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Guidelines on how to improve the psychological and social well-being of athletes in the sporting context

UNIVERSITÀ DEGLI STUDI
DI CAGLIARI

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1. Deliverable Introduction

The document "Guidelines on how to improve the psychological and social well-being of athletes in the sporting context", was drawn up thanks to the contribution of all the partners of the EDATS project and thanks to the professionalism present in each organization. Unica took care of the paragraph "Use of digital technologies in the sports context" thanks to the specialist contribution of Prof. Massimiliano Pau, the topics "Coach-athlete relationship" and "Gender equality and social inclusion" were edited by Dr. Andrja Geric, Sports Psychologist and Mental Coach (Sk Volley), while the "Environmental sustainability" section was written by Claudio Congiu (Alfieri) and Konrad Rechnio (UKS).

The drafting of the document was started in June 2024 and the drafting was completed in November 2024.

The document constitutes an initial analysis of needs and first basic research in relation to the well-being of the issues addressed, i.e. the health and well-being of athletes, injury prevention, the coach-athlete relationship, gender equality in sports environments and social inclusion.

The implementation phase of the project to which the document is linked concerns the implementation of methodologies to detect and process biomechanical data.

The target group of reference is made up of coaches, young athletes, sports managers and research professionals, for whom the paper will be useful to implement the subsequent training and awareness phases.

The "Guidelines" provide useful suggestions and guidance on how to improve the psychological and social well-being of athletes in the sports context, the coach-athlete relationship, how sport can be a tool for social inclusion, how technology can help sportsmen and how to promote gender equality in sport and environmental sustainability in sport. A specific section of the document has been dedicated to each of these topics.

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2. Preface

The main aim of the EDATS project is to support and encourage the professional and sporting careers of young athletes through the development and integration of digital technology that are accessible, easy-to-use and effective. This will be achieved through the pursuit of four specific goals:

1. By increasing collaboration between sports professionals and professionals experienced in applied digital technology;
2. By providing specific training on sport injury prevention to sports managers, coaches and young athletes;
3. By promoting the psychological and social well-being of athletes in sporting contexts;
4. By promoting awareness of environmental sustainability in sport and knowledge of European programs among young sportspeople and coaches.

The project approach is based on research and data collection, transnational and interdisciplinary dialogue through contributions from the partnership entities, testing of training programs, and implementation of tools to disseminate the results obtained and use them locally and internationally.

In the initial phases of the project, a series of activities aimed at realizing a greater increase in collaboration between sports professionals and professionals experienced in applied digital technologies. Based on such activities, the present document provides common guidelines on several aspects considered fundamental in the development of the EDATS initiative. In particular, the following areas have been covered:

1. How to improve the coach - athlete relationship;
2. How sport can represent a valid tool to enhance social inclusion;
3. How technology can help sportsmen and sportswomen;
4. How to promote gender equality and sustainability in sport.

Such activity has been carried out by considering, in the first place, the needs expressed by final users (particularly, trainers) using dedicated tools like questionnaires and focus groups.

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3. Needs analysis and best practices in training methodologies.

3.1. Introduction

To develop a comprehensive understanding of what are the potential best practices in terms of biomechanical data collection for sports training, we employed a multi-phase methodology, which combines data obtained through questionnaires administered to stakeholders (i.e., trainers, strength and conditioning coaches, etc.) and extracted by collaborative discussions among project partners. This approach allowed for a diverse range of insights, addressing both technical and contextual factors critical to an effective biomechanical data collection protocol.

3.2. Questionnaire Development

The first step was to create a structured questionnaire, aimed at gathering detailed information on the current use of biomechanical data collection systems, particularly as regards the types of sensors employed, as well as the perceived benefits and challenges associated with the use of technology to obtain quantitative information about relevant biomechanical parameters. This questionnaire was designed to be administered to a wide range of users involved in different sport disciplines (not only volleyball) to ensure the broadest possible applicability of the findings. To create an effective survey, the project team identified core themes based on previous research and expert consultations, including injury prevention, training methodologies, sensor technology, environmental sustainability, gender equality, and social inclusion.

3.3. Data Collection

Once finalized, the questionnaire was distributed among athletes, coaches, and other sports professionals across various sports disciplines. The goal was to gather quantitative and qualitative data on the practical experiences as well as the opinions of respondents. In addition to questions on technical aspects of data collection systems and sensors, the survey included open-ended questions that allowed respondents to discuss challenges, recommend improvements, and share insights on inclusivity and sustainability in sports.

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3.4. Discussion and Analysis among Project Partners

Following data collection, the results were shared and discussed in a series of collaborative sessions planned among the project partners. These discussions served two main purposes:

3.4.1. Data Interpretation

Project partners analyzed the aggregated data to identify common challenges, effective practices, and emerging trends.

3.4.2. Needs Assessment

Insights from focus group discussions informed a needs analysis focused on injury prevention, coach-athlete dynamics, digital technology integration, sustainability, and inclusivity. These sessions enabled the team to align on shared goals, prioritize key findings, and explore potential applications across different sports environments.

Through this methodology, the project aimed to establish a common protocol for biomechanical data collection that is informed by real-world insights and collaborative expertise. The following sections present the findings and recommendations derived from this structured approach.

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4. Biomechanical Data and Sensor Use in Sports

The primary objective of this initiative is to identify best practices in biomechanical data collection for sports beyond volleyball. Data gathered from the questionnaire highlights a variety of current experiences with biomechanical systems and identifies challenges, particularly around the selection and effective use of sensors.

4.1. Participants Profile

As shown by Figure 1 and 2, most respondents (predominantly coaches) come from the countries which compose the consortium, namely: Italy, Hungary, France, Poland and Serbia, thus providing a true European perspective on sports training and data collection needs. The analysis of age range data, which indicates an average around 40, suggests a mix of experience levels, likely providing insights from both established and emerging practices in the field. As shown by Figure 3, the varied background helps ensure that the findings reflect diverse viewpoints, especially those of coaching professionals who are pivotal in implementing training methodologies and data practices.

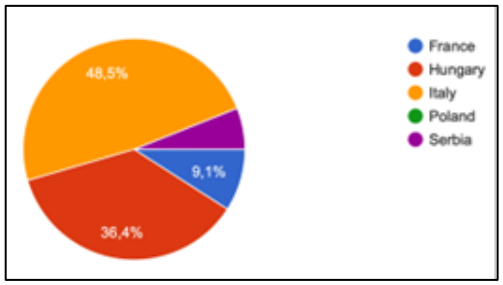

Figure 1: Nationality of respondents

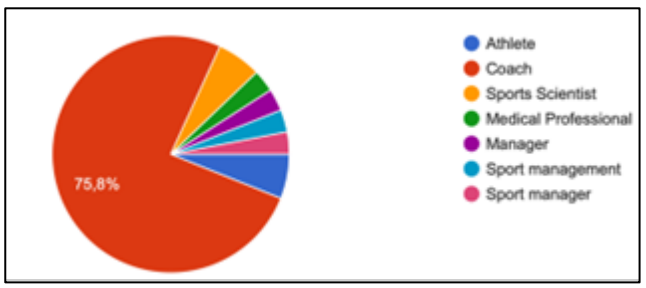

Figure 2: Professional profile of respondents

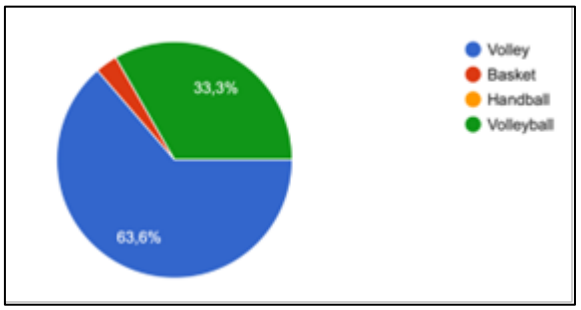

Figure 3: Sport background of respondents

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4.2. Experience with Biomechanical Data Collection Systems

Responses indicate that nearly half of the participants (45%) currently use biomechanical data collection systems in their training or professional practice. This suggests moderate adoption, with a notable portion of respondents (55%) either not using these systems or lacking familiarity with them. The relevant percentage of the latter is probably due to the cost of the systems (often considered not affordable especially for small clubs), resource requirements, and expertise needed to effectively integrate the results obtained from the biomechanical systems into the daily training planning routine, especially for sports practitioners who might prioritize practical training methods over technology-driven analytics.

4.3. Sensor Types and Preferences

Among those using biomechanical systems, accelerometers and force plates are the most employed devices, due to their versatility in measuring kinematic (i.e. accelerations, speed and trajectories) and kinetic (i.e., forces) parameters. Such preferences highlight a focus on tracking biomechanical parameters that are universally applicable across many sports. However, a few responses mention the use of in-body sensors and motion capture systems, signaling an interest in more advanced or specialized data. This variety in sensor choice may reflect both the financial and logistical considerations of adopting complex tools in different sports contexts.

4.4. Perceived Effectiveness of Data Extracted by Biomechanical Systems

Most participants find biomechanical data collection systems effective in terms of contribution to improve their training programs, with a significant number of respondents labeling them "effective" (50%) or "very effective" (20%). Only a few report a neutral stance, suggesting that while users generally see value in these tools, some may struggle to fully leverage their potential. The enthusiasm for these systems likely stems from their ability to provide precise feedback, though there appears to be room for improvement in training on system use and data interpretation.

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4.5. Key Challenges in System Utilization

The main challenges revolve around **ease of use**, **cost**, **system integration**, and **data interpretation**. For many respondents, the cost remains a prohibitive factor, particularly in sports environments where budget constraints are common. The complexity and integration with other training systems also pose issues, making it difficult for users to combine data from multiple sources or apply it in real time. This highlights the need for further "low-cost" affordable, user-friendly technologies and emphasizes the importance of developing best practices for data integration and interpretation, potentially through standardized protocols and training resources.

4.6. Injury Prevention Priorities

As shown in Figure 4, a substantial portion of respondents emphasize the importance of **proper warm-up and cool-down routines** and **strength conditioning** as pillars of injury prevention. Recovery techniques are also frequently highlighted, indicating a broad recognition of the value of holistic approaches to athlete care. This reflects a preventive approach to sports training that combines physical preparation, recovery strategies, and biomechanical assessments, aligning with modern understandings of injury mitigation.

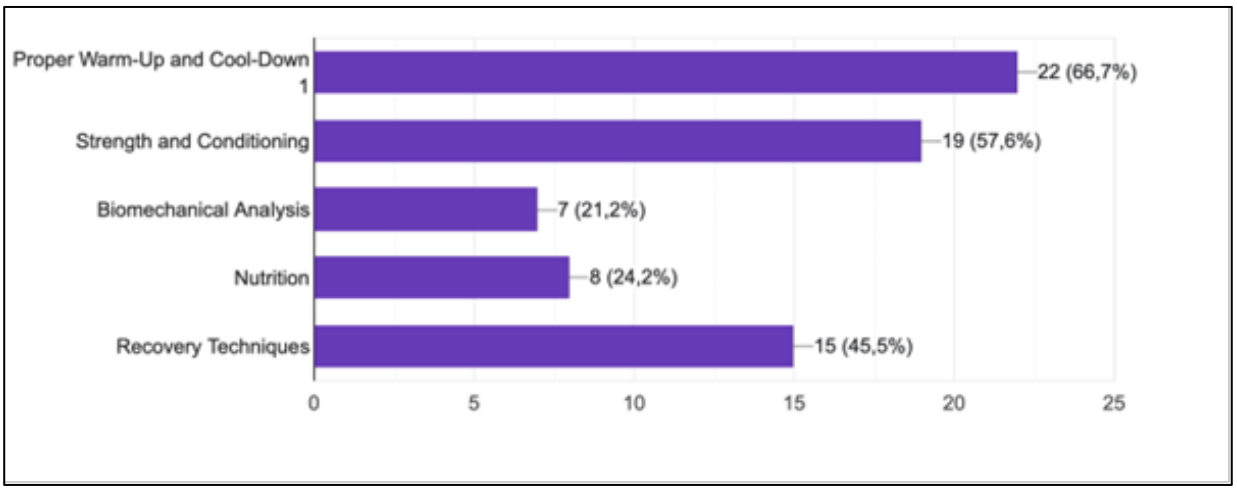

Figure 4: Replies on the most critical aspects of injury prevention in sport training

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4.7. Digital Technologies in Training

The application of digital technologies in training is quite widespread, with **video analysis tools** and **training apps** as the most widely employed. These tools offer valuable visual feedback and structured progress tracking, enhancing athletes' and coaches' abilities to monitor and refine performance. Wearable devices, although not as prevalent, provide more individualized data, often used alongside other digital platforms. This enthusiasm for digital tools reflects a growing appreciation for data-driven coaching, even in smaller or less funded training environments.

4.8. Environmental Sustainability Perspectives

Three-quarters of respondents consider sustainability either important or very important, indicating a growing awareness of environmental impact within sports contexts. Suggestions for improvement, like using energy-efficient facilities and sustainable equipment, illustrate a movement toward integrating eco-friendly practices within sports organizations. This priority aligns with broader societal trends and points toward an emerging responsibility for sports professionals to consider their environmental footprint.

4.9. Conclusion

This project findings provide a solid foundation for enhancing collaboration between sports professionals and technology experts, advancing biomechanical data collection practices, and creating an ICT platform to support athlete well-being and performance. The insights gathered through the questionnaire highlight key areas of alignment and opportunity to address the project's goals.

4.9.1. Strengthening Collaboration Across Disciplines

The responses reveal a gap in shared knowledge and access to biomechanics-focused resources among sports professionals. Although many coaches and athletes recognize the benefits of biomechanical data, challenges regarding cost, complexity, and data interpretation indicate a need for interdisciplinary collaboration. By connecting sports professionals with technology experts, it would be possible to create a knowledge-sharing network that demystifies biomechanical data, aligns technology choices with practical training needs, and facilitates real-world applications.

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Collaborative workshops, training modules, and shared resources will empower coaches, trainers, and sports scientists to effectively apply biomechanical insights, enhancing the coach-athlete relationship through improved understanding of individual needs and performance indicators.

4.9.2. Selecting Sensors and Defining a Data Collection Methodology

The survey shows a preference for widely accessible sensors, such as accelerometers, force plates, and motion capture systems, particularly for measuring movement, force, and speed. These tools are commonly associated with injury prevention and training optimization, aligning well with project goals.

Based on the user feedback, a clear methodology can be developed that focuses on standardized data collection practices for injury prevention and performance improvement. This methodology should outline:

- **Sensor selection guidelines** based on sport-specific needs, cost-effectiveness, and ease of use;
- **Data collection protocols** that prioritize ease of interpretation, enabling coaches and athletes to make quick, evidence-based adjustments in training;
- **Integration steps** to combine biomechanical data with digital training tools like video analysis and wearables, fostering a seamless, data-informed approach to coaching.

This systematic approach can serve as a benchmark for data collection, ensuring consistency, reliability, and broader applicability across sports environments.

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5. Improving Coach-Athlete Relationships in Sport

The relationship between a coach and an athlete is one of the most important factors that influence athletic performance, development, psychological state of athlete and overall well-being. This bond, built on trust, communication, and mutual respect, shapes the athlete's experience in sport and impacts their ability to perform under pressure. A strong coach-athlete relationship is not only essential for success but also for the athlete's motivation, psychological well-being, and long-term growth. However, like any relationship, the coach-athlete dynamic requires effort, self-awareness, and intentional strategies to ensure it remains positive and productive. Key strategies to improve the coach-athlete relationship in sport are communication, trust-building, emotional intelligence, and individualized coaching.

5.1. The Role of Communication

Effective communication is the cornerstone of any successful coach-athlete relationship. In sport, clear, honest, and consistent communication is essential for setting expectations, providing feedback, and offering emotional support. According to Jowett and Ntoumanis (2004), open communication helps both coaches and athletes understand each other's perspectives, which fosters mutual respect and enhances cooperation. It allows coaches to convey their training methods and strategies while enabling athletes to express their needs, concerns, and feedback.

One of the key aspects of communication in the coach-athlete relationship is feedback. Coaches should provide both positive and constructive feedback to guide the athlete's improvement. Positive reinforcement is critical for building confidence, especially in younger or less experienced athletes, while constructive feedback provides the athlete with specific areas to work on without undermining their self-esteem. Importantly, coaches should be mindful of how they deliver feedback, ensuring it is clear, non-judgmental, and aimed at improving performance.

Furthermore, active listening is an often-overlooked component of effective communication. Coaches should not only speak but also listen to their athletes, giving them space to express their thoughts, emotions, and concerns. This creates an open environment where athletes feel valued and understood, which in turn

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promotes a positive relationship. Research indicates that athletes who feel listened to by their coaches are more likely to feel motivated, trust their coach's decisions, and remain engaged in their sport (Mageau & Vallerand, 2003).

5.2. Building Trust

Trust is a fundamental element in any coach-athlete relationship. Without trust, the relationship is likely to be marked by tension, miscommunication, and dissatisfaction. Trust in a coaching context involves the athlete's belief that the coach has their best interests at heart, is knowledgeable, and is committed to helping them succeed. Coaches must earn this trust by being consistent, fair, and transparent in their actions and decisions.

One way to build trust is through consistency. When athletes know what to expect from their coach, whether it be in terms of behavior, feedback, or training philosophy, they are more likely to trust the coach. A coach who frequently changes their expectations, approach, or demeanor may create uncertainty and confusion, leading to a breakdown in trust.

Fairness is another important component of trust. Athletes need to feel that they are being treated equitably compared to their teammates, regardless of their skill level or status on the team. Coaches who show favoritism or fail to provide equal opportunities for development can damage the trust they have built with their athletes. Fairness also extends to how a coach handles mistakes and setbacks. A coach who is understanding and supportive in these situations is more likely to foster a trusting relationship than one who reacts harshly or punitively.

Lastly, transparency in decision-making helps build trust between coaches and athletes. Athletes often have strong emotional investments in their performance and playing time. When a coach makes decisions, such as adjusting an athlete's role on the team or changing a training regimen, it is important to explain the rationale behind these choices. This openness helps athletes understand the coach's reasoning and ensures they do not feel unfairly treated or confused by decisions that affect their athletic development.

5.3. Emotional Intelligence and Empathy

Emotional intelligence (EI) is another critical factor in the coach-athlete relationship. EI refers to the ability to understand, manage, and respond to one's

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own emotions and the emotions of others. A coach with high emotional intelligence is better equipped to navigate the emotional landscape of their athletes, especially in the high-pressure environment of competitive sports.

Empathy, a key component of emotional intelligence, allows coaches to connect with their athletes on a personal level. By recognizing and validating the emotions and challenges that athletes face, coaches create a supportive environment where athletes feel safe to express themselves. Empathy also helps coaches identify when an athlete may be struggling mentally or emotionally, even if they are not directly expressing it. This awareness allows coaches to intervene with appropriate support, whether it be through one-on-one conversations, adjustments to training, or referrals to a sports psychologist if necessary.

In addition to fostering emotional support, coaches with high emotional intelligence can better manage their own emotions in stressful situations. Sports can be highly charged environments, and coaches who are able to remain calm and composed in the face of setbacks, mistakes, or losses demonstrate emotional resilience. This composure not only sets a positive example for athletes but also creates a more stable and supportive team environment.

5.4. Individualized Coaching

One-size-fits-all coaching is no longer considered an effective approach, especially in modern sports environments where athletes differ in terms of personality, motivation, learning style, and development stage. Individualized coaching involves tailoring one's coaching approach to meet the unique needs of each athlete, which is essential for building a strong coach-athlete relationship.

Research has shown that athletes respond differently to various motivational styles (Vallerand, 2007). Some athletes may thrive on positive reinforcement and a collaborative coaching style, while others may prefer more structured guidance and direct feedback. Recognizing and adapting to these differences helps coaches connect with each athlete on a personal level, thereby fostering mutual understanding and trust.

Individualized coaching also involves considering the personal and emotional needs of athletes. For example, some athletes may require more emotional support during times of personal stress or after a poor performance, while others may prefer to be left alone to process their emotions independently. Coaches who

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take the time to understand the individual personalities and emotional needs of their athletes are better able to provide the right type of support at the right time.

In addition, goal setting is an area where individualized coaching can have a significant impact. Coaches who work with athletes to set personalized, achievable goals that align with their long-term aspirations show that they are invested in the athlete's development. These goals should be specific, measurable, and tailored to the athlete's current level of skill and performance, allowing for steady progress and motivation.

5.5. Conclusion

The coach-athlete relationship is a vital component of success in sports, and improving this relationship requires intentional strategies that focus on communication, trust-building, emotional intelligence, and individualized coaching. By fostering open communication, coaches can ensure that athletes feel heard and valued, while building trust through consistency, fairness, and transparency creates a stable foundation for development. Emotional intelligence and empathy allow coaches to support athletes through emotional challenges, while individualized coaching ensures that each athlete's unique needs and motivations are met.

Ultimately, a strong coach-athlete relationship not only enhances athletic performance but also promotes long-term psychological well-being and personal growth for athletes. Coaches who invest time and effort into developing these relationships will not only see improved outcomes on the field but will also contribute to the overall development of confident, motivated, and resilient athletes.

5.6. References

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6. Use of digital technologies in the sports context

In sports, like many other fields of human living, technology plays a pivotal role as it influences both the way games are played as well as the degree of involvement and enjoyment by fans. Of course, the technological advancements affect different aspects of sports world. At first, it can certainly be observed that the evolution in terms of sensors, materials and improved knowledge of human physiology and genetics strongly support the enhancement of athlete performance. Indeed, in recent years the availability at affordable cost of wearable technology allowed athletes and coaches to have available real-time data on several physiological metrics such as heart rate and heart rate variability, oxygen saturation, quantity and quality of sleep, as well as biomechanical data on acceleration and speed of body segments which are essential in characterizing the human movement. Moreover, devices like GPS trackers and accelerometers allow for precise monitoring of an athlete's movements, enabling coaches to optimize training programs and minimize the risk of injuries.

In addition to performance enhancement, technology plays a crucial role in ensuring the safety and well-being of athletes. For instance, in contact sports like football and hockey, concussions and other traumatic brain injuries are of significant concerns. To address this issue, researchers have developed innovative helmet designs equipped with sensors that can detect and measure the impact of collisions in real-time. This data enables medical professionals to assess the severity of head injuries more accurately and implement appropriate treatment protocols. It is also noticeable that, to date, there are many options in terms of medical screening and treatments to protect athletes' health and promote their wellbeing. For instance, diagnosis and treatment of injuries are greatly facilitated by imaging tools such as MRI, TC and ultrasound. Because of the huge available amount of data they provide, it is possible to accurately characterize virtually any kind of musculoskeletal injuries, thus supporting clinicians in planning optimized and tailored rehabilitation plans for athletes. At last, it should be remarked how the development of soft exoskeletons and advanced prosthetics allows disabled individuals to compete at the highest level, thus showcasing the potential of technology to overcome physical limitations.

Technology is also gradually modifying the way fans interact with their favorite sports and athletes. Besides the explosion of social media platforms like X, Instagram, and TikTok, which have become invaluable tools for athletes to connect

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with their fans as they provide behind-the-scenes insights, fostering a sense of community, virtual and augmented reality technologies have opened up new possibilities for immersive fan experiences, allowing viewers to feel like they are part of the action from the comfort of their homes. Also, the availability of real-time data coming from the athlete just while he/she is performing (think about heart rate in F1 races or cycling, jump height in volleyball, speed in track and field, traveled distance and shooting accuracy in soccer, etc.) greatly improves in the audience the sense of presence while the action takes place, and make fans aware of the more appealing details associated with the performance.

6.1. Technological solutions

As specifically regards volleyball, the most mature and/or promising technological solutions include:

6.1.1. Video analysis

Footage of training sessions and matches can now be analyzed in detail (even with the support of AI tools) to obtain data about ball trajectory and speed as well as athlete's movement. In this context, video analysis is essential for coaches to identify strengths, weaknesses, and areas for improvement and thus subsequently develop more effective training plans.

6.1.2. Wearable devices

Wearable devices for training and conditioning: as previously mentioned, wearable devices can provide coaches with valuable data on a player's performance. Some of the information that can be gathered with miniaturized non-invasive devices include heart rate, speed, and distance covered during training and games, jump heights. This data can then be used to tailor training programs to individual players' needs and help reduce the risk of injury.

6.1.3. Data analytics

The ever-growing impact of AI on our society, reflects also on complex sports like volleyball. Indeed, using dedicated machine learning models, teams can predict player performance, strategize rotations, and analyze vast amounts of match data quickly. These insights are invaluable for crafting match-winning strategies.

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7. Environmental sustainability

In a world increasingly aware of the environmental and social challenges we face, sustainability has become a central theme in almost every aspect of our lives. And sport is no exception. In this chapter, we will explore why sustainability in sports is crucial, the benefits it offers, the types that exist, and what environmental sustainability is in the sports industry.

Sustainability is fundamental because it responds to the need to protect our planet and its resources for future generations. In the context of sport, this importance is amplified, as sport has a significant impact on the environment, health, society and the economy. Some key reasons why sustainability in sport is crucial include:

7.1. Threats of sustainability

7.1.1. Environmental responsibility

Sports activities often have a high consumption of natural resources, such as water and energy, and generate waste. Sustainability in sport seeks to reduce this negative impact on the natural environment.

7.1.2. Social Impact

Sport has a powerful social reach and can affect the community in a variety of ways. Social sustainability refers to the promotion of equal opportunities, inclusion and access to sport for all.

7.1.3. Economic profitability

Economic sustainability in sport involves the responsible management of financial resources, ensuring that sports projects are feasible and that long-term benefits are generated.

7.2. Opportunities in relation with sustainability

On the other hand, sustainability in sport offers several benefits, both for the environment and for society and the economy.

7.2.1. Environmental benefits

Through measures such as reducing energy and water consumption, waste management and promoting sustainable mobility.

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7.2.2. Social benefits

Through measures such as accessibility to sports facilities, inclusion of disadvantaged groups, promotion of physical and environmental education and injury prevention.

7.2.3. Economic benefits

Through measures such as reducing operating costs and improving brand image. Even the most important planetary organizations include sustainability among the main topics of discussion

7.3. Connectivity to EU directives

The UN 2030 Agenda for Sustainable Development is an action program for people, the planet and prosperity signed in September 2015 by the governments of the 193 member countries of the United Nations. It encompasses the 17 Sustainable Development Goals.

Sustainable development is defined as development that meets the needs of the present without compromising the ability of future generations to meet their own needs. To achieve sustainable development, it is important to harmonize three fundamental elements: economic growth, social inclusion and environmental protection.

The role of sport is important in achieving the Sustainable Development Goals (SDGs) as its universal language unites peoples, cultures and genders. In 2017, UNESCO, during the 6th International Conference of Ministers and Senior Officials responsible for Physical Education and Sport (Mineps VI), made the Kazan Plan, a global agreement that combines sports policies and the Sustainable Development Goals, operational.

Specifically, sport intervenes on many of the goals set:

- it ensures a healthy life and promotes the well-being of all;
- guarantees quality education, gender equality;
- promotes economic growth and decent work;
- reduces inequalities between countries;
- it makes cities resilient, safe and sustainable;
- promotes peaceful societies.

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7.3.1. Objectives related to sport

The possible role of sport in achieving each of the 17 goals might be:

- **SDGs 1. Ending poverty / SDGs 8.** Work and economic growth: sport is obviously also economy and work; In fact, the sports sector encompasses types of employment at different levels, capable of offering ample job and income opportunities even for the less well-off social categories.

- **SDGs 2. Achieving zero hunger**, achieving food security, improving nutrition and promoting sustainable agriculture: sport can raise awareness of the importance of buying sustainable food, food security, healthy nutrition and sustainable agriculture.

- **OSS 3. Health and well-being:** sports activity improves well-being, health and prevents diseases and is an excellent tool for education to an active and healthy lifestyle. In addition, the variety of existing sports ensures that sports can be practiced at all ages and in all physical conditions and at all income levels.

- **SDGs 4. Providing quality education/ SDGs 5.** Gender equality: sport and physical education can motivate children and young people to attend and engage in education, and through the practice of sport, key skills and values such as tolerance and inclusion can be taught, sending a positive message for the elimination of gender differences even in broader contexts.

- **SDGs 6. Sustainable water management /SDG 7. Clean energy:** sports contexts such as water sports can promote and bring about improvements in water quality by reducing pollution and waste. Water use efficiency and energy efficiency also need to be improved in sports facilities by applying relevant standards and regulations.

- **OSS 9. Promoting innovation and resilient infrastructure:** sport can provide innovative and accessible sports spaces, supporting the construction and renovation of infrastructure, including sports facilities.

- **SDG 10. Reducing inequalities between countries:** Sport is an effective tool for addressing inequality in hard-to-reach areas and for empowering individuals and communities.

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- **SDG 11 Sustainable cities and communities:** sport encourages a green economy, the resilience of cities, the healthiness of environments. A healthy sporting activity requires the search for clean spaces, whether they are outdoors or indoors. Sport can help remove obstacles and barriers in the environment, transport and public services to ensure access for all, including persons with disabilities.

- **SDGs 12-13-14-15 Sustainable development:** sport can support sustainable consumption and production and nature-friendly lifestyles, reducing the environmental impact of sporting events (e.g. plastic-free stadiums and stadiums with photovoltaic panels, recycling of sports equipment, eco-sustainable uniforms, separate waste disposal). In addition, sports and sporting events, especially aquatic sports, can be excellent platforms for promoting the conservation and sustainable use of the oceans and seas.

- **SDGs 16-17 Peace, Justice and Strong Institutions and Partnerships:** sport offers a powerful communication platform to spread values such as respect, fair-play and teamwork. The global reach and universal character of sport make it a fundamental tool for pooling resources, creating synergies and creating multi-stakeholder networks and partnerships to foster sustainable development and the achievement of peace goals.

7.4. Sustainability of sport events in global context

In terms of sustainability, an important contribution is made by the organization and implementation of sporting events. Sporting events often consume significant resources and have a significant impact on the environment, involving aspects such as stadium construction, spectator influx management, carbon emissions, waste generation and much more.

According to a study by the United Nations Organization (UN Environment Emissions Gap Report), the sports sector produces between 1% and 2% of global greenhouse gas emissions. In some countries, including Italy, there is a positive trend in action to reduce these emissions.

An effective control and planning tool is given by the ESG (Environmental, Social and Governance) strategy, which is taking on an increasingly central role in the panorama of sporting events. Within sport events, this strategy refers to the

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approach taken by organizers to manage and integrate environmental, social and governance considerations into their activities and decisions. This approach aims to promote sustainability, social inclusion, accountability and transparency in the organization and conduct of sporting events. It includes actions such as reducing the environmental impact of events, promoting diversity and inclusion, protecting human rights, and improving corporate governance and ethics. ESG strategy is essential to ensure that sporting events are managed responsibly and sustainably, respecting the environment, the people and the communities involved.

Sport represents a privileged channel through which to act and communicate sustainability and it is precisely on this aspect that the medium and long-term plans of many sports organizations are focusing. The IOC (International Olympic Committee) and the United Nations share the goal of making the world a more peaceful and sustainable place. For the IOC, this means ensuring that sport plays a vital role in promoting education, peace, social inclusion and a healthy lifestyle. And when in 2015 sport was officially recognized as an important stimulator of sustainable development and was included in the United Nations 2030 Agenda, the IOC developed its strategy, placing Sustainability as one of the three pillars of the Olympic 2020 Agenda, together with Credibility and Youth. The Olympic Agenda 2020+5 is the new plan that regulates the next 5 years and adds some key trends to the five main areas (infrastructure and natural sites, procurement and management of resources, mobility, workforce and climate): Solidarity, Digitalization, Sustainability, Credibility, Economic and Financial Resilience. As the leader of the Olympic Movement, the IOC uses its influence to encourage the entire Olympic Movement – including National Olympic Committees, International Sports Federations and athletes – to make sport more sustainable.

The European Commission has also contributed to the debate on the subject, through recommendations on green and sustainable sport. The result of a shared work within the Expert Group on Green and Sustainable Sport created by the European Commission in conjunction with the provisions of the fourth EU Work Plan for Sport 2021-2024, of which the Department for Sport has been an integral part since 2021, the recommendations aim to understand the landscape of "green sports" within the EU and map the projects, existing initiatives and practices.

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7.5. European strategies in relation with sustainability

Aimed mainly at European and national public authorities responsible for sport and organizations in the sports sector, the recommendations are divided into 4 sections:

- Innovative cross-industry solutions;
- Sustainable sports infrastructure;
- Sustainable sporting events;
- Education and promotion of sustainable sports practices.

They represent a concrete common strategy aimed at encouraging the different actors operating in the world of sport to adopt measures, practices and actions that have a lower impact on the environment, supporting consumption, sustainable production and lifestyles that respect nature. The policies and actions of policymakers in EU Member States, international and national sports federations, professional and grassroots sports clubs, the fitness sector, the sporting goods industry, the sports tourism sector, but also consumers, leisure athletes and, finally, fans, have a significant impact on the climate and the environment.

Member States are invited to:

- developing national strategies for sustainable sport;
- make public funding to national governing bodies in the sports sector conditional on the achievement of sustainability objectives.

Sports organizations are invited to:

- establish the carbon footprint, i.e. the measure of the amount of greenhouse gas emissions released into the atmosphere by activities for one's sport;
- develop environmental sustainability plans as part of the development strategy of their sport.

The Commission's recommendations represent a clear picture of the strong desire of the sports world to act on issues related to environmental sustainability to which sport is also called upon to contribute and are consistent with the international and European standards of the Green Deal and the United Nations 2030 Agenda.

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In addition, the call for expressions of interest to take part in the Community of Practice on Green and Sustainable Sport SHARE 2.0 has been launched, whose members will work on the implementation of the recommendations of the Expert Group on Green Sport. This community will be open to all former members of the Group and all those interested in playing an active role in making sport more sustainable.

7.5.1. Sport for Climate Action initiative

The Sport for Climate Action initiative is another initiative towards environmental sustainability. Promoted in 2016 by the UNFCCC (United Nations Framework Convention on Climate Change) and other institutions to unite the efforts of the sports community towards environmental sustainability. The goal is to involve the world of sport in the fight against climate change, with a focus on reducing CO2 emissions and climate education, promoting sustainable and responsible consumption and encouraging concrete climate action through communication.

7.5.2. Possible solutions to make sports more sustainable for the environment

There are numerous start-ups and initiatives committed to making sports activities and practice increasingly carbon free. Let's see some of the possible innovations to alter the bio-physicality of the planet less and less.

For traditional sports that are already popular, there are multiple ways to increase their sustainability. The implementation of energy-efficient lighting systems in sports facilities, the use of recycled water to maintain playgrounds, and the promotion of recycling and waste reduction during sporting events are just some of the viable solutions.

Additionally, promoting local sporting events can significantly reduce the carbon footprint associated with travel. Encouraging the use of sustainable means of transport, such as bicycles and public transport, by spectators and athletes, further contributes to this goal.

The involvement of sports federations, athletes and fans is crucial to promoting a sports culture that values sustainability. Through collaboration, it is possible to develop initiatives that make sport not only a means of

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keeping individuals physically active but also a vehicle for environmental protection.

Technological advancement and sustainable innovation are opening up new avenues to make sports more environmentally friendly. Recycled and recyclable materials are becoming increasingly common in sports equipment, from clothing to accessories, reducing the ecological footprint of athletes.

7.5.3. Sustainable materials in focus

The use of eco-friendly materials to produce sports equipment is a fundamental step towards a more sustainable sport. Surfboards made from renewable materials, soccer balls made from recycled materials, and sportswear made from sustainable fibers are examples of how the sports industry is embracing sustainability.

The sustainable management of sporting events is another key area. This includes everything from reducing waste and water consumption to using renewable energy to power events. Carbon offset programs for major international sporting events are becoming increasingly common, helping to neutralize the environmental impact of such events.

Encouraging athletes and fans to use sustainable means of transport is essential. This can be achieved through offering affordable and efficient public transport options for sporting events, as well as promoting the use of cycling and walking as eco-friendly alternatives.

Education plays a crucial role in promoting more sustainable sport. Raising awareness among athletes, fans and organizers about the environmental impacts of sport and sustainable practices can spur significant change. Awareness campaigns and educational programs can encourage more responsible behavior and conscious choices among sports fans.

In conclusion, while we strive to make environmentally sustainable sports a widespread reality, success depends on collaboration between the sports industry, athletes, fans and communities. Through innovation, education and active participation, we can ensure that sport continues to bring joy and togetherness, while minimizing its impact on the environment.

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8. Gender Equality, Social Inclusion, and Injury Prevention in Young Athletes

8.1. Introduction

The development of young athletes is influenced by several factors, including their physical health, access to resources, and social environment. Ensuring gender equality and promoting social inclusion in youth sports is not only essential for fair participation but also plays a critical role in injury prevention. The physical differences, training opportunities, and access to injury prevention resources can vary greatly between young male and female athletes, and between athletes from different socioeconomic and cultural backgrounds. Addressing these disparities is essential to fostering an inclusive sporting environment where all young athletes are equally protected from injury risks.

8.2. Gender Differences and Injury Risk in Youth Sports

Gender plays a significant role in determining injury risks for young athletes. Biological differences between boys and girls—such as muscle strength, joint flexibility, and hormonal factors—can affect the types of injuries they experience and their susceptibility to certain injuries. For example, young female athletes are at a higher risk of developing anterior cruciate ligament (ACL) injuries compared to their male counterparts, particularly in sports that involve jumping and pivoting, such as soccer, basketball, and volleyball. This increased risk can be attributed to factors such as anatomical differences (e.g., wider hips leading to greater knee stress), hormonal fluctuations, and muscle imbalances.

Our project focuses on improving the technique of jumping and landing to minimize the risk of injury to the ankles and knees of young athletes. By correcting their jump mechanics, we aim to ensure safer landings and reduce stress on these vulnerable joints, ultimately promoting long-term physical health and injury prevention.

Despite these known differences, injury prevention programs are often not tailored to address the specific needs of young female athletes. This gap can result in higher rates of injuries among girls and young women, which not only affects their athletic performance but may also contribute to long-term health problems. An inclusive approach to injury prevention in youth sports must recognize these differences

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and provide gender-specific training and injury prevention programs that reduce the risk of common injuries in both boys and girls.

Moreover, gender inequality in access to sports resources, such as training facilities, qualified coaches, and medical care, can further increase injury risks for young female athletes. In many cases, girls' sports programs receive less funding and support than boys' programs, which limits their access to high-quality training and injury prevention resources. Addressing these disparities is essential to promoting gender equality and ensuring that all young athletes have equal protection from injury risks.

8.3. Social Inclusion and Injury Prevention

Social inclusion is equally critical in the context of injury prevention, as young athletes from marginalized communities often face higher risks of injury due to lack of access to adequate training, medical care, and injury prevention education. Children from low-income families, for example, may not have access to professional coaching, proper sports equipment, or facilities that are designed to minimize injury risks. These athletes may be more likely to participate in unsupervised or informal sports, where injury risks are higher due to inadequate safety measures.

Additionally, young athletes from underrepresented racial or ethnic groups may face cultural or language barriers that limit their access to injury prevention resources. For example, they may have less access to healthcare or rehabilitation services, and their coaches may lack the cultural competence to effectively communicate important injury prevention strategies. These factors increase the likelihood of preventable injuries among these athletes, perpetuating cycles of inequality in youth sports.

Athletes with disabilities also face unique injury risks that are often overlooked in mainstream sports programs. Adaptive sports programs that cater to the needs of athletes with disabilities are often underfunded and lack the necessary resources to prevent injuries. These athletes may also encounter social barriers, such as stigma or exclusion, which can discourage them from seeking proper medical care or injury prevention guidance.

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8.4. Inclusive Coaching and Its Role in Injury Prevention

Coaches play a crucial role in preventing injuries among young athletes, and their approach to inclusivity can significantly influence injury rates. Inclusive coaching focuses on understanding the individual needs of each athlete, considering factors such as gender, physical ability, and background when designing training programs. By adopting an inclusive approach, coaches can tailor injury prevention strategies to address the specific risks faced by different groups of athletes.

For young female athletes, this may involve incorporating strength training exercises that target muscle imbalances around the knees to reduce the risk of ACL injuries, as well as educating them about the importance of proper landing techniques and agility drills. For athletes from low-income or underrepresented communities, inclusive coaching might involve ensuring that they have access to affordable or donated equipment that meets safety standards, as well as providing injury prevention education in a culturally sensitive manner.

Moreover, inclusive coaching promotes open communication between coaches and athletes, which is vital for injury prevention. Athletes who feel valued and included are more likely to report injuries or discomfort early on, allowing coaches to address potential problems before they become more serious. This proactive approach can significantly reduce the risk of chronic injuries or long-term damage.

8.5. Access to Resources and Medical Care

Access to resources, including proper training facilities, equipment, and medical care, is essential for effective injury prevention. However, disparities in resource allocation often lead to unequal injury risks for different groups of young athletes. For example, girls' sports teams may have limited access to strength and conditioning programs, which are essential for preventing injuries like ACL tears. Similarly, athletes from low-income families may not have access to proper medical care, making it difficult to address injuries promptly and effectively.

To promote injury prevention and social inclusion, it is crucial to ensure that all young athletes, regardless of gender or socioeconomic background, have equal access to resources. Schools and sports organizations should invest in injury prevention programs that cater to the specific needs of different groups of athletes. This includes providing gender-specific injury prevention training, offering affordable healthcare options for low-income athletes.

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In addition, sports organizations should collaborate with healthcare providers to offer regular medical screenings and injury prevention education for all young athletes. These programs can help identify athletes who may be at higher risk of injury and provide them with the necessary resources to reduce these risks. For example, pre-season screening programs can assess an athlete's physical condition and identify muscle imbalances or weaknesses that may predispose them to injury. By addressing these issues early, coaches and healthcare professionals can develop personalized injury prevention plans for each athlete.

8.6. Proposed Strategies for Promoting Equality and Injury Prevention

To effectively promote gender equality, social inclusion, and injury prevention in youth sports, a multi-faceted approach is needed. First, there should be increased investment in injury prevention programs that are tailored to the needs of different groups of athletes. This includes gender-specific training programs for young male and female athletes, adaptive sports programs for athletes with disabilities, and affordable injury prevention resources for athletes from low-income families.

Second, schools and sports organizations should prioritize diversity and inclusion training for coaches, ensuring that they are equipped to address the unique injury prevention needs of all young athletes. Coaches should be trained in culturally competent communication, as well as in recognizing and addressing the specific injury risks associated with different gender and social groups.

Third, sports organizations should implement policies that ensure equal access to injury prevention resources for all young athletes. This includes providing funding for gender-specific programs, offering scholarships or financial assistance for low-income athletes, and ensuring that athletes with disabilities have access to adaptive equipment and facilities.

Finally, public awareness campaigns should be launched to highlight the importance of injury prevention in youth sports, with a focus on promoting gender equality and social inclusion. These campaigns can help challenge harmful stereotypes, promote positive attitudes toward diversity in sports, and encourage young athletes to prioritize their physical health and well-being.

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8.7. Conclusion

Promoting gender equality and social inclusion in youth sports is essential not only for fairness and equity but also for injury prevention. By addressing the unique injury risks faced by different groups of young athletes, we can create a safer and more inclusive sporting environment for all.

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