worldwide through digital platforms.

Moreover, applications and videogame consoles technology encourage wellness and health-promoting exercises. Virtual and augmented reality technologies are being used for treatment plans, diagnostics, therapies for psychological health and physical problems, surgical simulations, and interprofessional development (Lupton, 2018). Moreover, three-dimensional, briefly 3D, printing technologies are being developed for use in medicine, prosthetics, and well-being education. Lupton (2018) informs that another critical advancement in the digital era was the proliferation of care and wellness sites and blogs. Hence, the World Wide Web offered easy access to information. The development of specialized websites enabled health, medical, and sports professionals and organizations to create websites to disseminate information to society. Therefore, people started developing their blog content and engaging online forums in order to communicate with one another and exchange knowledge.

According to some academics, social media may be utilized to provide recommendations on treatments. Simultaneously, social media platforms have an enormous amount of unmanaged, harmful, or erroneous medical material (Rigamonti, et al., 2020). Essentially, the cost-benefit

elements of medical information consumption data on social media are still being collected. The considerable growth of social media and its integration into an athlete's daily routines will have a growing impact on sport medical treatment and monitoring (Rigamonti, et al., 2020). Consequently, physicians, clinics, patients, and the health sector as a whole would be wise to recognize both the challenges and opportunities that come with interacting via social media and collaborate to create a contemporary medical data communication platform.

Digital media and technologies have significantly impacted personal interactions, households, other social groupings, entertainment, learning, employment, enforcement and safety, and the economy. Moreover, high-tech innovations enable convenient and immediate information transmission; Lupton (2018) adds that the pieces of data created by one smart gadget may now be shared with another device. Various digital technologies provide a selection of media categories as well as cross-platform tools that enables content to be distributed through many systems (Lupton, 2018). Thus, the updated information can be distributed throughout many channels, typically concurrently.

Wearable gadgets frequently use their applications and social networking sites, although they may provide accessibility to other social media sites. These software-enhanced interoperability functionalities enable users to easily exchange or integrate information across smartphones, platforms, and websites (Lupton, 2018). Users are increasingly encouraged to migrate between applications, networks, and web pages, publishing and re-sharing their personal information across multiple websites and utilizing numerous points of entry to access the networks (Lupton, 2018). Through the application of geolocational detectors and mapping devices, digital technologies enable the digitized positioning of an individual in time and space. For instance, smartphones incorporate global positioning systems, briefly GPS, and sensor systems such as accelerometers and gyroscopes, which are all location-based, as well as mapping technologies that may determine the user's actual location. An additional class of medical equipment with embedded sensors analyzes the physical

surroundings in which individual lives. Lupton (2018) claims that sensor gadgets are developed to follow the elderly's habits, movements, and vital signs, such as health rate, at home and in assisted living settings. Hence, these technologies include smart beds, armchairs, and surfaces to monitor users' motions and track their health indicators.

Sensors are becoming particularly prominent in exercise medicine, in addition to conventional fitness tracking those athletes apply in training. Rigamonti et al. (2020) suggest that sensor-driven movement may gain popularity for precautionary or medical training when geolocation or velocity monitoring can be integrated with the heart rate to measure activity and performance requirements and prevent individuals from exhaustion. The ability to measure metrics, such as “accelerations or decelerations of players during an attack or defensive maneuvers,” may be utilized to enhance training programs in team sports (Rigamonti, et al., 2020).

Smartwatches frequently integrate sensors and applications for measuring health and wellness. Lupton (2018) states that the Apple Watch, which was announced in 2015, features a variety of sensors, including "geolocation, accelerometer, gyroscope, and heart rate monitors," which enable self-tracking (p. 33). According to Lupton (2018), it is equipped with two significant applications, namely Workout and Fitness, that employ embedded sensors, such as heart rate detectors, geolocation, and accelerometer, to analyze owners' physical activity and physiological parameters.

Similarly, Samsung has introduced the Galaxy Gear smartwatch, featuring health tracking capacities. Additionally, the Google Fit program aims to monitor health and fitness activities (Lupton, 2018). Thus, digitalization enabled humans to track their health indicators and improve self-care routines. Moreover, digitalization introduced gamification to the health and sports industries. Lupton (2018) suggests that gamification is currently often utilized in marketing strategy, persuasive computing, and behavioral therapy. Thus, applications have been used to gamify several aspects of embodiment.

Numerous gaming innovations, also known as exergames, employ sensors to produce digital information about users and motivate them to exercise more often to enhance weight loss. Through techniques such as gamification and exergaming, video games and other digital reality systems may encourage adolescents to acquire and maintain a high level of regular physical exercise (Rigamonti, et al., 2020). Lupton (2018) provides examples of exergames that impact health positively. For instance, one example is Wii Fit, which assesses gamers' body mass index and offers statistics on their physical conditioning. Additionally, Xbox Fitness allows players to exercise with personal trainers and start receiving personalized feedback on their accomplishments. Finally, the Xbox Kinect technology offers functions such as determining which limbs were used in an exercise, tracking the person's endurance and pulse rate, and offering an overall physical activity spending indicator.

Notably, several applications that seek to merge entertainment with exercise have been launched. For instance, the famous 'Zombies, Run' employs augmented reality to encourage users to run longer and faster (Lupton, 2018). The game incorporates gaming methods such as tasks that users should complete in order to proceed and a plotline about zombies hunting people that participants listen to while running. Moreover, run records and information such as calories burnt are recorded to track users' performances. At the opposite end of the age range, 'brain-training' gaming applications are available to assist the prevention or reduction of memory loss symptoms and Alzheimer's in seniors. Lupton (2018) emphasized that gamification tactics inspire individuals to participate in self-monitoring, physical exercise, or self-care because they find it enjoyable. For instance, many self-tracking users appreciate characteristics such as converting various parts of their ordinary routine into measurements and examining these statistics as they evolve and compete with their friends.

Whenever behaviors and bodily processes are measurable, metrics and conceptions of health and wellness become crucial interpretations of these activities. Lupton (2018) acknowledges that well-being and enjoyment are represented by numbers acquired by a sensor-embedded smart device, self-tracking gadget, or gaming application. Self-tracking profiles for care objectives start to define a



data entity formed from a user's various personalized sets of data (Lupton, 2018). Additionally, the social media evolution modifies health patterns in society. People can picture themselves in many kinds of the embodiment using Selfie photos. Lupton (2018) informs that #fitspo, which stands for fit inspiration, is a famous Instagram hashtag that refers to photographs individuals publish online. By following this trend, people post pictures to display themselves consuming healthy food, indulging in athletic and fitness activities, and exhibiting how fit and healthy they appear in the workout clothes (Lupton, 2018). The concept behind the #fitspo tag is that individuals who want to improve their physical fitness may follow these fit-looking people, strictly adhere to any recommendations for obtaining the levels of fitness and good health and get inspired to strive to their successes. Although these strategies seem to inspire a lot of people, does this mean that they are exercising just to post? To be part of the trend?

### Ideas Resume

Dexeus, 2018	Digital revolution includes new and innovative technologies, such as artificial intelligence. The world is now made of bits instead of atoms.
Loureiro, 2018	The new technologies change the traditional ways and offer new opportunities.
Kaur, 2019	Digitalization shifts sports' perception towards digital, tech-savvy, health, and image-conscious modes.
Tian, 2020	Data plays a crucial role in the development and growth of modern sports.
Wang, 2020	The integration of Big Data technology in the sports field is an unavoidable decision.
Xiao, 2017	Worldwide digitalization are crucial development trends in sports.
Caya and Bourdon, 2016	Digital technologies assist remarkably in sports teams' management and organization by providing access to sports information explanation and understanding.
Allen and Hopkins, 2017	Microsoft Sports Performance Platform Leverages supports deep-learning algorithms to refine football players' performance.
Krzanich, 2016	The evolving digitalization affected and modified the terms sports exist.

Hamari and Sjöblom	E-Sports are “a form of sports where the primary aspects of the sport are facilitated by electronic systems; the input of players and teams, as well as the output of the e-Sports system, are mediated by human-computer interfaces”.
Hilvoorde and Pot, 2016	The e-Sports creation led to major consequences in the sporting industry.
Hilvoorde, 2016	The E-sports have fundamental elements of sports, such as social interaction and the possibility of players being a part of the game community.
Lavopa and Delera, 2021	The Industry 4.0 offers a unique way of combining software, hardware, and communication in order to create a seamless interconnection between physical and virtual dimensions and enhance extensive data collection and analysis.
Schulze, 2019	Today digital technologies are very closely integrated with many industries and various types of business, and they also cover social and economic aspects.
Schwab, 2016	The 4 <sup>th</sup> revolution has almost erased the borders between digital, physical, and biological areas.
Ross and Maynard, 2021	Nowadays, Artificial Intelligence, Augmented Reality, the Internet of Things, and autonomous machines have significantly merged within the sports industry.
GSIC, 2019	The new broadcasting formats and sponsorship impact the overall industry growth as the crucial contributors.
Kappen, 2019	Exergames are engaging applications that provide accessible and easy physical activity for aging people.
Mura, et al., 2018	Exergames are characterized by the "bi-dimensional virtual reality environment of the video game, through the use of the player's selected virtual shape".
Costa, et al., 2019	Exergames help increase stimulation in order to start healthy habits.
Healthy Games, 2021	Exergames not only assist in boosting physical exercise motivation but also offer entertainment and healthy solution for office workers that spend the whole day at the desk.
Andrade, et al., 2019	Exergames help fight low self-esteem, obesity, and overweight in children and adolescents.

Jenny, et al., 2016	E-Sports are equal to traditional sports; gamers are recognized as athletes within society.
Petermeier, 2020	Illustrates five of the most popular e-Sports games in 2020: CounterStrike: Global Offensive, League of Legends, Fortnite, Dota 2 and Overwatch.
ASOIF, 2019	The present-day situation of IFs' engagement and interest in e-Sports illustrates the 'Diffusion of Innovation Theory,' "which indicates that adoption of a new idea, behavior, or product does not happen simultaneously in a social system; rather it is a process whereby some people and organizations are more apt to adopt the innovation than others".
Digiteum, 2021	The fitness and sports industry is gradually filling with various applications, smart trackers, and wearables.
James and Petrone, 2016	Sensors are crucial because they allow to obtain new information in a laboratory context and offer 27 better sporting equipment, which, as a result, assist in improving athletes' performance.
Toffoletti, 2018	The neoconservative cultural and political atmosphere has fostered a plethora of feminist goals, methods, and collaborations aimed at reforming the gender-power relations impacting women's rights and social debate.
Bramham & Wagg, 2016	Although postmodernism celebrates diversity, its outlines are projected onto existing uneven power structures of race, religion, and ethnicity.
O'Donoghue & Holmes, 2015	Sports performance data may be analyzed utilizing elementary statistics in the same way that data from other fields are assessed and evaluated.
Lupton, 2018	Digitalization and healthcare gamification via various applications and software affect how humans perceive health, interact with doctors or trainers, and respond to organisms' needs.
Rigamonti, et al., 2020	Telemedicine might assist in classifying patients with sports-related injuries between appointments or r it could even help resolve some mild issues immediately.

### **3. Convergence of Sports and Digital Cultures**

#### **Innovative Sports Terminologies and Questioning the Hegemony of Sports**

With technological development, scholars and sports philosophers started to question the hegemony of the sports concept itself. Hilvoorde (2016) suggests that the debate on whether eSports can be considered sports continues; nonetheless, digital technologies play a vital role in modern lives, engaging more and more people into cybersports. Digital games, therefore, challenge the hegemonic concept of the sport, raising the critical topics of digital advancements and the future of the sports industry.

Nowadays, digital games are more complex and include many aspects of sports, such as analytical skills development, speed of reaction, and strategy planning. According to Hilvoorde (2016), modern games cannot be compared to the first generation of e-games because they offer a vast number of possibilities and functions. Essentially, players can modify the game conditions, context and express themselves. The diverseness of games includes exciting aspects of sports that are shifted into the virtual game environment. Moreover, E-sports have fundamental elements of sports, such as social interaction and the possibility of players being a part of the game community (Hilvoorde, 2016). The application of digital technologies in traditional sports is considerably increasing each year (Hilvoorde, 2016). Thus, it is crucial to accept the fact that virtual and real sports are merging to offer new opportunities to the industry.

Consequently, technologies also change the sports industry dramatically. For instance, technologies are able to deal with drawbacks of authentic sports, such as injuries and accidents. Hilvoorde (2016) states that conducting Formula 1 in a virtual environment will assist in reducing the risks of crashes but also emphasize the positive impact on the environment through the elimination of sound and air pollution. Thus, digital sports positively affect such elements as reducing health risks and environmental issues. Nonetheless, people should address the current concept of sports and the relevancy of face-to-face contact, physical body interaction, and the natural environment.

In order to discuss the innovative sports terminologies, it is crucial to highlight the examples of innovative technologies used in sports. Digiteum (2021) suggest that the innovative technologies modifying the sports field include mobile applications, intelligent wearables, Artificial Intelligence analytics, web platforms for statistics and analysis, and various software for leagues, teams, and sports event management. For instance, Dona Rise and Dona Shine are mobile applications that combine fitness and yoga sessions, help to expand social networks, and find the most suitable instructors (Digiteum, 2021). Sports mobile application became a vital term that people use every day when addressing the sports industry. Thus, sports mobile applications save time and offer brilliant opportunities to enhance skills.

The following fundamental technology used in sports is the Internet of Things; athletes are able to connect their smartphones to innovative wearables and receive analytics on their performance. Digiteum (2021) presents Teslasuit, the winner of multiple awards in the world of sports, because it provides unique telemetry data and functions as a post-injury rehabilitation suit. In addition, many web platforms are available for gathering game stats and other analytical data. For example, the Sports Performance Platform, which was developed by Microsoft Garage, demonstrates multiple beneficial functionalities for sports teams and organizations (Digiteum, 2021). There are also team and event management software that have impacted sports. Wooter App is used to organize, manage events, and communicate with the audience (Digiteum, 2021). Essentially, these technologically-advanced sports software enables managers to make team profiles, plan timetables, advertise events, and connect to fans.

### **Olympic Virtual Series: Tokyo Summer Olympics 2020**

Recently, International Federations, namely IFs, started to show interest in e-Sports industry. According to ASOIF (2019), Association of Summer Olympic International Federation, many IFs expressed their considerations on building e-Sports platforms and developing virtual copies of their

sports. ASOIF (2019) conducted research to investigate the fundamental determinants for IFs on adopting e-Sports as an integral part of their digitalization strategies and, also, indicate challenges of e-Sports directions. ASOIF (2019) states that the discussions on whether e-Sports can be called sports and become a part of the Olympic movements are crucial nowadays. Essentially, even though only ten percent of sports industry leaders supports the idea of establishing e-Sports as part of the Olympic Games, the potential of accepting e-Sports by the International Olympic Committee, briefly the IOC, is growing with each year (ASOIF, 2019). Hence, one of the brightest examples of the e-Sports potential is the organization of the Olympic Virtual Series, which aimed to promote e-Sports around the globe.

Essentially, implementing the Olympic Virtual Series at the Tokyo Games contributed to e-Sports development while still supporting the importance of physical sports. Tokyo Summer Olympics were conducted between the 23rd of July and the 8th of August 2020 and included the participation of both physical and virtual athletes (Mahendra, 2021). Furthermore, the Tokyo Games contributed significantly to the acceptance of cybersports because it was the first time the Olympics included virtual games under E-Sports. According to Euronews and AP (2021), the Olympic Virtual Series was implemented using virtual and augmented reality. Thus, the athletes from all over the world were able to compete from the comfort of their home.

Consequently, the Tokyo Games 2020 demonstrated a significant enhancement of the Olympic plan by initiating new types of sports. According to Mahendra (2021), the International Olympic Committee organized a pre-game virtual series, which included five virtual versions of physical sports, namely baseball, cycling, rowing, sailing, and motorsport. The Olympic Virtual Series was conducted before the actual Olympic Games, between the 13th of May and 23rd of June 2021, with the primary goal of integrating the physical and virtual sports communities and promoting the Olympic Movement (Palar, 2021). Mahendra (2021) suggests the IOC has made the first move towards accepting E-Sports as a part of the sporting industry; nonetheless, more actions should be

taken in order to receive full acceptance. Mahendra, (2021) adds that the IOC's promotion of E-Sports was a strategic move to attract more audiences, especially cybersports enthusiasts. Without a doubt, the IOC should introduce other initiatives, such as online games, for instance, Call of Duty, to present e-Sports as a sport.

Significant to add that the IOC cooperated with international sports federations to run the Olympic Virtual Series. Mahendra (2021) acknowledges that the five significant federations included World Rowing, World Sailing, Fédération Internationale de l'Automobile (FIA), World Baseball Softball Confederation (WBSC), and Union Cycliste Internationale (UCI). Hence, the federations assisted in designing and implementing virtual games based on physical sports. The goal was to use virtual games as a marketing strategy for promoting specific physical sports via its virtual version. To conclude, the organization of these virtual events is the IOC's crucial decision to contribute to e-Sports mainstreaming.

Essentially, one of the aspects that interferes with e-Sports to have the same status as traditional sports is the monetization gap. According to GSIC (2019), the monetization gap will disappear in the future because nowadays, the e-Sports audience is growing and expanding globally, the new league's infrastructures are evolving, and the industry's revenues are increasing considerably. Thus, GSIC (2019) suggests that "monetization of e-Sports will finally start to close the monetization gap in relation to other established traditional sports leagues and become one of the top priorities in the future" (p. 35). Notably, one of the crucial reasons for growing e-Sports monetization is the rise of live-streaming that assists in reaching more people worldwide. Thus, streaming is a powerful driver of e-Sports that increases the sales and popularity of electronic games.

The increasing number of people watching games via streaming will impact the new streaming formats formulation. GSIC (2019) acknowledges that the new streaming formats will evolve from PC to console and mobile. In addition, the growing popularity of e-Sports forces the leagues' model to change. According to GSIC (2019), the most prominent models will be the franchise

and semi-closed systems of tournaments, competitions, and leagues in the next decade. These formats support the same competing teams every year "without relegation and promotion and centralize all the league's operations: advertising, sponsorship, streaming and merchandising" (GSIC, 2019). Consequently, these two models will lead e-Sports to a more well-constructed environment considering various stakeholders.

Today, many leagues and competitions already operate using a franchised model GSIC (2019) suggests that the Championship Series of the leagues, such as Overwatch and League of Legends, demand teams to pay a franchise fee for their participation. Nonetheless, it is essential to remember that the global success of e-Sports may result in cyberattacks targeted at different stakeholders. Thus, in the future, cybersecurity will become a top priority in the next ten years to enable protection to all the parties of the e-Sports industry (GSIC, 2019). The e-Sports field demonstrates crucial growth; nonetheless, the inclusion of e-Sports as an Olympic component will take a longer time because the legal framework, challenges, and security should be considered first.

To conclude, the e-Sports popularity is increasing, new games and competitions are introduced. Duge (2021) emphasizes that e-Sports has become a mass phenomenon; the amount of people who watch, play, and share games via Livestream is growing steadily. Essentially, e-Sports are becoming recognized widely as a sport because games require particular skills, both mental and physical. A massive breakthrough in the history of e-Sports was the International Olympic Committee's decision to include e-Sports into the program of Tokyo Games 2020. Nevertheless, the head of the IOC, Thomas Bach, informed that e-Sports were carefully chosen; for instance, Counter-Strike and Call of Duty were not selected because currently, these games controvert the values of the Olympic movement (Duge, 2021). Essentially, according to Duge (2021), Daniel Luther, a president of the e-Sport-Bund Deutschland, argued that in the future, there would be many various possibilities to develop e-Sports, focusing on strategic, shooting and sports games. The future Olympics may develop the agenda further by considering the involvement of e-Sports in the Olympic Movement.



Therefore, e-Sports will receive a status of a sport due to its considerable expansion and popularity. Mons (2020) predicts that e-Sports will be recognized by sports organizations worldwide and promoted during the Olympic Games; therefore, e-Sports industry will obtain the Olympic status by 2028. Mons (2020) suggest the two generations crucially affected the spread of e-Sports, such as generations Z and Alpha. These two generations will continuously promote the cybergames and in the future e-Sports will become one of the biggest sports. The crucial advantage and the explanation for the fast growth of e-Sports is that the games can be played by anyone around the world regardless of location, place, gender, or age. This sport is accessible, nonetheless, it requires certain skills, concentration, and strategy (Mons, 2020). The professional cyber athletes are already earning millions of prize money for competitions. Consequently, in the future, the revenue of e-Sports industry will exceed the revenues of traditional sports. In the future, VR and AR growth will enhance the e-Sports industry, resulting in changing humans' perception of sports. Essentially, this trend is attracting more participants, sponsors, fans and organizations due to the numerous opportunities. With the increment of the popularity and the number of fans will the idols of the new generations be cyber athletes?

### **Implications: The Convergence of Sports and Digital Cultures**

Notably, the connection between sports and digital technology is strengthening steadily. Miah (2017) argues in his book, namely *Sport 2.0: Transforming sports for a digital world*, that digitalization as a phenomenon does not threaten physical sports; instead, digital and sports cultures converge to provide mixed experiences and unify the best aspects of both physical sports and digital technologies. The author discusses that technological progress brings society closer to the sports industry enhancement, where "the primary medium of participation is not a physical playing field but a digitally mediated space" (Miah, 2017). Significantly, Miah (2017) connects the terms, such as games, sports, and play, and identifies how human perception of these practices' changes.

Consequently, digital and sports cultures have similarities and differences; nonetheless, the sports industry is evolving, and the convergence happening nowadays can be referred to as the term 'Sport 2.0,' which demonstrates the shift to a digital means of experiencing sports.

Essentially, the virtual worlds are incorporated into daily human routines and become inseparable from reality. For instance, nowadays, people have access to remote medicine, such as surgical procedures and online consultations. Digitalization has modified many industries worldwide, affecting the ways society exists and functions. Moreover, both real and digital worlds are affected by their convergence. Miah (2017) explains the importance of this convergence by stating that "digital experiences are becoming more physically enabled through wearable technologies, and sports are becoming more digitized through sharing, big data, and immersive spectator experiences" (p. 16). Thus, the advancement of digitalization and the evolution and application of innovative technologies in sports create entirely unique cultural experiences, consisting of new values, needs, and expectations, shaped by modern practitioners. Thus, the sports industry is affected dramatically; new trends depict the growth of new types of sports, for instance, digitally-based practices and the change of sports culture, its fundamental goals, and the environment as a whole.

Important to mention that digitalization will assist in the formulation of better sports initiatives. Miah (2017) emphasizes that technologies shift the sports industry towards a "more sustainable, digital world in which their only environmental burden will be hard-drive space and electricity use" (p. 17). As a result, sports of the new era will be organized considering the social well-being and environmental issues. Thus, the organization and management of sports will no longer be conducted in ecologically-unfriendly areas in the real world (Miah, 2017). Moreover, the evolution of e-Sports and the increasing number of e-Sports athletes, who compete in virtual worlds, will fasten the development of digital sports events, such as virtual football, golf, or basketball.

There is no doubt that today people spend much time on the Internet due to the convergence of virtual and non-virtual worlds. Miah (2017) argues that the so-called second wave conference is

not only a fusion of digital and real content, but to a greater extent, it is the co-production of content and a culture change. Hence, convergence affects the sports experiences, which are altered by the use of digital technology.

Thus, the second wave convergence includes technological and cultural convergences. Miah (2017) suggests that societies should "go through a cultural convergence, as much as a technological convergence, in order to realize the benefits of digital change" (p. 72). Moreover, the sports industry is a brilliant example that demonstrates how the convergences are taking place. For instance, Miah (2017) presents the convergence of athletes' and spectators' experiences, which is solely established on aspirations and desires of "media organizations and sports producers to bring spectators closer to the athlete's experience, to allow them a greater understanding of what it takes to make a great sporting performance possible" (p. 72). Miah (2017) adds an example of NFL's Atlanta Falcons stadium, which has in-seat vibration technology, known as 'impact seating.' Therefore, the stadium's design was developed to ensure the best possible experience for spectators by making them feel the collisions between athletes on the field while sitting on their seats.

Despite the advantages of using technology in sports, society still has resistance and rejection to the convergence of sports and digitalization. Many people do not perceive digital sports as part of the sports industry because they argue that e-Sports logically cannot occupy the same ontological space (Miah, 2017). Firstly, physical sport is the opposite of digital sports games since it does not involve physical strength and abilities, such as cyber games. Secondly, opponents of convergence emphasize that remote viewing of sports games and events via the Internet or television does not bring the same values, experiences, and pleasure as watching sports live.

Without being affected by the denial of convergence, digitalization continues to penetrate the world of sports, and digital viewing becomes more enhanced and engaging compared to the live viewing experience. For instance, 3D high-definition televisions are already developing in conjunction with virtual-reality technologies (Miah, 2017). Miah (2017) predicts that in the future,

the convergence between sports and digitalization will demonstrate the rise of "seamless simulation machines, which may digitize participation in sports so thoroughly that the difference between digital and physical participation becomes imperceptible" (p. 81). Thus, these digital technologies will enable a better experience in comparison to the live viewing of sports.

Significantly, the convergence of sports and digital cultures present fundamental implications in sport management. For instance, Miah (2017) argues that sports managers should reshape their perception of sports, accept the connection between physical spaces and digital cultures, and embrace innovative technologies. Moreover, sports managers, leaders, and participants should consider digital technologies as opportunities for "creative expression, or social engagement, rather than as detracting from it" (Miah, 2017). Miah (2017) notes that society is not ready yet for the open discussion about providing the equivalent status of e-Sports to traditional Olympic sports. Nonetheless, e-Sports and digital tools provide a vast number of possibilities for the Olympic Movement to reach more people and target new audiences. Therefore, sports managers should be aware of the effectiveness and various benefits digital technologies offer to the sports industry.

In addition, digitalization is connected firmly to elite athletes' performances. Miah (2017) acknowledges that digital technologies that professional sportspeople are using for training and extracting performance data are continuously growing. The author emphasizes that the last thirty years of technological revolution have created new and better ways for athletes; the sports industry utilized "timing technology, heart-rate monitors, exercise ergometers, and virtual-reality simulators" (Miah, 2017). Nowadays, new trends are rising in the sports field, such as the integration of social media and sports experiences. Significant changes can be found in the emerging e-Sports industry, where fans watch games not through live matches or TV shows but the cyber athlete's own Twitch or YouTube channel. Consequently, sports managers must realize that broadcasting is a phenomenon of the past. To stay on par with today's audiences, which mainly use social media and mobile applications to view and share information, they need to focus on new information transmission

channels. At the moment, fans are already actively sharing their feelings and impressions about athletes, games, and competitions on social networks such as Twitter and Facebook.

Hence, social media and mobile applications provide more opportunities for coverage of sports events and games, as well as facilitate communication between various sports about joint training, marathons, and competitions, and improve the interaction between fans. Nevertheless, many people do not accept the convergence of sports and digital environments because of the limited physical activity of cyber athletes and unhealthy lifestyles. Nonetheless, Miah (2017) argues that digitalization enhances active lifestyle because "physical activity is becoming increasingly mediated through digital technologies, notably through the gamification of exercise and physical activity" (p. 109). Digitalization influences the active introduction of technologies in both professional and amateur sports. New workout programs available on mobile applications motivate more and more people to exercise from home and maintain a healthy lifestyle. Innovative tools equipped with sensors and mobile apps help people regularly exercise, create personalized workouts and share the results with friends on various social networks. The fast development of exergaming, which refers to active gaming, combines games with physical activities. Moreover, exergames represent an example of how digital technologies support healthy behavior social norms and motivate people to exercise more often.

Therefore, the convergence of gaming, technologies, and sports move the societal focus towards more healthy lives in the technological world. For example, nowadays, people can utilize mobile phone applications in their sports routines "such as Run Keeper to track their physical activity, but also to share what they have done across social-media networks" (Miah, 2017). Therefore, individual sports activities turn into gamified, social experiences with the help of digitalization.

Significantly, another implication that sports managers should consider is that cyber athletes, namely professional game players, are becoming as popular as traditional sports athletes. Miah (2017) suggests that top cyber athletes earn considerable amounts of money in the e-Sports competitions and

cooperate with sponsors; for instance, the renowned cyber athlete with the nickname Fatal1ty, Jonathan Wendell, won more than \$450,000 in prize money between 1999 and 2006 (Miah, 2017). Notwithstanding, the move towards e-Sports is not affected only by the increasing number of gaming communities. According to Miah (2017), the e-Sports rise is influenced significantly by the digital gamification of traditional sports. Therefore, as the sports industry progresses, "more digital elements will be brought into the gaming experience for athletes, transforming them into mixed reality encounters" (Miah, 2017). Therefore, the sports industry will improve experiences for athletes and enthusiasts by combining gaming elements with sports.

To summarize, the convergence of digitalization and physical sports makes it possible to collect, process, and transmit information much more efficiently, as well as better organize training for highly qualified athletes and ordinary people who value a sports lifestyle. By combining advanced digital technologies and traditional sports, fitness games, platforms, and other mobile applications have been created. Nowadays, people can personalize their athletic training experience and tailor exercise based on their personal health metrics and desires. Thus, sports managers need to embrace, use, and promote digital technology in the sports industry. Thus, through the digital transformation of the industry, many companies and organizations are improving sports events and games through professional statistics, the use of online broadcast channels, sports analytics, and improving interactions between athletes and their fans. It is crucial to add that in the present day, the world's sports clubs and federations are focused on creating and using new tools and technologies to improve the interaction of fans with the game, athletes, and the sports environment in general.

With the help of new technologies, sports managers and coaches can receive essential data on the load and indicators of athletes, such as blood pressure and heart rate, control their weight, calorie intake, training schedule, and sleep patterns. In addition, digitalization has become an integral part of major competitions in recent years. Stadiums are digitally improved, and sports analytics are used to capture athletes' data for the proper running of sports. Consequently, digitalization makes hosting

competitions, tournaments, and games more accessible and engaging. Nonetheless, the most important implication is that technological development attracts new segments of the population to the sports industry. With the attraction of new segments and with the huge convergence of traditional and digital, will we have in the future a league in between traditional sports and E-sports?

Ideas Resume:

Hilvoorde, 2016	Digital technologies play a vital role in modern lives, engaging more and more people into cybersports.
Digiteum, 2021	Innovative technologies modifying the sports field include mobile applications, intelligent wearables, Artificial Intelligence analytics, web platforms for statistics and analysis, and various software for leagues, teams, and sports event management.
ASOIF, 2019	Many IFs expressed their considerations on building e-Sports platforms and developing virtual copies of their sports.
Mahendra, 2021	The IOC has made the first move towards accepting E-Sports as a part of the sporting industry.
Euronews, & AP, 2021	The Olympic Virtual Series was implemented using virtual and augmented reality.
Palar, 2021	The Olympic Virtual Series was conducted before the actual Olympic Games with the primary goal of integrating the physical and virtual sports communities and promoting the Olympic Movement.
GSIC, 2019	"monetization of e-Sports will finally start to close the monetization gap in relation to other established traditional sports leagues and become one of the top priorities in the future".
Duge, 2021	E-Sports has become a mass phenomenon.
Mons, 2020	Predicts that e-Sports will be recognized by sports organizations worldwide and promoted during the Olympic Games.
Miah, 2017	Technological progress brings society closer to the sports industry enhancement.

## 4. Biological Advances in Sport

### Gene Doping in Sports

The development of science has allowed humanity to modify crops and food genetically. It is essential to add that human genetic modification is possible due to the development of genetic engineering. Therefore, gene modification promotes the required genes that will lead to the rapid desired results. Genetic engineering is facing resistance from society and various organizations. The main question is whether it is ethical to genetically modify people, for example, athletes, and whether the sporting events in which these athletes will participate are fair. Notably, doping refers to substances or processes which can artificially improve athletes' performance, efficiency, physical and mental capacities. Intending to achieve higher results, some athletes start to use illegal substances.

Thus, doping is the fundamental problem in the world of sports. Cantelmo, Silva, Mendes-Junior and Dorta (2020) argue that the role of an elite athlete is considered as "an extremely coveted position, which can lead an individual to use doping" (p. 1093). With the technological transformation and knowledge extension, doping evolved into unique and complicated substances and methods. Cantelmo et al. (2020) state that the newest doping method is gene doping or, in other words, gene modification. The use of doping has a long history in sports; for instance, athletes have been using substances to enhance their performances in different parts of the ancient world.

Interestingly, that some doping strategies remained until modern days. Moreover, Cantelmo et al. (2020) inform that the examples of doping can be identified "among Greeks in the third century BC, athletes in the ancient Olympics, Egyptians, gladiators in the Roman period, and medieval knights, among others" (p. 1093). Essentially, in the last thirty years, gene therapy was created and developed in order to treat severe human diseases (Cantelmo et al., 2020). Consequently, with the technological development and extension of genes' knowledge and dynamics, new ways have been formulated which allow manipulating human genetic material.



Important to add that genetic manipulation refers to gene expression regulation. According to WADA (2021), which is a World Anti-Doping Agency, genetic manipulation occurs when genetic material is changed by using normal or genetically modified cells and their analogs. The sports industry has its rules and codes, including the list of prohibited substances and methods. Bird, Goebel, Burke and Greaves (2016) emphasize that the most famous code is the 'World Anti-Doping Code,' "which is implemented by the World Anti-Doping Agency (WADA) and WADA publishes a list of prohibited substances and prohibited methods" (p. 196). The doping substances that meet one of the following descriptions are prohibited in sports by WADA: "first, evidence that it has the potential to enhance sports performance; second, use of the substance or method represents a health risk; third, use of the substance or method violates the spirit of the sport" (p. 197). In addition, there are three whole doping groups, namely substances and methods prohibited at all times, substances and methods prohibited in competition, and substances prohibited in particular sports (WADA, 2021) (Bird et al., 2016). Sports organizations prohibit doping to provide fair conditions for every athlete.

Additionally, the term doping itself is connected to ergogenic drugs. Bird et al. (2016) argue that, in other words, doping characterizes the manipulations of the organism via substances to optimize both physical and mental performance. WADA, (2021) acknowledges that gene and cell doping that alters genome sequences, including gene editing, silencing, or transfer, to improve sports performance is strictly prohibited. Gene manipulation also refers to the particular proteins and enzymes production decreasing or increasing processes (Cantelmo et al., 2020). Notably, the genome includes the genetic data of living beings and determines each individual's specific characteristics and traits. Significantly, severe disorders or chronic illnesses appear "when the process of gene expression results in reduced levels or altered polypeptides" (Cantelmo et al, 2020). Ormond et al. (2017) state that gene editing can be done in germline and somatic cells. For instance, somatic genome editing cannot be transferred to an individual's offspring, while germline genome editing can be passed from

the modified individual to offspring (Ormond, et al., 2017). Gene modification is a huge breakthrough in science with its advantages, disadvantages, and risks.

First of all, according to theoretical implications, gene modifications can significantly improve athletes' performances and stimulate their organism to achieve extraordinary results in sports. Nonetheless, Lopez et al. (2020) claim that gene modifications are dangerous as they may impact health negatively and violate the meaning of competition. Despite that, the scientific progress has resulted in numerous gene therapy trials, which "are ongoing in clinical studies worldwide" (Lopez, et al., 2020). Therefore, there will be a revolutionized possibility of gene modification application in sports in the future.

Moreover, the best candidates for gene modifications have been discovered according to scientific research. Cantelmo et al. (2020) suggest the genes that boost performance "may include genes that encode erythropoietin (EPO), myostatin blockers, insulin-like growth factor (IGF-1), growth hormone (GH), vascular endothelial growth factor (VEGF), fibroblast growth factor (FGF), leptin, endorphins, enkephalins,  $\alpha$ actinin 3 (ACTN3), cytosolic phosphoenolpyruvate carboxykinase (PEPK-C), and peroxisome proliferator-activated receptor- $\delta$  (PPAR $\delta$ )" (p. 1098). Nonetheless, both scientific and sports communities and organizations did not reach a consensus regarding gene doping acceptance.

Important to note that there were no recorded attempts to use gene therapy. According to Cantelmo et al. (2020), gene modifications and the development of confirmatory tests are still in the early stages of progress. Nevertheless, the turning point in gene doping was the discovery of CRISPR (Cantelmo et al., 2020). CRISPR refers to gene editing, which is used as a gene therapy approach (Lopez, et al., 2020). This technique was developed for the healthcare industry to edit human somatic cells, especially in cancer immunotherapy (Fears & Meulen, 2017). Essentially, according to Cantelmo et al. (2020), CRISPR can be theoretically used for doping purposes in sports. Nevertheless, gene modifications may cause various health side effects.

The world of sports in the digital era of advanced technologies concentrates on achieving success by any means. There were many cases in the sports industry when athletes have used chemicals with stimulant and ergogenic properties to win and overcome the rivalry (Cantelmo et al., 2020). Therefore, doping became popular among athletes and resulted in sports organizations' increasing concerns. Cantelmo et al. (2020) mention that in order to avoid dishonestly and athletes' health hazards, the first fundamental organization that decided to ban athletes on the grounds of doping in 1928 was the International Association of Athletics Federations, briefly IAAF. Consequently, the first test policy was introduced by the International Olympic Committee in 1967 "to certify that athletes were competing correctly" and initiate "the banishment of some specific drugs" (Cantelm et al., 2020). Nevertheless, Cantelmo et al. (2020) suggest that the doping methods due to the expansion of technology are becoming more sophisticated, and thus, more challenging to detect. Gene therapy progresses rapidly, and it is already impacting and changing the sports industry.

### **Genetically Advanced Versus Modified Athletes: Discussion**

In the sports society, the question of the influence of genes on athletes and their functioning has always been raised. Epstein (2013) discussed the genetic baseline physiology on how genes influence players' talents, attitudes, and stamina in sports and why some individuals are more suited to specific sports than others. According to the author, certain athletes are biologically programmed to excel at particular sports. In basketball, hereditary traits such as height and arm span are significant advantages (Epstein, 2013). Consequently, hard effort and devotion are not enough to become a great athlete, like an NBA basketball player or an Olympic sprinter. As a result, genes and a particular body type suited to a specific sport are required to succeed.

The bone structure also significantly influences adaptation to various sports, for instance, running, sprinting, and swimming. For example, because of genetic differences between short and long-distance runners, some people are inherently better at either one (Epstein, 2013). The best

marathon or long-distance runners have muscular legs and a slender torso. Epstein (2013) emphasizes that the knowledge of body type and genetic factors will assist in identifying which sport is more suitable for a particular individual. Additionally, the desire to train, motivation, level of endurance, and injury vulnerability are results of genes that impact the person's performance in sports.

Moreover, the historical and geographical background affects athletes' skills and capabilities. Epstein (2013) acknowledges that Kenya and Ethiopia have the highest number of world-class long-distance runners. Because these regions have a warmer climate and are located closer to the equator, humans developed smaller bodies, which enable them to distribute heat more efficiently. This natural occurrence, namely local physiological adaptations, resulted in the fastest runners in the world.

Notably, many scholars examined the ethical issue of genetic modifications in sports. One of them is Andy Miah, who wrote a book named 'Genetically Modified Athletes,' arguing that being human is crucial in sports and genetic modification should not dispute this function (Miah, 2004). The author discussed the meanings of 'good sport' and cheating in sports, privacy rights and using genetic data, the terms doping and anti-doping, and the sports' dignity. Miah (2004) emphasized that genetic modification "seeks unfair advantage, fails to honor the contract to contest, encourages and permits secrecy and deception as to conditions of preparation and competition, applying possibly harmful or deleterious technologies, uses 'unnatural' means, and leads to the exploitation of athletes' (Miah, 2004). Therefore, the author suggests that many scientists consider genetic modifications highly unacceptable and invaluable. The genetic interruption is perceived as a threat to human nature and essence; nonetheless, it also demonstrates a growth potential in the future.

When the book was published, the success of gene modification technologies was limited. Nonetheless, (Miah, 2004) offers brilliant ideas and implications relevant to today. Miah (2004) emphasizes that international sporting organizations incorporated genetic technologies under the common term, namely doping. Consequently, the issue of doping is that it results in "unnecessary short-term and long-term harm to the athletes who use them (where necessary risk implies the risk

required to accept in order to undertake the sport)" (Miah, 2004). Therefore, doping could be dangerous for athletes, placing their health at risk.

One of the crucial concerns in sports is the propensity for legitimizing genetic technologies. Miah (2004) emphasizes that the result of legitimizing genetic technology is the genetic essentialism' evolution, which refers to the view that the differences in performances of distinctive athletes are exclusively based on genetic dissimilarities. Therefore, genetic essentialism is morally disturbing because it only characterizes athletes' evaluation by their genes. Miah (2004) states that even if there were benefits in using genetic screening as a foundation for selecting who would be the next generation of top athletes, investing in these technologies would be at the expense of other athletes' qualities that might be valuable in determining who is the next elite athlete. According to Miah (2004), genetic essentialism is questionable because it could "create a situation whereby promising athletes might be deterred from struggling simply because they are told that their genetic predisposition is not optimal" (Miah, 2004). Genes alone should not indicate the professionalism of an athlete in competitions.

The same concept of genetic essentialism applies as a dilemma for diverse modification solutions such as somatic, germline, and pharmacogenomics. If genes are mistakenly perceived as influencing one's ability to succeed in different spheres of life, then the use of such technology should be avoided (Miah, 2004). This challenge is especially concerning in a world where home genetic testing is already widely available and poorly regulated (Miah, 2004). Consequently, there may be further grounds to constrain and ban the genetic technology applications in sport if there are no adequate methods to attempt and evolve an interpretation of genetics as a critical component of recognizing what causes societal success.

From the standpoint of the anti-doping agency, the problem would be that genetically enhanced athletes would have the edge over non-genetically modified competitors. Miah (2004) informs that as a result, the first concern is whether sportspeople have the right to keep their genetic

information protected in sports. If sport is viewed as a contract between several parties, it may be concluded that the athlete waives such rights by participating freely (Miah, 2004). Notwithstanding, if such information is kept confidential, regulatory authorities will have no legal basis to respond against modified athletes in the tournament. The confidentiality of genetic material is controversial in sports since being unable to discern between genetically modified and non-modified opponents would lead to competitions between unethically matched opponents, where unfairness is a crucial feature of the event.

Many athletes, without a doubt, may recognize their genetic heritage as an essential part of what brings sport meaning. As a result, the competition's goal would be to demonstrate who is the most genetically talented among athletes. Nonetheless, this viewpoint appears to favor genetically advantaged individuals (Miah, 2004). Furthermore, it does not appear to make sense to claim that genetic variation is a valuable component of competitiveness. Indeed, many sports organizations perceive genetic diversity as an irrelevant discrepancy in competition and aim to reduce this gap between participants by dividing them into distinct categories (Miah, 2004). For instance, there are many contact sports in which weight is classified as an insignificant imbalance in competitions.

Essentially, the logical considerations for assuming that anti-doping must become a cultural tradition in the perspective of gene editing reflect the anticipated difficulties that anti-doping authorities would experience in identifying gene modifications. Miah (2004) suggests that although much of the dispute is hypothetical, there is reason to suppose that many types of genetic changes will not be identifiable by testing because the appropriate technology is yet not available, and the procedure would be far too intrusive for being medically approved. Cantelmo et al. (2020) inform that due to the lack of any effective detection method for gene doping, uncontrolled usage is possible in the future, making training and preventive programs against this sort of doping vital. To be authorized, a detection technology must meet rigorous WADA standards, go through numerous validation phases and be a consistent and credible procedure. Suppose such detection testing is

deemed useless nowadays. In that case, there will be even more need to pursue more suitable strategies of maintaining sports ethics, fairness, and security for sports participants in the future.

Nonetheless, there is a high potential for the future rise of genetic modifications in sports. According to Miah (2004), being genetically changed, in general, is compatible with being human; hence, it is irrational to argue that genetic alteration should not be a beneficial feature of sports performance. Trying to gain an edge over rivals, on the other hand, does not provide a valid basis for seeking to deploy such technology. Conversely, genetically modified athletes would have to prove that being modified is part of their humanity; thus, athletes should be treated with dignity and respect.

Meanwhile, the debate about genetic alteration in sports continues to rage. One possible answer to this ethical quandary is to invent new, genetically modified tournaments while continuing to accept volunteer anti-doping testing protocols (Miah, 2004). This solution may alleviate worries about fair play; however, the implications for competitive sports would indeed be tremendous. If genetically altered athletes compete at a level much above the ability of non-enhanced rivals, public interest in the latter may dwindle considerably (Miah, 2004). Admittedly, it will be genetically engineered athletes who will be breaking through human limits and exceeding established physical limitations, making the sports more entertaining in the future.

Although it is doubtful that genetic technologies will be used to design athletes with particular skills, qualifications, and qualities in the foreseeable future, the application of genetic techniques to improve athletic performance and effectiveness, such as boosting muscular strength or erythrocytes, namely red blood cells, could occur rather eventually (Finn & Jones, 2009). Nevertheless, Finn and Jones (2009) argue that athletes are more prone than the typical person to experiment with genetic modification because of their willingness to embrace risks in order to achieve better performance. As a result, it appears that representatives of the sporting world must confront the potential concerns of gene modification soon as possible.

Another ethical question concerns the importance of gene doping for erasing the line between gender-based divisions. In their book review, Finn and Jones (2009) discuss the implication of *Genetic Technology and Sport: Ethical Questions* written by Claudio Tamburrini and Torbjorn Tannsjo. Finn and Jones (2009) emphasize that the authors argue that genetic technologies have the potential to eliminate gender bias in sports. Sexual prejudice manifests itself in dividing sports into male and female sections. Furthermore, given the normative character of sports, they argue that gender distinctions are unimportant, and that males and females should battle against one another and that the best candidate will prevail (Finn & Jones, 2009). Nonetheless, there are valid reasons for female and male division in the sporting industry.

There are numerous justifications for maintaining sex distinctions in sports as they are. According to Finn and Jones (2009), permitting males and females to start competing with each other at the professional level may discourage women from participating in sports because, in general, women lack physical activity power in some traditional sports in contrast to males. According to (Finn & Jones, 2009), Tamburrini and Tannsjo propose that genetic technologies can assist females in keeping pace with men by neutralizing the inherent benefits that males were shown to have in terms of athletic performance. Nonetheless, the topic of genetic modification remains open as in the future; there is a possibility of creating super-athletes among both men and women, so should the division in the sport industry remain by gender, age, etc. or should we create new divisions?

Ideas Resume:

Cantelmo, et al., 2020	The newest doping method is gene doping or, in other words, gene modification. The doping methods due to the expansion of technology are becoming more sophisticated, and thus, more challenging to detect.
WADA, 2021	Gene and cell doping that alters genome sequences, including gene editing, silencing, or transfer, to improve sports performance is strictly prohibited.



Bird, et al., 2016	Doping characterizes the manipulations of the organism via substances to optimize both physical and mental performance.
Ormond, et al., 2017	Gene editing can be done in germline and somatic cells.
Lopez, et al., 2020	Gene modifications are dangerous as they may impact health negatively and violate the meaning of competition.
Fears and Meulen, 2017	CRISPR is a that technique was developed for the healthcare industry to edit human somatic cells, especially in cancer immunotherapy.
Epstein, 2013	Discussed the genetic baseline physiology on how genes influence players' talents, attitudes, and stamina in sports and why some individuals are more suited to specific sports than others.
Miah, 2004	Being human is crucial in sports and genetic modification should not dispute this function.
Finn and Jones, 2009	Athletes are more prone than the typical person to experiment with genetic modification because of their willingness to embrace risks in order to achieve better performance.

## 5. New Directions in Sports Marketing

### Over Top Content

In addition, the digital transition phase requires new marketing tools to promote sports. Thieringer (2021) suggests a few of the most potent trends for sports promotion with examples. Consequently, the first trend in sports marketing is Over Top Content, briefly OTT. The brilliant examples of companies that offer OTT are Amazon Prime, Netflix, and Facebook (Thieringer, 2021). Essentially, OTT refers to the possibility to receive the content independently. Traditionally, it was possible to watch professional sports on TV; nonetheless, nowadays, fans can watch live sports anywhere and on any device. In addition, traditional media companies face intense competition from digital platforms, which can create users' profiles and target the audience they need in more effective ways.

### **Artificial Intelligence**

The following marketing trend is the advertising of sports via artificial intelligence. Thieringer (2021) suggests that the excellent type of artificial intelligence for sports promotion is chatbots. For instance, FC Arsenal has introduced Robot Pires, a chatbot communicating with fans on various platforms, such as Skype, Telegram, Slack, and Facebook Messenger (Thieringer, 2021). Significantly, the chatbot was named after Robert Pires, a legendary former Arsenal football player. The goal of this chatbot is to provide valuable data about games, results, statistics, and even share videos in entertaining and humorous ways (Thieringer, 2021). Therefore, the use of chatbots in sports marketing has numerous benefits. First of all, chatbots will collect, analyze, and evaluate the data based on users' requests. Secondly, organizations can reach new target audiences and enhance fan loyalty by offering intelligent chatbots that are able to provide unique and exciting content. Thus, sports companies will invest more in AI development and application in the future.

### **Virtual, Augmented and Mixed Reality**

Virtual, Augmented, and Mixed Reality, briefly VR, AR, and MR offer unique possibilities for sports marketing. Thieringer (2021) emphasizes that just a few companies invested in these technologies in the past because of their expensiveness. Nowadays, the application of VR, AR, and MR is growing dramatically because of the vital benefits these technologies can offer to different industries and segments. According to Thieringer (2021), many online shops experience a high cost per acquisition because the free delivery practices have displeased customers' behaviors. Nowadays, the massive problem of online shops is that customers order the same product in different sizes and colors and purchase only one option after trying it at home. Thus, the AR, VR, and MR technologies will assist in testing the products virtually, for example, sports shoes or clothes. The VR glasses will enable customers to enhance their experience and save time by choosing the most suitable product.

Notably, the development of Virtual Reality and Augmented Reality brought various benefits to the field of sports. Ahir, Govani, Gajera and Shah (2019) suggest that VR innovations facilitate significant sports tasks, such as "building different preparing conditions, making virtual adversaries, gathering physiology and biometric record and assessment of preparing impact" (p. 6). Competition conditions have become a vital element of achievement regarding the fast progress of focused games. Hence, coaches and trainers aim to prepare these conditions before the actual competition in order to improve athletes' performances and chances to win (Ahir et al., 2019). VR and AR are brilliantly solving these challenges by imitating games' conditions and providing the opportunity for athletes to practice beforehand. Ahir et al. (2019) add that VR and AR preparing strategies "frames intuitiveness of sportsman and virtual conditions by supplanting the customary preparing way, which requires strategies, stamina and methods" (p. 6). The crucial possibility of VR and AR is to display a 3D reality, which may be imaginary, microscopic, or macroscopic (Ahir et al., 2019). Therefore, these technologies visualize and recreate the game atmosphere in the 3D virtual world to simulate the real world dynamically.

The future of computer-created reality innovations in sports is impressive. Based on Ahir, et al. (2019), virtual reality innovations will modify people's perception, thinking, and time management. Additionally, the sports industry has started to apply Augmented Reality to achieve extraordinary results. Ahir et al. (2019) emphasize that the expansion of these technologies is happening now at the highest speed. Hence, VR and AR will be used almost in every sport in the future. There will be opportunities to visit virtual places, both imaginary and real, for instance, stadiums and arenas that are planned to be constructed. Athletes will train and practice game strategies without leaving their homes. Thus, the technologies will bring a radical change to the sporting world. The development of Virtual Reality is in the early stages of its potential in sports. Shortly, there will be opportunities for the emergence of new sports entirely based on VR and similar technologies, such as Mixed and Augmented Reality.

### **Wearables Market**

Moreover, a significant trend that will change the sports industry is the evolution of the wearables market. Thieringer (2021) notes that the wearables market will become one of the most crucial sports sectors. Consequently, the trend will increase dramatically in the future, and more athletes and sports enthusiasts will purchase wearables to improve their health and sports performances. Furthermore, the sports organization should consider the fast growth of e-Sports. Thieringer (2021) acknowledges that video games are becoming more widespread globally; more and more gamers have entered the e-Sports industry. Essentially, scholars forecast that the number of cybersports enthusiasts will reach more than five hundred million in 2024 (Thieringer, 2021). Thus, e-Sports demonstrate enormous potential for sports managers and marketers.

### **Sustainability**

The crucial future direction in the sports industry is focusing on sustainability. Based on research, eighty percent of products are purchased for emotional reasons without thinking about their impact on the environment (Thieringer, 2021). In modern times, people pay more attention to environmental issues and sustainability. Sports and sustainability are closely connected; thus, organizations and companies must ensure that their products and services are sustainable and harmless to the environment and social well-being. The sustainability trend includes various sports movements, such as collecting rubbish when jogging (Thieringer, 2021). In addition, more sports brands have started to manufacture their products from recyclable and eco-friendly materials.

Sustainability will have a prominent role in promoting environmental protection among sports enthusiasts. Mons (2020) states that the driving forces supporting the sustainability movement include consumers, influences, and organizations. Therefore, the crucial targets are to have a neutral footprint and care about the environment. Hence, the stadiums of the future will be entirely carbon-neutral, the waste policies will be strict about encouraging every participant to recycle their waste. In addition,

with the help of advanced technologies, stadiums will produce their water and energy usage. The technologically-advanced ways of transportation, such as electric, self-driven, and self-parking vehicles, will solve the parking problem and decrease parking spots (Mons, 2020). Nowadays, transportation contributes significantly to CO2 emissions; total CO2 emissions from the air, road, and other modes of transportation account for around seventy-five percent of total CO2 (Soranata, Landis, Jing, & Suto, 2021). Air and noise pollution and noise from traffic negatively influence human health. Thus, the use of bicycles, trains, and trams instead of cars will be encouraged to decrease the negative environmental impact. However will this sustainability real or is just an illusion that the industry is using as a marketing strategy?

### **Dark Social**

The next trend is called Dark Social and refers to website traffic. Thieringer (2021) explains that Dark Social is the website traffic that is difficult to analyze for organizations. He adds that more than eighty percent of global traffic is Dark Social; it is created by users who share links through Instagram, WhatsApp, and email. Therefore, it is complicated to analyze such traffic, even by special analysis tools (Thieringer, 2021). Nonetheless, according to Thieringer (2021), Adidas realized the potential of Dark Social and created a specific campaign, namely Adidas Tango Squads. The company selected influences and offered them gifts and events' invitations. Essentially, the distribution of this information happened via messenger platforms.

### **Women In Sports**

Important to add that more women will be involved in sports in the future. Thieringer (2021) states that men have always dominated the sports industry; however, the direction is shifting towards the rise in women's engagement and participation. For example, the ISPO organization understood the importance of this trend and developed a high-quality program for motivated and active women,

namely 'Connecting Women' (Thieringer, 2021). The North Face brand, specializing in sporting clothes and equipment, initiated a specifically targeted women campaign called 'She Moves Mountains' to address the female audience and attract more women (Thieringer, 2021). In the future, the number of women in sports will grow significantly. Therefore, sports organizations and brands should consider women as their strong potential customers and increasing target audience.

Notably, women will conquer the sports industry; there will be a significant increase in women's sports. Mons (2020) suggests that gender will not play a significant role for sports enthusiasts in the future. The sports industry will turn gender-neutral, and equality between men and women will be emphasized dramatically. Moreover, female athletes will gain massive popularity and become role models for younger fans and sports enthusiasts. Therefore, women will become active and crucial participants in the sports industry.

### **Children and Seniors in Sports**

Essentially, except for an increasing number of women, the future trends include the growth of children and seniors involved in sports. Nowadays, e-Sports is thriving and increasing the involvement of children in the gaming industry. Therefore, more and more children face health problems such as obesity due to a sedentary lifestyle. Target groups involving children and adolescents, together with digitalization, provide new opportunities for companies in the sports industry (Thieringer, 2021). For example, exergames have been created that contribute to maintaining an active lifestyle by combining fitness and games. In addition, digitization helps companies reach children through online advertising of their products, sports, and services. Hence, Thieringer (2021) suggests that parents should introduce children to sports as early as possible. One of the brightest examples is the 'The Daily Mile' campaign introduced in the UK to encourage children to jog for fifteen minutes per day on their walk to school (Thieringer, 2021). Thus, organizations start various sports campaigns to encourage children's involvement in sports. As was mentioned earlier,

the trend demonstrates that seniors also play a vital role in the sports industry nowadays and in the future.

In the sports world, there was a cliché that only young and active people can participate in sports thanks to the advertising companies that have created this stereotypical image. Nevertheless, at present, sports companies and advertising organizations are restructuring the perception of sports in society as more and more older adults become participants in sports competitions and activities. Consequently, the demand for sporting goods for the elderly gradually increases from year to year. It is essential to mention that this target group is the most financially stable and demanding (Thieringer, 2021). According to Thieringer (2021), Canada conducted a brilliant campaign for seniors to encourage an active lifestyle, namely 'Make Health Last.' The campaign includes a range of illustrations demonstrating seniors who are actively doing sports in contrast to seniors who are not involved in sports. The vital question of the campaign is 'What will your last ten years look like?' (Thieringer, 2021). Therefore, the sports industry will promote this trend further by targeting seniors and offering more products and services for this specific target group in the future.

To summarize, the most crucial future trends include individualization, sustainability, and digitalization in the sports industry. The world is experiencing major changes due to technological progress, and digitalization immensely advances the process of radical transformation (Thieringer, 2021). Organizations should constantly observe and investigate the latest trends to be able to sustain a competitive advantage, target new audiences, co-create value with customers, and achieve success in the sporting industry. Thus, the aforementioned trends are predicted to bring more business opportunities and expand the sports industry considerably. Did sport lose identity just to follow the trends and attract more people?

### **Options for Sports Managers in the Phase of Digital Transition**

The digital transition offers various options and opportunities to sports managers. First of all, the fast development of digital media enhances the sports industry by providing new channels of broadcasting of sports and media events and innovative ways of training and athletes' performances realization via mobile applications (Dugalić, 2018). Thus, sports managers should realize that technologies nowadays help improve not only athletes' performances but also enhance viewers' experiences by providing a better contemporary image and sound broadcasting systems (Dugalić, 2018). In addition, digitalization assists in monitoring safely in sports venues, for instance, stadiums, by video surveillance. Dugalić (2018) emphasizes that digital cameras play a vital role in sports because they capture and display the game from various angles. Thus, the sports managers and trainers can identify athletes' mistakes and improve sports performances through corrections and personalization offered by digital sports-media records. Moreover, advanced microphones are crucial in sports because they record high-quality digital sounds to enhance the fans' viewing experience. In addition, drones can be used to capture the game in panoramic overview and demonstrate the complete picture of the sports game.

Important to note that digital channels of communication are steadily replacing traditional broadcasting systems. Dugalić (2018) suggests that real-time communication is growing significantly, and sports managers should consider the potential of digital broadcasting systems and social media engagement in the sports industry. Moreover, digital channels have a greater chance to attract more audiences, including fans, sponsors, and athletes. According to Dugalić (2018), the sports industry required more opportunities for "global communication among participants (measured in billions when it comes to major sports events: the Olympics and World Championships) than other areas: fashion, culture, entertainment/media, which then leads to the need to establish viral services" (p. 66). Therefore, the sports-digital media system provides global communication among participants. Nowadays, communication requires more advanced technologies of information sharing



and transfer; thus, sports managers should investigate and identify the best digital channels to synchronize sports activities and enable to improve communication. Knowledge of new digital technologies is critical for sports managers' survival nowadays. Therefore, sports analytics, digital broadcasting, sports applications, and personalized training tools, as well as digital marketing are essential to managing the sports industry in the modern days.

The essential goal of sports managers is to develop and implement high-quality services and emphasize the importance of sporting events and processes management efficiency. Nowadays, teams invest more in digital technologies to precisely analyze and evaluate athletes' and users' behaviors and needs by utilizing the latest technologies, such as Artificial Intelligence, Machine Learning, and sports analytics (Softtek, 2021). Significantly, Softtek (2021) highlights that the value of the sports technology market in 2020 was equal to approximately 11.7 billion dollars. Sports managers should consider the foundations of digital transformation in the sports industry. The digital transformation consists of four crucial pillars, such as fan involvement, operational excellence, stadium optimization, and team performance (Softtek, 2021). The knowledge of these foundations will assist in efficient and optimal managing of athletes, stadiums, and fans' engagement.

Consequently, the first pillar of digital transformation is fan engagement. Hence, fan engagement refers to the management strategies focused on the fans' and sponsors' interactions and relationships developed by sports associations (Softtek, 2021). It is essential to add that digital technologies are vital for management because they help sports adapt to demographic and social fluctuations. Additionally, the sports industry is shifting towards a combination of physical and virtual realities. Therefore, sports managers should consider technologies as innovative ways to provide a better experience for fans and adjust to various changes happening in the industry.

Secondly, operational excellence is vital to consider in the phase of the digital transition. Sports managers often face issues regarding event and crowd management, as well as security for events' participants. For instance, sports venues and stadiums are usually heavily crowded; thus,

technologies provide unique possibilities and tools for organizers of sports events to solve the crucial challenges. Technological systems and devices can be used "tracking, broadcasting, network systems, digital signage, building management or location-based services" with the common goal to ensure safety and create a better environment for large sports venues (Softtek, 2021). Thus, the security operators and sports managers will enhance the experiences offered by a particular sports event.

The third central pillar of digital transformation is stadium optimization. Stadium optimization is similar to the second pillar, namely operational excellence, because they both focus on efficiency, security, and intelligent technologies. Nonetheless, stadium optimization considers customer loyalty through adding technological advancements to stadiums (Softtek, 2021). Thus, the fundamental goal of a smart stadium is to provide the maximum level of efficiency and sustainability of facilities and enhance the operations when staging events.

Continuously, the final pillar of the digital transition phase is based on team performance. Sports managers, among other sports stakeholders, such as coaches, athletes, sponsors, and promoters, should understand that digitalization provides technologies that allow improving decision-making processes according to statistics and real-time data (Softtek, 2021). Therefore, the sports industry can decrease failures, mistakes, injuries, and recovery times by utilizing the latest technological software and gadgets. Thus, the athletes' health and performance indicators can be monitored, recorded, analyzed, and controlled.

Significantly, the technologies which are used in these four fundamental areas are increasing considerably. Based on Softtek (2021), the use of digital tools will be seventy percent higher in 2027 compared to now. The benefits of digital technology are immeasurable when considering its versatility and personalization capabilities. The use of artificial intelligence has become a crucial breakthrough in the industry because it helps to meet the needs of all sports participants better, improve the efficiency of equipment and sports facilities, and change the training of athletes for maximum results. Nevertheless, the implementation of digital transformation still presents a range of

challenges for sports managers, such as budgeting and searching for investments (Softtek, 2021). Additionally, Softtek (2021) offers a quote of Rafael Conde, a director of Digital & Innovation at Vector ITC:

“Professional league teams around the world have begun to allocate a portion of their budgets to invest in technology tools that help them improve not only the sporting performance of their players but also their financial statements, customer services, and facility management systems. Good connectivity of sports facilities, an omnichannel experience in the stadium itself, and a smart way to move around the stadium will be key criteria for fans to consider in their decision to go to one game or another” (Softtek, 2021).

Therefore, sports managers should continuously allocate their budget for technologies and search for new sponsors, brands, and companies that are ready to invest in sports industry development. When sports managers discuss digital transformation, they focus primarily on paperless processes. Nonetheless, Franco (2021) states that the benefits are more comprehensive and include better availability, accessibility, reliability, and easiness of management processes. Thus, digital transformation assists in organizing a centralized database to enable a high level of security and connectivity between data protected by encrypted passwords and user credentials (Franco, 2021). Essentially, digitalization helps protect the confidential data related to management processes and provides access only to authorized personnel. In addition, the system is reliable because it is qualified by daily backup processes, which certify the reliability and protection of data.

Additionally, sports management benefits include digital solutions that embrace the team's creativity and organizational digital maturity. Therefore, Franco (2021) adds that digital transformation affects not only processes in sports organizations but also workflow and corporate culture in general. Digitalization provides brilliant opportunities to sports management such as e-learning, digital certifications, and advanced tournaments management processes. Franco (2021) argues that the most crucial barriers on the way to digital transformation are cultural and behavioral

issues. For instance, sports managers should reshape their mindset to be ready for the adaptation of new technologies and changes in the daily workflow. Thus, it is vital to develop a workforce digital transition plan as a part of organization development to educate each company member about the new technologies and their significance in the sports industry.

Moreover, it is complicated for some members to change their familiar way of working; thus, organizations need to provide training, sessions, and seminars to emphasize why they need to change the traditional workflow to optimize results. Essentially, the phase of digital transition may take time because it is a continuous process of learning and adopting new technologies. Sports managers should focus on maintaining corporate motivation and spirit among all organization members to achieve success and sustain a competitive advantage. Technologies are evolving rapidly, and sports organizations should learn and adjust their traditional processes accordingly to survive in the sports industry.

#### Ideas Resume:

Thieringer, 2021	Suggests a few of the most potent trends for sports promotion.
Ahir, et al., 2019	VR innovations facilitate significant sports tasks, such as "building different preparing conditions, making virtual adversaries, gathering physiology and biometric record and assessment of preparing impact".
Mons, 2020	The technologically-advanced ways of transportation will solve the parking problem and decrease parking spots; gender will not play a significant role for sports enthusiasts in the future.
Soranata, et al., 2021	total CO2 emissions from the air, road, and other modes of transportation account for around seventy-five percent of total CO2.
Dugalić, 2018	The fast development of digital media enhances the sports industry by providing new channels of broadcasting of sports and media events and innovative ways of training and athletes' performances realization via mobile applications.
Softtek, 2021	The digital transformation consists of four crucial pillars, such as fan involvement,

	operational excellence, stadium optimization, and team performance.
Franco, 2021	The benefits are more comprehensive and include better availability, accessibility, reliability, and easiness of management processes.

## 6. Future View

The sports industry evolves with the highest speed; thus, it is only possible to predict what kind of future technological sports will have. Jacobs (2015) argues that the whole sports industry will be affected by globalizing culture, changing trends, habits, demographics, and needs in the next twenty years. The technologies of Industry 4.0, such as virtual and augmented reality, will enable fans to stand virtually next to their favorite sports player and experience the game with the most outstanding level of engagement. Furthermore, fans will be able to make decisions via demonstrating their opinions and collective voice on social media in the role of sports executives. Traditional broadcasting will disappear replaced by non-broadcast media, such as Netflix, Facebook, Yahoo!, and Google (Jacobs, 2015). Consequently, the new ways of broadcasting will offer highly customized ways to watch live sports. Nowadays, teenage video games can receive college athletic scholarships and compete in e-Sports tournaments and competitions (Jacobs, 2015). Moreover, Jacobs (2015) states that Chinese scientists applied an innovative technique created in the U.S. and modified the DNA of eighty-six human embryos, aiming to create genetically modified athletes with unlimited skills and capabilities. Thus, the evolution of new technologies will change stadiums, broadcasting, athletes, ticketing, among others, which will be discussed further.

### Stadiums

Notably, the stadiums of the future will still remain an essential part of human culture. According to Jacobs (2015), the stadiums will continue to develop, grow, and astonish with realistic mega displays. In addition, smart ticketing technology will be introduced in order to utilize sports

fans' social activities and boost live events by establishing a connection before and during the game between friends on social media. Jacobs (2015) emphasizes that self-driving vehicles will replace human drivers; thus, the live sporting events' issue, namely parking, will be solved. The author expresses that digitalization does not endanger stadiums because people will still be eager for human interaction in the future. Thus, the stadiums will be enhanced by new technologies to provide the best possible experience to sports fans.

The sports venues will outperform other entertainment formats, for example, in-home watching, by embracing the newest technology innovations in the near future. GSIC (2019) suggests that the three most dominant innovative solutions utilized by smart venues will be "the use of big data to gain a deep understanding of consumers, the appearance of digital platforms that allow the creation of automated personalized content, and the optimization of connectivity in-stadium" (p. 18). The digital platforms will play a critical role in the fan experience optimization both outside and inside the sports venues. GSIC (2019) adds that the sports entities will track visitors' behaviors, evaluate their preferences, and offer higher-value services accordingly through extensive data analysis and other digital competencies. Therefore, new technologies will enhance sports venues' accessibility, enjoyment, and comfort.

The critical question is about how stadiums will look and operate in 10 - 25 years. Jacobs (2015) predicts that stadiums of the future will be "more modular, less expensive to build, and more multipurpose" (p. 9). Unique construction materials, such as exceptionally lightweight carbon fiber, will be utilized to enable buildings' transformations. The usage of self-driving and self-parking vehicles will improve stadiums' footprint. There will be a better stadium space organization, which will allow stadiums' buildings close to city centers resulting in the engagement of more people. In addition, the innovative technologies will provide a front-row experience to anyone regardless of the seat.

## **Broadcasting**

Traditional broadcasting will change in the future, and the term itself will become old-fashioned. Jacobs (2015) suggests that Google, Facebook, among others, will start broadcasting games for free. In 10-25 years, the term 'broadcast' will completely disappear because people will access sports matches and other content via various digital spaces, which provide personalization of experience based on viewers' preferences (Jacobs, 2015). Consequently, this viewing experience will be solved or shared between the groups of fans because each experience will be exceptionally unique. Jacobs (2015) mentions that virtual and augmented reality headsets will enable watching the games from desired perspectives and angles. Therefore, people will be able to share comments and ideas in real-time, change the game rules if they are not satisfied with the outcomes, and watch the game based on conditions modified and reset.

## **Athletes**

The digital revolution will not only affect stadiums and broadcasting; it will genetically modify athletes. Based on Jacobs (2015), in 5-10 years, athletes start using genetic amplification in order to prevent injuries and ensure safety. Thus, the genetic enhancers are allowed to use in a specific amount up to a certain level. Jacobs (2015) mentions that in 10-25 years, genetic modifications will become standard for athletes; the sports competitions between naturally-born and genetically modified humans will gain popularity among society and become an integral part of sports culture. Thus, various sports will include leagues of naturally-born and enhanced athletes created in the laboratories. It is possible that in the future, athletes will be able to modify their bodies with gene modifications, innovative life-management systems, increase muscle mass, or develop rapid speed and pain tolerance.

### **The Third Venue**

The third venue refers to a place where people can watch sports. Essentially, the third venue in the future will demonstrate life-sized virtual replays close to reality. Jacobs (2015) suggest that the watching experience will be enhanced significantly through "augmented reality, interactive tabletop technology, holographic replays, and 3-D displays" (p. 18). In addition, family-friendly third venues will replace sports bars in the future. Cryptocurrencies' growth will provide real-time sports betting for fans without requiring licensing issues (Jacobs, 2015). Thus, cryptocurrencies will enable an interactive and unique experience for sports fans. Therefore, emerging technologies of Industry 4.0 will reshape the third venues through smart glasses, virtual and augmented reality, flexible screens. The virtual experience provided will remind an absolute and ideal illusion by combining real and virtual worlds.

Currently, people are inventing and utilizing technologies in order to improve visual and aural perceptions. The third venue of the future will include "motion, smell, wind, and other sensations to watching a video" (Jacobs, 2015). Jacobs (2015) suggests that the third value will offer experiences close to the stadium atmosphere; nonetheless, these experiences will be more comfortable, creative through the integration of live and digital perspectives and personalization. Consequently, the e-Sports growth will facilitate the third value enhancement.

### **Sponsorship and Advertising**

Rapidly developing technologies and sports content will impact sponsorship and advertising. Jacobs (2015) offers two scenarios on how sponsorship and advertising will change in the future. According to the first scenario, brands will start owning new leagues, sports, and competitions and progress far away from sponsorship and advertising. The approach of brand-backed sports will become the new philosophy; thus, sports will express brands. Based on the second scenario, sports sponsorship will disappear because brands will concentrate their marketing finances on digital and



highly-personalized ad campaigns and strategies. Thus, there will be a different advertisement for each target person, and brands will receive an immediately provable return on investment.

Consequently, companies will focus on creating perfect advertising and content with a focus on high personalization in the future. Jacobs (2015) highlights that the "era of the 'official' and exclusive' sponsor ends" (p. 24). It is essential to add that developing countries will sponsor corporations to stand out in their region and create an image of a modern and attractive country for tourists. The countries will also aim at joining intercontinental trade zones in order to enhance tourism, attract foreign investments, and decrease interest rates. Jacobs (2015) argues that sports sponsorship will become an essential tool for nation-building. In 10-25 years, broadcasters, advertising agencies, sports leagues, and journalists, among other intermediaries between fans and athletes, begin to disappear (Jacobs, 2015). Thus, technology will enable athletes to have their own pool of sponsors on their smartphones.

### **Teams and Leagues**

Notably, some rules for teams and leagues will be standardized in the future. For example, Jacobs (2015) states that "Japanese baseball adopts the larger MLB ball, while European basketball adopts NBA rules" (p. 28). Thus, the teams and leagues will experience the fundamental global shift in professional sports, which will enable the possibilities of international players' movement. Jacobs (2015) presents that NFL will make a radical change and promote a growing number of "rugby stars to make the transition to American football" (p. 29). Therefore, many sports players will move not only from one country to another but from one sports team to another. In 10-25 years, the amount of global and intercontinental leagues will grow dramatically. The teams will include players from various countries; nonetheless, the nations will compete against each other, supported by fans' excitement (Jacobs, 2015). Moreover, there will be the rise of extensive alliances, which are

formulated to decrease business risks and monitor player movement to the super teams. Consequently, the global cities will present professional teams in each practical sport.

### **E-Sports and Fantasy Sports**

The e-Sports market offers brilliant opportunities for companies and clubs to attract more audiences and earn profit through sponsorship, new products introduction, and merchandising. Based on (ISPO, n.d.), the global turnover of the e-Sports industry is predicted to reach more than one and a half-billion dollars in 2024. Hence, Bergmann (2021) highlights a few critical elements of e-Sports magnetism for sponsors. First of all, e-Sports engage an attractive target group, namely digital-savvy and young people who are used to digital payments. Secondly, the industry evolves quickly by engaging the newest technologies available, such as virtual and augmented reality and blockchain, among others.

Essentially, the e-Sports market grows and interacts continuously with various entertainment segments, for example, Netflix and Spotify, covering a bigger audience. The new famous cyber athletes appear among the young generation, and companies can benefit from cooperation and partnership with major cyber stars and influencers. Consequently, the e-Sports industry offers better success control through digital tracking opportunities and abilities to measure activities (Bergmann, 2021). Moreover, e-Sports games can include various advertisements through showing and recommended brands directly in the games or during live streams. Bergmann (2021) emphasizes that the e-Sports championships, such as the League of Legends World Championship, are modifying the traditional sports industry. Hence, the new and more attractive sponsorship models appear on the sports market.

Additionally, many companies and organizations realize that they should sponsor e-Sports. Bergmann (2021) argues that when the e-Sports industry was in its initial development stage, only hardware manufacturers invested heavily in the games. Nevertheless, sponsors and partners are from

entirely different and diverse industries nowadays. Bergmann (2021) acknowledges that the League of Legends World Cup sponsor list consisted of "Mercedes-Benz, Red Bull, Master-Card, Axe, Bose, Cisco, and Spotify, among others" (para. 6). Notably, the banners with these brands' logos were displayed during the championship.

Hence, the significance of the e-Sports market will continue to expand rapidly. The advantages and unique opportunities, such as a young target group and growing viewer numbers, motivate more non-endemic firms to invest and organize sponsorship activities (Bergmann, 2021). Bergmann (2021) also suggests that if traditional sports would not react shortly, they will overlook a vast market segment and prospective sponsors. Hence, e-Sports is already evolving to integrate into the real sports industry and become a vital part of sports.

The contributions of non-endemic companies to the e-Sports market can be explained by their desire to reach young target groups. Bergmann (2021) states that it is almost impossible to reach young people through traditional marketing channels nowadays. Thus, brands invest and support the e-Sports industry by integrating into the gaming ecosystem. Thus, they start to offer gaming social media content and even co-branded heroes in games (Bergmann, 2021). Thus, brands promote their products and add extra value to potential customers, who are gamers and fans. Thus, the gaming ecosystem offers considerable growth to companies that create a sponsorship environment.

Sponsoring E-Sports is beneficial for companies and has massive potential. Jahns (2019) mentions Louis Vuitton, a fashion brand that cooperated with League of Legends' developers, namely Riot Games, and initiated an LVxLoL collection. The collection included shoes, accessories, and various clothing, such as shirts and trousers. Essentially, the collection was so admired by fans of League of Legends that it was sold entirely within an hour.

Consequently, another example of successful sponsorship is BMW, actively participating in the e-Sports industry. Petermeier D. (2021) states that BMW became started sponsoring games and became an official partner of the League of Legends World Championships. The company aims at

becoming a vital sponsor in the industry by partnering with the world's best eSports leagues. For instance, BMW sponsored only LoL teams; nevertheless, it started to cooperate with Dota 2 currently (Petermeier D. , 2021). The BMW will continue contributing to the e-Sports development and promotion because the market is up-and-coming and will bring more opportunities in the future.

Additionally, the e-Sports competitions and championships illustrate the dominance of the Asian teams. Bergmann (2021) argues that e-Sports is more widespread in Asian countries, and the industry has become mainstream. For instance, e-Sports are partly learned at school in China. Bergmann (2021) continues that successful gamers, or in other words, cyber athletes have a reputation corresponding to football stars like Cristiano Ronaldo. Significantly, e-Sports is still not recognized as a sport in many countries.

Nevertheless, the growth of e-Sports and fantasy sports will change the sports industry dramatically through the evolution of video and real-life play. Jacobs (2015) illustrates that in 10 years, a game language will evolve, and players will not need a controller. For instance, Microsoft Kinect and the Wii will introduce a new game language by which players will be to play with their movements via every limb and facial expression (Jacobs, 2015). Consequently, in 10-25 years, the gameplay will be supported by virtual and additional reality, which can adapt quickly to players' skills. In the future, e-Sports will become one of the most essential areas of sport and will involve more and more people around the world.

## **Fans**

Rapid advances in technology will also profoundly impact the relationship between sports teams and fans. For example, Jacobs (2015) argues that fans will create content in videos and images that are significantly larger than the content created by broadcasters. Thus, fans will represent the crucial source of broadcast video production. The fans will have the possibility to participate in the vital decision-making process for the teams; they will "participate, analyze, critique, deconstruct,

fantasize and connect with their favorite players and teams in real-time" (Jacobs, 2015). In addition, crowdsourcing will become a tool to involve fans in making decisions and increasing the organization's sharing and participation with primary target demographics. Artificial Intelligence will produce complex algorithms in order to predict fan reactions (Jacobs, 2015). In 10-15 years, the popularity of fantasy sports is growing, "private quant jocks are consulted or hired by franchises when making trades or drafts" (Jacobs, 2015). Increasing fans' participation in decision-making and strategic discussion will increase the desire to purchase tickets; therefore, more people will be involved in sports.

### **Extreme and Adventure Sports**

Many new types of sports will appear in the future, including extreme and adventure sports. Jacobs (2015) states that in twenty years, "sports like skysurfing will look as old-fashioned as the shot put" (p. 40). The development of science towards the creation of improved exoskeletons and prostheses will lead people to a new era of sports. The future of the sport is about combining technology and the athlete to provide more excellent safety while engaging in extreme sports. Also, the sports industry will change with the development and use of robotics. Robots will be able to train humans; a person will be able to observe sports tricks performed by robots and, through the readings of sensors, understand how to perform a particular sports trick correctly.

In 10-25 years, thanks to robotics and specially designed safety equipment, injuries earned during extreme sports will be reduced to complete disappearance. The use of exoskeletons will become the new norm for athletes practicing dangerous sports (Jacobs, 2015). It is crucial to add that the exoskeletons will be self-powered for increased performance. Thus, the equipment will enable athletes to avoid injuries under any conditions. Notably, the next future of the sport will include the massive deployment of exoskeletons, smart, athletic suits, and unique prostheses that will enable

ordinary people, professional athletes, and people with disabilities to engage in sports activities and participate in various competitions.

### **Payment and Ticketing**

How fans spend and how franchises earn money will change with the use of artificial intelligence, digital wallets, and virtual currencies. For instance, Jacobs (2015) emphasizes that artificial intelligence will analyze fan preferences and select the best seating positions. Consequently, the ticket sales system is modified and adapted to the wishes of each fan. Jacobs (2015) claims that there will be a function to sit next to his Facebook friends while watching the game. It will also be possible to choose places with single people to meet, or with families so that the children are not bored and can make friends.

Therefore, these possibilities will be provided to people based on their detailed personal data. Notably, in the future, fans will be able to buy tickets and earn particular points that can be converted into virtual currency (Jacobs, 2015). It will be possible for fans to earn more points by "promoting the game on social media and spend some on a better bat for their video game star avatar" (Jacobs, 2015). Essentially, in 5-10 years, paper tickets will disappear, replaced by digital technologies. In addition, technologies will assist in eradicating lines in 10-25 years; thus, increasing the revenue and game attendance.

### **Fanbase Economics**

Another vital aspect to discuss is fanbase economics, which will change considerably in the future. Jacobs (2015) reveals that robotics and automation will advance the middle-class wealth reduction. The author offers two scenarios of future event development regarding fanbase economics. The first scenario illustrates that sports marketing will concentrate crucially on women, which will impact the downturn in the middle-class by effectively formulating the upper-middle class female

fanbase (Jacobs, 2015). In comparison, the second scenario highlights that sports leagues will not be able to provide inexpensive offerings for the bottommost ninety percent of "fanbases' earners, and live attendance at games declines steeply" (Jacobs, 2015). Essentially, the crucial goal will be to increase female fanbases by involving more women in sports.

Thus, sports organizations, teams, and leagues will emphasize involvement, fellowship, and family orientation. Jacobs (2015) states that women care about family; therefore, societies will search for options to bring families together by sports. In addition, leagues will encourage people to share brilliant sports and games performed by women on social media to increase female fans' motivation. Continuously, in 5-10 years, more women will be engaged in football, basketball, and other sports. Jacobs (2015) adds that franchises will concentrate on promoting women's teams to demonstrate a high level of equality. Therefore, in 10-25 years, women will represent a more significant part of the live game fanbase; men will attend games with their girlfriends or family members.

Technologies, such as drones and robotics, will replace many workers and decrease the number of low-end jobs. Technological advancements will increase the percentage of unemployed people; humans will carry out short-term projects with discrete tasks that will still be complicated to complete for robots (Jacobs, 2015). Regardless, special basic income programs will help people receive enough livelihoods and attend sports games. Essentially, women will have much more time to attend sporting events thanks to technology. To summarize, humans will in the future collaborate with artificial intelligence, working alongside robotic systems to deliver better and faster results in a variety of fields, including sports. New technologies will give us a unique experience of perception of the sports industry.

#### Ideas Resume:

Jacobs, 2015	The whole sports industry will be affected by globalizing culture, changing trends, habits, demographics, and needs in the next twenty years.
--------------	---

GSIC, 2019	The smart venues will use the big data to have a better and personalized service.
Bergmann, 2021	The E-sports are attracting more sponsors and from different markets such as Mercedes-Benz, Red Bull, Master-Card, Axe, Bose, Cisco and Spotify.
Jahns, 2019	Louis Vuitton initiated an LVxLoL collection just for League of Legends.
Petermeier, 2021	BMW started sponsoring games and became an official partner of the League of Legends World Championships.

## 7. Innovative Future Sports Trends

### Quantified Self

Essentially, with the evolution of technology, new trends appear in the sports industry. Warriner (2014) suggests that the Internet is the basis for people's happy lives nowadays. The sports industry is changing significantly by developing trends and initiatives. According to Warriner (2014), one of the trends is the quantified self, which refers to the ability of athletes to coordinate and measure their performances through biometric wristbands, thermal imaging cameras, trackside, and other bio-tracking clothing. Thus, the technologies facilitate the improvement of sporting techniques by obtaining, analyzing, and monitoring internal signals. The next trend is the usage of personal health-tracking applications, including calorie counters, schedules, and other various functionalities that help evaluate a person's health indicators and provide recommendations accordingly.

For instance, Cardio Tennis group exercise classes are modified with the help of technology, namely heart rate monitors. Warriner (2014) discovers Cardio Tennis was launched in 2013; it focuses primarily on providing fun and social interaction rather than tennis techniques improvement. Nonetheless, the participants can evaluate their performance via technology and communicate with one another. The popularity of such exercise sessions will grow dramatically due to their strong potential and increasing participation.



## **Gamification**

Continuously, gamification is a significant trend in the sports industry. Gamification is the phenomenon of using video game techniques to increase users' engagements, satisfaction, and motivation. For instance, Warriner (2014) mentions that Lifelogging refers to "running a 24/7 video diary from a wearable device". Therefore, people can see their friends' performances from Facebook or other social networks, interact and discuss particular needs and interests. Currently, many applications are available to make sports activities accessible, friendly, and inclusive. Warriner (2014) states that people are using gaming applications in order to boost their motivations, narrow personal improvement, and enhance competition by receiving rewards, points and achieving new game levels. Warriner (2014) mentions Fitocracy as an example of an online game that motivates participants to complete exercises and other challenges by using achievements and points. It is also a network game because users can connect, follow, and comment on the routines of other players. Thus, such online games are engaging due to users' possibility to tailor the system according to their personal goals and interests to achieve the desired result and share it with other sports enthusiasts.

In addition, another brilliant example of an online sports game is Battle Badminton. Warriner (2014) highlights that Battle Badminton is a functional social platform that allows "individuals to set up games and be ranked nationally" (p. 5). The crucial goal of the platform is to encourage participants to play more regularly by accepting challenges and interacting with other players. Thus, Battle Badminton members can win points for each game on the court and achieve one of the nine status levels (Warriner, 2014). Thus, the frequency of playing badminton and players' motivation increase with the help of technology. Additionally, Nike SB is the social platform explicitly created for skateboarders (Warriner, 2014). This digital space enables skateboarders to communicate, choose routes, and obtain relevance.

### **Healthy Hedonism**

Significantly, healthy hedonism is a trend characterized by a desire to search for enjoyment and happiness in conscious ways. The idea of the boredom of health-consciousness "has fallen by the wayside"; therefore, any activity in the modern world should have a health-centered proposition (Warriner, 2014). Thus, the evolution of healthy hedonism impacts sports participation remarkably. People are becoming more responsive about their health and bodies and try to exercise more often; nonetheless, the busy schedule and busy modern lives make it more complicated (Warriner, 2014). Hence, surgery innovations and quick-fix beauty products are becoming more popular and decreasing the need to maintain physical activity.

### **Cult of Home**

The final trend which modifies the sports industry is the cult of the home. Warriner (2014) argued that more people have started following this trend and exercising at home using various technologies and applications. For instance, the availability of athletics technologies explicitly created for in-home exercises is expanding, which provides "the comfort, safety, and convenience of indoor leisure – closer associate the experience not just of being outside on the streets but of being a pro athlete on the circuit" (Warriner, 2014). The applications, such as BitGym for iPad, have a function of cardio machine updating with proactive trails from various destinations globally. The application traces the runner's actions via the front camera and combines them with a moving visualization. The exercises at home are also improved by using virtual and augmented reality technologies, namely a virtual reality headset (Warriner, 2014). Thus, a sports enthusiast can virtually move to any place in the world and perform the desired exercises comfortably without leaving home.

The future of the sports industry will include the development of more complex tools and technologies. Moreover, the debate on the importance of technologies in sports between technophiles

and traditionalists continues to develop. On the one hand, technologies bring advantages through innovations, a high level of engagement and participation, and improved data analysis; athletes can enhance their performance significantly. On the other hand, Warriner (2014) argues that the digital era may influence the sports industry negatively; for example, "play must be data-enhanced, but not predictable, quantified self-devices must inform, but not bully" (p. 13). Optimization is a good initiative; however, there is no point in playing if everything in the game will be optimized (Warriner, 2014). Therefore, smart technologies have their advantages and disadvantages when referring to sports. In the future, with the new technologies, will people go out to the gym or even to play sports if they can have almost the same experience in the comfort of their home?

### **5G and wearables**

Notably, wearables and 5G will bring many opportunities to the sports field in the future. Becker (2021) suggests that the industry of wearables is predicted to grow by approximately twenty-two percent per year. Therefore, more than five hundred million wearables would be purchased worldwide by 2024 (Becker, 2021). This growing trend is explained by expanding the health and sports industries. Becker (2021) states that the two most significant future trends are wearables and 5G technology. Consequently, 5G technology will offer a faster and more reliable connectivity, while wearables will become an integral part of clothing.

Nowadays, innovative companies developing and offering smart technologies have started cooperating with sports leagues in order to enhance the industry's digital transformation. Becker (2021) emphasizes that opportunities are remarkable; the startup Prevayl and its CEO, Adam Crofts, aim at creating smart clothes, which will be characterized by high-quality materials, unique design, and intelligent functions. This type of clothing will measure the owner's health indicators and recommend whether the athlete should sleep longer or train less.

Essentially, the smart clothes will be equipped with washable and invisible sensors, which will perform the crucial task, namely collecting the user's body data. The clothes will motivate and support the owner in maintaining a healthier lifestyle to live longer. Becker (2021) informs that the clothes will send personalized feedback with recommendations on improving physical and mental health to the user's gadget. Important to note that the area of intelligent wearables is evolving towards well-being, health, and sports. The 5G trend will improve fan experience during the major games and tournaments viewing and sports events. Becker (2021) argues that the 5G will connect the user's devices, wearables, and other tools and operate similarly to a smart city. Thus, people will be able to receive primary data, order transport, check sports statistics, and communicate with friends. The speed of 5G will enable humans to be connected to various devices all the time.

Thus, the powerful technological innovation which will significantly modify the industry is 5G. Müller (2021) informs that 5G provides only benefits and opportunities for sports. For example, 5G reduces transmission delays to zero and assists in broadcasting sports in a unique way. According to Müller (2021), there is a considerable possibility to watch virtual 3D broadcasts in five years. The audience will have the live experience in virtual reality, being able to watch the game without physical presence during the sports event. At present, traditional sports have been virtualized in Asia, and in the future, 5G will revolutionize all the competitions (Müller, 2021). As a result, will the line between the virtual and the real world (sports and e-Sports) disappear?

### **Artificial Intelligence**

During the coronavirus pandemic, AI-based solutions were introduced to ensure safety regarding the health of sports events visitors. Becker (2021) emphasizes that these solutions were designed with the primary goal to measure the visitors' temperature at the sports venues' entrances and determine the corona cases based on the results. In addition, unique wearables enhanced with

social distancing sensors were designed to ensure the proper distance between people (Becker, 2021). Thus, the pandemic impacted the development of many new intelligent technological solutions.

The technological transformation occurs within the sports industry nowadays. Christian Müller, a CEO of digital sports experience expert Infront X, states that people are the backbone of real and virtual transformation (Müller, 2021). He suggests that the live aspect of sports is still vital to society because it brings emotions, excitement, and authenticity compared to cybersports. Therefore, this live aspect and unreadiness of people to accept the convergence of virtual and real worlds were slowing down the digital transformation of the industry for years (Müller, 2021). Nevertheless, innovative technologies, live streaming delays reduction, and new applications of Artificial Intelligence are driving forces of the transformation of sports in the digital era. Moreover, transformation resulted in a radical change in sports content and media behavior during the last years (Müller, 2021). Generation Z, born between 1990 and 2010, is interested in exciting and fast content, which can be watched in a short amount of time. For instance, Müller (2021) argues that Generation Z prefers watching the best match summaries rather than a fully-recorded match. Therefore, these preferences and patterns affected the ways people started to consume sports.

The current situation, namely the coronavirus pandemic, impacted the sports industry significantly. Müller (2021) suggests that nowadays, people prefer activities such as e-Sports and gaming. The pandemic forces people to keep social distancing, work from home, and spend most of the time working or resting in front of their computers and laptops. The new technologies, platforms, such as TikTok and Instagram, and various mobile applications have accelerated the digital transformation of the sports industry. Hence, the most forward-looking technology for the sports industry is Artificial Intelligence. Müller (2021) states that AI can help in saving time and providing higher quality content. For instance, it can produce match summaries, including the most interesting moments of the game, search for the necessary information, provide precise analysis in seconds, and compile videos with the main scenes from various matches. Moreover, AI can be applied in the sports

industry to reduce and prevent possible injuries based on athletes' physical conditions, health indicators, and game risks analysis. Consequently, with the help of big data, AI may predict the possibility of injuries, including thousands of athletes; thus, it brings considerable value to a sports team or an athlete.

In addition, digital transformation impacts the rise of individualization or, in other words, personalization. Essentially, the rise of social media has increased the creation of personalized content via powerful algorithms. Therefore, the sports industry is using social media channels to create better offerings with the help of AI and automatization (Müller, 2021). The AI also assists in determining which sports videos are more popular on the platforms. Thus, the sports content can be modified, changed, and personalized in order to satisfy the audience and provide a higher value to each fan and viewer.

#### Ideas Resume:

Warriner, 2014	The future trends in Sport. The Internet is the basis for people's happy lives nowadays.
Becker, 2021	The two most significant future trends are wearables and 5G technology.
Müller, 2021	The sports industry is using social media channels to create better offerings with the help of AI and automatization.

### **Conclusion**

Many outstanding examples, ranging from mobile applications and virtual support to cybersports and self-driving automobiles, are involved in developing the sports business. Humans' modern technology was regarded as futuristic and unbelievable a decade ago. Nevertheless, the economic worth of the sports business increased as a result of digitalization. As essential contributors, new broadcasting formats and sponsorship influence total industry growth. Exergames and e-Sports are two new types of sports that have emerged as a result of digitalization. E-Sport, often known as cybersport, has emerged as one of the most prominent fields in the digital era.

The Internet of Things and Artificial Intelligence quickly invades the fitness and sports industries with new applications, intelligent trackers, and wearables. Athlete monitoring systems, for example, use data and individual health variables to reshape game tactics and training accordingly in order to achieve better results. With the advancement of technology, researchers and sports scientists began to address the hegemony of the sports paradigm itself. Nevertheless, digitalization as a phenomenon does not threaten physical sports; instead, digital and sports cultures converge to provide mixed experiences and unify the best aspects of both physical sports and digital technologies.

Significantly, the convergence of sports and digital cultures presents fundamental sports management implications. Essentially, sports managers must redefine their sports perspective, understand the link between physical venues and digital communities, and embrace cutting-edge technology. Furthermore, sports managers, organizers, and athletes should view digital technology as possibilities for enhancing creative activity and social participation. The potential for computer-generated reality breakthroughs in sports is exciting. People's vision, reasoning, and time management will be altered due to virtual reality advances. In addition, to accomplish extraordinary achievements, the sports sector will employ Artificial Intelligence, Big Data, and Virtual and Augmented Reality. As a result, these technologies will be employed in nearly every sport in the future. Future stadiums will be more technologically savvy, modular, and multifunctional.

Moreover, traditional broadcasting will become obsolete because consumers will receive sports matches and other material through multiple digital venues that enable customizing experiences depending on viewers' choices. Furthermore, in the future, fans will be able to participate in the crucial decision-making process for the teams with the help of digital platforms. Genetic alterations may likely become routine for athletes in the future; sports tournaments between naturally-born and genetically modified individuals will acquire recognition among society and become an intrinsic component of sports culture. Sports, health, science, and digitalization will entirely integrate in the future, forming a new industry with its unique trends and values.

All this new technology brings to the sports amazing advantages but it's expensive. Will it be a fair competition if some countries don't have the money to buy all the new technologies? Will it start to be a technological competition instead of body, strength, power, accuracy, technique competition?



## References

- The World Anti-Doping Code. (2021). <http://www.wada-ama.org>
- Ahir, K., Govani, K., Gajera, R., & Shah, M. (2019). Application on Virtual Reality for Enhanced Education Learning, Military Training and Sports. *Augmented Human Research*, 5(1), 1-9.
- Allen, S., & Hopkins, W. (2017). Big Data and More at the 2017 Sports Analytics Conference, Australia. *Sportscience*, 21, 23-27.
- Andrade, A., Correia, C. K., & Coimbra, D. R. (2019). The Psychological Effects of Exergames for Children and Adolescents with Obesity: A Systematic Review and Meta-Analysis. *Cyberpsychology, Behavior, and Social Networking*, 22(11), 724-735.
- Association of Summer Olympic International Federations. (2019). <https://strivesponsorship.com/wp-content/uploads/2020/01/Association-of-Summer-Olympic-International-Federations-Esports-2019.pdf>
- Becker, L. (2021, February 15). <https://www.ispo.com/en/markets/wearables-and-5g-wellness-advisor-and-event-planner-one>
- Bergmann, A. (2021, August 12). <https://www.ispo.com/en/markets/esports-events-sponsorship>
- Bird, S. R., Goebel, C., Burke, L. M., & Greaves, R. F. (2016). Doping in sport and exercise: anabolic, ergogenic, health and clinical issues. *Annals of Clinical Biochemistry*, 53(2), 196-221.
- Bramham, P., & Wagg, S. (2016). *Sport, Leisure and Culture in the Postmodern City*. Routledge.
- Cantelmo, R. A., Silva, A. P., Mendes-Junior, C. T., & Dorta, D. J. (2020). Gene doping: Present and future. *European Journal of Sport Science*, 20(8), 1093-1101.
- Caya, O., & Bourdoun, A. (2016). A Framework of Value Creation from Business Intelligence and Analytics in Competitive Sports. In *2016 49th Hawaii International Conference on System Sciences (HICSS)* (pp. 1061-1071). IEEE.

- Costa, M., Vieira, L., Barbosa, E., Oliveira, L., Maillot, P., Vagheti, C., Carta, M., Machado, S., Rojas, V. & Monteiro-Junior, R. (2019). Virtual Reality-Based Exercise with Exergames as Medicine in Different Contexts: A Short Review. *Clinical Practice & Epidemiology in Mental Health: CP & EMH*, 15-20.
- Dexeus, C. R. (2018). The deepening effects of the digital revolution. In *The Future of Tourism* (pp. 43-69). Springer.
- Digiteum. (2021, November 18). <https://www.digiteum.com/impact-of-technology-sports-fitness/>
- Dugalić, S. (2018). Sport, media and digitalization. *Sport – Science & Practice*, 8(1), 56-69.
- Duge, C. (2021, June 14). Olympic Virtual Series: Premiere for eSports at the 2021 Olympics. <https://www.ispo.com/en/trends/olympic-virtual-series-premiere-esports-2021-olympics>
- Epstein, D. (2013). *The Sports Gene: Inside the Science of Extraordinary Athletic Performance*. Yellow Jersey Press.
- Euronews, & AP. (2021, July 23). *Tokyo 2020: Virtual reality and augmented reality bringing spectators closer to the action*. <https://www.euronews.com/next/2021/07/23/tokyo-2020-virtual-reality-and-augmented-reality-bringing-spectators-closer-to-the-action>
- Fears, R., & Meulen, V. T. (2017). How should the applications of genome editing be assessed and regulated? *ELife*, 6, e26295.
- Finn, S., & Jones, C. (2009). Book reviews. *Sport, Ethics and Philosophy*, 94-102.
- Franco, J. (2021, March 21). Digital Transformation, Innovation and Creativity at the Service of Sports Management. <https://itkf.global/news/digital-transformation-innovation-and-creativity-at-the-service-of-sports-management/>
- Global Sports Innovation Center. (2019). Digital Transformation Of Sports Entities By 2025.
- Hamari, J., & Sjöblom, M. (2017). What is eSports and why do people watch it?. *Internet Research*
- Healthy Games. (2021). <https://healthy.games/>
- Hilvoorde, I. v. (2016). Sport and play in a digital world. *Sport, Ethics and Philosophy*, 10(1), 1-4.

- Hilvoorde, I. v., & Pot, N. (2016). Embodiment and fundamental motor skills in eSports. *Sport, Ethics and Philosophy*, 10(1), 14-27.
- Internationale Fachmesse für Sportartikel und Sportmode. (n.d.).  
<https://www.ispo.com/en/topic/esports>
- Jacobs, J. M. (2015, September). *Future of Sports*: <http://futureof.org/wp-content/uploads/The-Future-of-Sports-2015-Report.pdf>
- Jahns, M. (2019, December 13). <https://www.ispo.com/en/companies/esports-collection-louis-vuitton-sold-out-within-hour>
- James, D. A., & Petrone, N. (2016). *Sensors and Wearable Technologies in Sport: Technologies, Trends and Approaches for Implementation* (pp.1-49). Springer.
- Jenny, S., Manning, R., Keiper, M., & Olrich, T. (2016). Virtual(ly) Athletes: Where eSports Fit Within the Definition of “Sport”. *Quest*, 69(1), 1-18.
- Kappen, D., Mirza-Babaei, P., & Nacke, L. (2018). Older Adults’ Physical Activity and Exergames: A Systematic Review. *International Journal of Human–Computer Interaction*, 35(2), 140-167.
- Kaur, N. (2019). Emerging trends in sports coaching. *International Journal of Physiology, Nutrition and Physical Education*, 4(1), 1784-1786.
- Krzanich, B. (2016). *Digitization Is Upon Us — The Biggest Change In Sports In Over 100 Years*.  
<https://the-cauldron.com/the-digitization-of-sports-the-biggest-change-in-sport-in-over-100-years-7a0761c2e14a>
- Lavopa, A., & Delera, M. (2021). <https://iap.unido.org/articles/what-fourth-industrial-revolution>
- Lopez, S., Meirelles, J., Rayol, V., Poralla, G., Woldmar, N., Fadel, B., Pizzatti, L. (2020). Gene doping and genomic science in sports: where are we? *Bioanalysis*, 12(11), 801-811.
- Loureiro, A. (2018). There is a fourth industrial revolution: The digital revolution. *Worldwide Hospitality and Tourism Themes*, 740-744.

Lupton, D. (2017). *Digital Health. Critical and Cross-Disciplinary Perspectives*. Routledge.

Mahendra, V. (2021, July 2). *Financial Express*.

<https://www.financialexpress.com/brandwagon/esports-inclusion-in-tokyo-olympics-a-drop-in-the-ocean/2281655/>

Miah, A. (2004). *Genetically Modified Athletes: Biomedical ethics, gene doping and sport*. Routledge.

Miah, A. (2017). *Sport 2.0: Transforming Sports for a Digital World*. MIT Press.

Mons, J. K. (2020, January 7). *10 stunning predictions about the future of sports in the coming decade*. <https://sporttomorrow.com/10-striking-predictions-about-future-of-sports/>

Movesense. (n.d.). <https://www.movesense.com/showcase/physilect/>

Müller, C. (2021). <https://www.pwc.ch/en/insights/transformation/live-sport-transformation.html>

Mura, G., Carta, M. G., Sancassiani, F., Machado, S., & Prosperin, L. (2018). Active exergames to improve cognitive functioning in neurological disabilities: a systematic review and meta-analysis. *European Journal of Physical and Rehabilitation Medicine*, 54(3), 450-462.

O'Donoghue, P., & Holmes, L. (2014). *Data Analysis in Sport*. Routledge.

Ormond, K., Mortlock, D., Scholes, D., Bombard, Y., Brody, L., Faucett, A., Young, C. (2017). Human Germline Genome Editing. *The American Journal of Human Genetics*, 101(2), 167-176.

Palar, S. (2021, June 21). *The Olympic Virtual Series*. <https://olympics.com/en/featured-news/olympic-virtual-series-everything-you-need-to-know>

Petermeier, D. (2020). <https://www.ispo.com/en/trends/top-5-most-popular-esports-games>

Petermeier, D. (2021, December 2).: <https://www.ispo.com/en/know-how/unitedinrivalry-bmws-esports-marketing-strategy>

Rigamonti, L., Albrecht, U.-V., Lutter, C., Tempel, M., Wolfarth, B., & Back, D. A. (2020). Potentials of Digitalization in Sports Medicine: A Narrative Review. *Current Sports*

*Medicine Reports*, 19(4), 157-163.

Ross, P., & Maynard, K. (2021). Towards a 4th Industrial Revolution. *Intelligent Buildings International*, 13(3), 159-161.

Santos, A. (2020). Devem os Esports ser considerados Desporto? In *Esports: o desporto em mudança*". Edições do COP.

Schulze, E. (2019). <https://www.cnn.com/2019/01/16/fourth-industrial-revolution-explained-davos-2019.html>

Schwab, K. (2016). *The Fourth Industrial Revolution*. Currency.

Softtek. (2021, August 26). *The four pillars of Digital Transformation in the world of sport*.

<https://softtek.eu/en/corporate-en/the-four-pillars-of-digital-transformation-in-the-world-of-sport/>

Soranata, K., Landis, A. E., Jing, F., & Suto, H. (2021). *Supply Chain Management of Tourism Towards Sustainability*. Springer.

Thieringer, J. (2021, April 13). *10 Sports Marketing Trends That You Should Know and Use*.

<https://www.ispo.com/en/trends/10-sports-marketing-trends-you-should-know-and-use>

Tian, E. (2020). A prospect for the geographical research of sport in the age of Big Data. *Sport in Society*, 23(1), 159-169.

Toffoletti, K., Francombe-Webb, J. & Thorpe, H. (2018). *New Sporting Femininities: Embodied politics in postfeminist times*. Palgrave Macmillan.

Wang, X. (2020). Digital Management of Sports Industry Based on Big Data Era. In *Journal of Physics: Conference Series*. Vol. 1533, No. 3, p. 032061. IOP Publishing.

Warriner, J. (2014). Future Trends: Innovating to Grow Participation In Sport. *London: The Sport and Recreation Alliance*.

Xiao, X., Hedman, J., Tan, F. T., Tan, C.-W., Clemmensen, T., Lim, E., Henningson, S.,

Mukkamala, R., Vatrappu, R. & van Hillegersberg, J. (2017). Sports Digitalization: An

overview and A research agenda. In *International Conference On Information (ICIS)*.  
Association for Information Systems.