



How Technologies Impact Sports in the Digital Age

Sascha L. Schmidt

Abstract

Schmidt introduces the relationship between technology and sports in the digital age taking time to outline improvements to athletic performance, sports consumption, sports management, and governance. He also describes how technology drives the development of new sports and the enhancement of traditional sports. Finally, he outlines the process by which technologies were selected for the second edition of *21st Century Sports: How Technologies Will Change Sports in the Digital Age* as well as the structure and chapters of the book.

1 The Growing Business of Sports

In today's world, sports have become a vast industry that involves a multitude of sectors and markets, employing millions of people worldwide. With various sub-categories, it can be challenging to determine the precise size of the global sports industry. However, experts estimate that the sports industry contributes around 1% of the world's GDP when sports infrastructure, events, hospitality, training, and the manufacturing and retail of sports goods are considered (KPMG, 2016; Research & Markets, 2022). Despite the significant impact of the COVID-19 pandemic on the sports industry, it is gradually recovering; and its contribution to the world's GDP is expected to remain proportional (Beiderbeck et al., 2021).

Beyond money, sport helps businesses to generate emotions. Every year, billions of euros are invested worldwide to positively charge companies' brands, improve brand image, and emotionalize even functional products with the help of sport.

S. L. Schmidt (✉)
Center for Sports and Management, WHU—Otto Beisheim School of Management,
Vallendar, Germany
e-mail: sascha.schmidt@whu.edu

The increasing number of new and growing sporting mega-events worldwide, for example, led to a global sports sponsoring volume of USD 78 billion in 2022 (Research & Markets, 2022)—despite the COVID-19 pandemic.

With all the excitement for sports, however, we cannot neglect that, from a business perspective, sports is one of the most conservative industries on the planet. In a way, sports is designed for long-term stability—to preserve competitive balance and avoid winner-take-all and natural monopoly dynamics. Every athlete must have a chance to win. The worst scenario in sports is when one athlete or team wins all the time. This is even true for commercial leagues like the NBA, the NFL, the English Premier League, and the German Bundesliga. Integrating fast-moving tech ventures into sports can create tension due to the vastly different competitive dynamics of these two domains and disrupt, albeit temporarily, the competitive balance so important in sports.

Nevertheless, the sports industry is undergoing a period of rapid growth, driven by exciting new technological developments and the rise of data as the new currency in sports (Ratten, 2019). As data analytics continues to evolve, sports act as a proving ground or “laboratory” for new technologies (Michelman, 2019). This has given rise to a flourishing sports tech landscape, with 38 unicorns such as Animoca Brands, Fanatics, OneFootball, DraftKings, or Sorare leading the way. Experts predict that 2021 will be remembered as the year that SportsTech finally hit the big time, with the industry almost reaching the USD 12 billion investment milestone. Of that, more than 60% was invested in fan-focused solutions (Penkert & Malhotra, 2022), reflecting the growing importance of engaging with fans in new and innovative ways.

2 The Dynamic Sports–Technology Relationship

The pace of on-field and off-field innovation has accelerated with advances in hardware, software, and data analytics.

Professional sports have always benefitted from technology advancements. For example, F1 racing teams have used telemetry since the late 80s to record performances and determine—on the fly—the best car setup the pilot can use. A more modern example is the new high-tech domain of the modern America’s Cup; sailing, requires an intricate interplay of software, hardware, electronics, hydraulics, and human input.

Technology and sports have a dynamic relationship. Sports is a proving ground for new technologies and technologies are, at the same time, a major source of disruption in sports. The ways that sports is played by athletes, viewed by consumers, and monetized and regulated by management, are all being revolutionized by the deployment of technological innovations.¹

¹ For a view of sports through the lenses of athletes, consumers, and managers, see the SportsTech framework by Penkert and Malhotra (2019).

2.1 Technology Improves Athletic Performance

In the past, training and competition preparation were driven by intuitive practices; one followed the tried path without knowing exactly why. Nowadays, athletes—professional, amateur, or leisurely—are increasingly turning to new technologies to get the most out of their physical and mental capabilities and gain competitive advantage. Technologies fundamentally change the way they train and compete. Today, technologies used during sports activity include sensors and devices close to the body, wearables and performance tracking systems worn on the body, and smart pills and implants in the body (Düking et al., 2018). These technologies all aim to boost sportive performance by measuring and interpreting fitness, tactical, and technical data on an individual or team level to provide performance feedback and training guidance. They help athletes prevent and reduce the risk of injuries, to manage stress, and detect overloading. Most of these technologies are allowed prior to and after competition, but not during.

Technological influence is particularly observable in Paralympic competitions where a lot of innovation in sports aids, prostheses, and equipment is taking place. Many Paralympic athletes are dependent on technical aids to carry out their sport. So, innovation emerges here in the area of greatest need (von Hippel et al., 2011). The renowned futurologist Yuval Noah Harari expects new performance records to be set at the Paralympics rather than the Olympic Games. In his opinion, technical progress alone will decide when the time will come (Harari, 2016). In just a few years, the technological aids for handicapped athletes will advance to the point that prostheses or exosuits will provide Paralympic athletes with additional strength, stamina, and stability that facilitate better-than-human performance (Walsh et al., 2007).

In 2012, double amputee Oscar Pistorius of South Africa was the first athlete to compete in a track event of both Olympic and Paralympic Games. Therefore, it was not a surprise that two-time Paralympic long jump champion Markus Rehm, who has beaten able-bodied athletes at the international level for years, sought to compete in the Rio Olympic Games in 2016. Rehm's Olympic dream fell short, however, as he was unable to prove that his blades did not give him an advantage over able-bodied athletes. A critical challenge remains ensuring fairness for all athletes (Kyodo News, 2019).

The debate about acceptance of technical aids also has a history in able-bodied sports. In contrast to the Paralympic body, however, the Olympic body limits the use of technology to ensure fair competition. Ten years ago, for example, the International Swimming Federation started to establish boundaries for technology doping when it banned the shark-like swimsuit Speedo LZR Racer and its imitators after more than 130 world records fell in the 17 months after its introduction (Crouse, 2009). Similarly, the international governing body for athletics recently announced new regulations for running shoes to counter the rising influence of game-changing equipment on athletics (The Guardian, 2020).

Besides technologies that come into play on the pitch, there are numerous technologies that help improve sports off the pitch, i.e., to facilitate and improve the consumption and management of sport. These too we explore in this book.

2.2 Technology Improves Sport Consumption

New blockchain-based web3 technologies in combination with mixed reality and artificial intelligence improve the way people consume sports and enhance the experience for fans and spectators. For example, new technical solutions make different types of content available such as original video or editorial content, sports news, and game results via traditional media distribution and sports streaming platforms. More specifically, robot-controlled drones recording in 360° provide a richer view of sporting events for streaming. Technological advances also help to connect fans with their favorite stars, teams, and leagues—both to increase fan loyalty and to enhance their sports consumption experience (Chan-Olmsted & Xiao, 2019). For example, transaction platforms help ease the purchase of tickets to events or merchandise items and memorabilia. Social media technologies enable fans further to build networks and communities with others with similar sports interests.

Betting on sports and fantasy sports are recent drivers of fan engagement. It is now a sport of its own with multi-billion-dollar business. Emerging technologies provide assistance with betting real or play money on sports events and online games. Included in this category are platforms to place sports bets, support fantasy sports, game publishers, and sports prediction games to improve the player experience (Penkert & Malhotra, 2019).

2.3 Technology Improves Sports Management and Governance

Besides athlete performance and sports consumption, technological innovations improve the management of sports facilities, teams, associations, leagues, events, fitness studios, and media companies. Application technologies used for professional or amateur sports teams, clubs, and venues can increase the efficiency of operations and provide better experiences for sports consumers (Harrison & Bukstein, 2016). For instance, customized apps help teams or coaches find and recruit talent, in-stadium solutions facilitate operations, and still others provide tools for organizing tournaments, leagues, races, and other major sporting events (Parent & Chappelet, 2015). In addition, technical solutions can be intended for or related to the media, sponsor brands, and investors (Penkert & Malhotra, 2019). For example, we see emerging platforms such as Rallyme or Sporttotal that connect brands with teams and athletes and provide marketplaces for both to raise money directly from fans and benefactors.

Officiating is another important task improvable by the application of technology. The use of microphones and earpieces, tracking systems for off-side play,

goal-line technology, and video assistant refereeing emerged in professional sports in recent years. New assistance systems or laser curtains to aid referees' decision-making can help to further prevent human evaluation errors and reduce incorrect decisions on the pitch (Weisman, 2014). Once they have proven their reliability, automated refereeing, and scoring systems are likely to become more widespread (Beiderbeck et al. 2023).

2.4 Technology Enables New Classes of Athletes in Existing Competitions

Advances in new technologies present not only opportunities to enhance human athletic performance, but also to augment sports by enabling new classes of athletes, like machines, to compete in existing sports (Schmidt, 2018). Direct duels with machines ignite fascination. Machines can already play structured games with known rules.² In 1996, for example, the first man–machine duels in chess attracted a lot of public attention. When the computer Deep Blue challenged then-undisputed chess world champion, Garri Kasparov, it managed to beat the chess grandmaster in one of six games. Two decades after Kasparov's defeat in chess, 18-time world champion Lee Sedoll was outmatched in one out of five games against the AlphaGo machine in the Chinese board game Go. Artificial intelligence also defeated humans in games like Jeopardy, poker, and Dota 2, without being explicitly programmed to do so. These programs relied on machine learning to teach themselves the game, a testament to the remarkable potential of artificial intelligence technology.

There have also been interesting human–machine duels, where humans compete against each other indirectly by steering robots. RoboGames, for example, has already hosted competitions of robotic athletes in football, basketball, weightlifting, table tennis, and sumo wrestling (Kopacek, 2009). Moreover, the supporters of the RoboCup, a worldwide community of tens of thousands of members, pursue the vision of competing with a team of autonomous humanoid robots against the reigning football world champions—and winning by 2050.

While humans still compete against each other by steering robots in car racing, Formula E will soon no longer require human input. This is because the racing car series, built up in competition with Formula 1, will soon allow autonomous Roboracers to compete against each other. The first prototypes of these racecars are already undergoing promising tests on the track. The goal is to have different teams compete against each other with the same hardware. The competition, therefore, takes place in algorithm design. With the help of artificial intelligence that each

² Although chess players do not compete based on athletic prowess, the International Olympic Committee has acknowledged the sport-like properties inherent in chess and recognized chess as a sport.

team develops itself, the driverless racecars will compete on the asphalt at speeds of up to 300 km/h (Standaert & Jarvenpaa, 2016).

2.5 Technology Drives the Development of New Sports

Propelled by user innovation, it took about 30 years for extreme sports to become mainstream and suitable for a mass market (Hienerth, 2006; Hienerth et al., 2014). Today, besides improving and augmenting existing sports, emerging technologies can create new sports virtually overnight. The rise of esports from a small hobby to a huge billion-dollar industry is a clear demonstration of how technology can drive the development of sports. Newzoo (2022) forecast predicts that the revenue generated from esports will grow from 1.4 billion USD in 2022 to 1.9 billion USD in 2025.

Esports is a shining example of how technology is shaping the future of sports. The virtual environment of esports allows for exciting and innovative features that can't be found in traditional sports. And while esports is still relatively small—with only a few thousand professional gamers—its global audience has already surpassed a staggering 530 million in 2022 and is expected to grow to 641 million in 2025. This is due, in part, to the lingering effects of the COVID-19 pandemic and the rise of markets in Southeast Asia, Latin America, and the Middle East and Africa. It's not just a niche group either—esports fans are part of a massive community of 3 billion regular and casual video gamers worldwide.

According to industry experts, in the long term, video games could become by far the largest form of entertainment in the world and esport the largest sport on the planet—even bigger than football, in terms of the number of players and spectators and in terms of sales (Scholz, 2019). Adding esports to the Olympic Games seems to be rather a question of time. For example, esports were officially added to the Asian Games in 2022 and the International Olympic Committee initiated an esports competition in March 2023.

Other sports, such as drone racing, have grown in recent years from a backyard hobby to a sport with international leagues, professional competitions, and a growing fan base. Similar to esports, overnight, ordinary people became superstars of the drone racing scene. Semi- and fully automated drone racing is on its way to becoming a serious (Jung et al., 2018) noteworthy sport discipline competing with traditional sports for the attention of the global audience. Drone racing allows the human body and mind to compete like never before and fly with unparalleled speed and agility. The past couple of years has seen a surge in the appeal of drone racing, particularly during the pandemic. With the advent of advanced and high-speed drones, coupled with increased investments in flight tech research, the industry has witnessed an upward trend. The emergence of racing leagues and more events has further propelled this growth on a global scale. According to Polaris Market Research (2022), the current worth of the worldwide racing drone market stands at a whopping USD 798 million in 2022, and there are predictions that it will continue to flourish at a promising CAGR of 21% over the next decade.

Finally, there are new sports that you may not have heard of—yet—like Speedgate. This live-action sport was created with the help of artificial intelligence. Deep-learning algorithms analyzed data from more than 400 different sports, 7,300 sports rules, and 10,000 sports brand images to create it. Speedgate includes elements of rugby, soccer, and croquet. Six-player teams kick or pass a ball up and down a 180-by-60-foot field with three gates (one at the center and one at each end). The object is to score points by kicking the ball through one of the end gates (Ha, 2020).

3 Emerging Technologies Will Shape the Future of Sports

The purpose of this book is not only to evaluate emerging technologies regarding their impact on sports in the next five to ten years, but also to take a broad look into the future of sports 20 or even 30 years ahead and to think about *unknown unknowns*. Doing so, we gain familiarity with and examine how new technologies will change sport itself, consumer behavior, and existing business models. Instead of applying a systematic technology forecasting (Cetron, 1970), scanning (Van Wyk, 1997), or road-mapping approach (Phaal et al., 2004; Walsh, 2003), we take an exploratory approach that allows us to more creatively gain insight on our subject (Reiter, 2017). Although we can give some indication as to why, how, and when emerging technologies will impact sports, the exploratory findings of the book are not immediately useful for decision-making by themselves. They serve to identify technologies, trends, and developments early on and to raise attention to the opportunities and threats associated with them.

3.1 Selection of Emerging Technologies Relevant to Sports

To select the most relevant technologies for the future of sports in the digital age, we first looked at technology forecasting reports and studies. There are a number of established market research and intelligence firms, tech blogs, and platforms (for example, Gartner, CB Insights, ZDNet, and TechCrunch amongst others) in technology forecasting, scanning, and road mapping. They have all developed tools and methods to analyze millions of data points on venture capital, startups, patents, partnerships, and news mentions to predict which emerging technologies will experience breakthroughs and develop their full potential; they also predict technology timelines. For instance, every year US market researcher Gartner examines new emerging technologies and arranges them on what they call the *Emerging Technologies Hype Cycle*. We took their Hype Cycle for 2017, 2018, and 2019 (Gartner,) as a basis to select the most relevant emerging technologies for the first edition of the book (Schmidt, 2020). We focused on technologies that seem likely to be disruptive, whose full potential will be reached in five to ten years, and for which there are early use cases in sports. From the 35 technologies of the Hype Cycle, we have selected only those technologies that will be particularly relevant

to the sport of the future. Scholars and practitioners were then invited to write a chapter outlining their predictions for the selected technologies in sport. In the second edition of our book, we delved into the latest Gartner *Emerging Technologies Hype Cycle* and compared it to previous years' data (Gartner, 2022). We found that immersive technologies like metaverse, non-fungible tokens (NFTs), and web3 are gaining increasing importance. These cutting-edge technologies provide new avenues for fans to engage and expand user experiences into virtual worlds and digital currencies, potentially leading to new revenue streams. However, it's important to note that these technologies are interconnected, with artificial intelligence, blockchain, and web3 all intertwined. That's why we have included essays that explore these fascinating technological innovations and their convergence.

3.2 Book Structure

We have organized this book into six sections: an introductory section, three sections on technologies, a section on technology convergence, and an outlook section.

I. Introduction. Beyond this chapter, in which we introduce our thinking and the structure of the book, we dedicate this section to capture the emergence of the sportstech industry and its current state. Nicolas Frevel, Sascha L. Schmidt, Daniel Beiderbeck, Benjamin Penkert, and Brian Subirana propose a “Taxonomy of Sportstech” to provide an all-encompassing structure of technology use from the athlete, consumer, and management point of view.

Next, Sanjay Sarma, Brian Subirana, and Nicolas Frevel discuss in “How Thesis Driven Innovation Radars Could Benefit the Sports Industry” how sports organizations and their management can benefit from a systematic approach to handling emerging technologies in sports. In doing so, they make the case for the application of *Thesis Driven Innovation Radars*.

Finally, Sascha L. Schmidt, Daniel Beiderbeck, and Heiko von der Gracht discuss in “How to Predict the Future of Sports” whether and how the future of sports can be predicted, and which scientific tools and measures exist to foresee the impact of technology on sports in the digital age. They discuss the pros and cons of popular quantitative vs. qualitative forecasting methods. Finally, they outline how to apply the Delphi method and provide empirical results from a number of future studies in sports.

II. Physical technologies. The first technology category is mostly about hardware. It includes advanced materials, robotics, sensors, devices, fibers, textiles, coatings, composites, nutraceuticals, biomedical engineering, etc. All these technologies play a key role in capturing data. Five chapters make up this section; we introduce them each in turn.

Josh Siegel and Daniel Morris explore in “Robotics, Automation, and the Future of Sports” the growing influence of robotics and automation on sports and potential resultant future states including new models for spectator experience. They

consider how robotics and automation create opportunities for improved athlete training and detail how robotics and automation have augmented sports to date by allowing new athletes to compete creating new sports and providing a playing field for intellectual athletes.

Frank Kirchner explores in “Robotics and AI: How technology may Change the Way We Shape Our Bodies and What This Does to the Mind” the possibilities of some of the most recent developments in robotics and artificial intelligence to shape the future of physical activity and the effect this may have on both the body and the mind. He provides existing examples as well as future possibilities for robots as athletes, robots as trainers and teachers, and robots as human athletic opponents and therapists. Kirchner concludes with possible effects on the human body and mind if mankind enters extensive physical interaction with intelligent machines.

Martin U. Schlegel and Craig Hill explore in “The Reach of Sports Technologies” the use of sports technologies in order to provide the basis for validation, transfer, and diffusion of knowledge into fitness, wellness, and health, as well as occupational health, safety, and defense. They explain how sports technologies impact multiple verticals including insurance, stadium setup and maintenance, and broadcasting. Finally, they explore the challenges presented by the use of sports technologies including the barriers to open standards, security, and privacy.

Daniel Beiderbeck, Harry Krüger, and Tim Minshall highlight in “The Future of Additive Manufacturing in Sports” the present and projected impact of additive manufacturing technologies on the sports ecosystem. They describe the advantages of additive manufacturing and outline the benefits for the sports industry. They also illustrate how the interplay between additive manufacturing and technological advancement in other fields like artificial intelligence, sensor technology, and robotics can create new products and business models.

Finally, Dietmar W. Hutmacher offers in “The Current State and Future of Regenerative Sports Medicine” an overview of the progression of currently available regenerative treatment concepts and a summary of the different modalities of available and potential treatments. Finally, he offers a critical, though visionary, view on how regenerative sports medicine technologies may lead to new treatment concepts and increasing engagement of both sports’ injury patients and physicians.

III. Information processing technologies. This technology category is mostly concerned with data handling and information processing. It includes technologies in the realm of big data, advanced analytics, artificial intelligence, blockchain, machine learning, quantum computing, etc. Five chapters make up this section; we introduce them each in turn.

First, Benno Torgler examines in “Big Data, Artificial Intelligence, and Quantum Computing in Sports” the exciting possibilities promised for sports by technologies like big data, artificial intelligence, and quantum computing. He concludes that together and separately, the technologies’ capacity for more precise data collection and analysis can enhance sports-related decision-making and increase organization performance in many areas.

Christina Chase argues in “The Data Revolution: Cloud Computing, Artificial Intelligence, and Machine Learning in the Future of Sports” that data is the currency by which competitive advantage is won and lost. Those who find creative ways to unlock and harness it—largely through the employment of artificial intelligence, machine learning, and cloud computing—will be the champions of tomorrow.

Michael Bartl and Johann Füller introduce and explore in “The Rise of Emotion Artificial Intelligence: Decoding Flow Experiences in Sports” emotion-based artificial intelligence, which they argue has the potential not only to radically change the way sports are trained, but also how sport is experienced and consumed. Their chapter illustrates how affective states can be measured with the help of artificial intelligence and how the provided analytics may impact the sports experience.

Sandy Khaund gives in “Blockchain: From Fintech to the Future of Sport” an explanation of the oft-spoken-about, but little-understood blockchain technology. He then walks the reader through likely applications of blockchain technology on and off the sporting field taking time to outline the revolutionary power of smart contracts for athlete compensation, gambling, and even broadcasting contracts.

Martin Carlsson-Wall and Brianna Newland survey in “Blockchain, Sport, and Navigating the Sportstech Dilemma” the current blockchain tech landscape in sport and introduce the sportstech dilemma. To guide companies navigating this dilemma, they propose three strategic questions concerning the level of integration into the sports ecosystem, the potential for a hybrid business model, and the geographic footprint. Finally, they look further into the future and see unexpected possibilities for blockchain in sports.

Jason Potts, Stuart Thomas, and Kieran Tierney consider sport as an economy and the impact of innovation, blockchain technology, and its applications, on truth and trust in sports and business models and opportunities. In “Blockchain Innovation in Sports Economies” they discuss blockchains’ potential applications in sports—NFTs, DAOs, and web3 chief among them. Finally, with blockchain technology as their new foundation, they imagine the future of sports economies.

IV. Human interaction technologies. This technology category is mainly about human interaction. It plays a particularly important role in, e.g., in fan engagement with technologies such as virtual reality, augmented reality, mixed reality, extended reality, voice, and mobile technologies in general. Three chapters make up this section; we introduce them each in turn.

Ben Shields and Irving Rein argue in “Strategies to Reimagine the Stadium Experience” that the in-stadium sports experience is important and worth fighting for, despite the challenges presented by seemingly limitless sports and entertainment options, increasing ticket costs, and transportation issues. To persuade fans to spend their time and money attending sporting events, they contend that sports organizations will need to rethink their conception of the stadium and offer four strategies to do so including leveraging new technology like augmented reality and virtual reality.

Andy Miah, Alex Fenton, and Simon Chadwick consider in “Virtual Reality and Sports: The Rise of Mixed, Augmented, Immersive, and Esports Experiences” how virtual reality, augmented reality, mixed reality, and extended reality are being integrated into the sports industry. They focus on how new, digitally immersive sports experiences transform the athletic experience for participants and audiences and create new kinds of experiences that, in turn, transform the sporting world.

Dominik Schreyer discusses in “How Technologies Might Change the European Football Spectators’ Role in the Digital Age” whether ever-expanding the seat supply in football clubs will ultimately be sustainable. He questions how technologies might change the European football spectators’ role in the digital age, specifically focusing on the potential role of augmented and virtual reality in shaping the stadium experience in 2040. In all, he outlines ten projections, painting a future scenario indicating the European football spectators’ loss of significance.

Finally, Johanna Pirker demonstrates in “Video Games, Technology, and Sport: The Future is Interactive, Immersive, and Adaptive” how video game events and streaming experiences offer interesting new ways of interaction between the viewer and the player or the viewer and the game. She reasons that traditional sports can follow successful strategies like these. In addition, she shows how virtual reality, head-mounted-displays, and augmented reality devices are opening new avenues for the future of spectator experience in sports.

V. Technology convergence. The lines between the different technology categories are becoming increasingly blurred due to the convergence of technologies. AI, blockchain, and web3 technologies are all merging into a new realm called the metaverse. This exciting new space is helping to create a virtual universe, where we are building a new civilization. The foundation of this 3D internet is gaming, and major publishers such as Microsoft’s Activision Blizzard, Riot Games, Tencent Games, and Valve are leading the way. These companies have created their own ecosystems with their own rules and governance, and the same principles apply to the architects of the new virtual universe. As the world continues to be captivated by the rise of immersive technologies and the intermingling of data processing technologies with human interaction technologies, we felt compelled to expand our book with a new section dedicated to exploring the exciting phenomenon of technology convergence.

In “Sports in the Third Connected Age,” Rishad Tobaccowala looks back on how sports were impacted by the first two connected ages and forward to the key changes expected to sports fan experience, the monetization of sports, and the nature of sports in the Third Connected Age. He also explores the implications and ramifications of this new age for sports leaders. Finally, he outlines three key steps for future success: changing thinking, investing in education, and focusing on partnerships.

In his chapter, “Navigating the web3 Landscape: a Forward-Looking Perspective on the Future of Sports Business for Athletes, Consumers, and Management,” Amir Raveh introduces and emphasizes the importance of GenAlpha in guiding decision-making and dives into the fundamentals of web3 technology and

its potential applications for community building in the sports business. Finally, he discusses the impact of web3 technology on sports consumption, athletes, and management, as well as its potential for growth in the global sports technology startup scene.

In “Imagining the Future of Fandom,” Shelly Palmer discusses how fans would attend a sporting event or concert if there were no technical or financial constraints. He elaborates on what “attending” might mean by painting a picture of a future in which fans have access to the data coaches during the game and digital twins of their game-worn collectibles in a virtual world. Also possible in this future, star players might appear to fans as full-motion holograms, avatars, or synthetic humans.

VI. Outlook. In this final section, we offer a potential view of the technology-driven future aided by “Impossible Sports” by Brian Subirana and Jordi Laguarda. To illustrate how technologies will shape future sports, they explore an imaginary future following a fictional character and her family through a day in their lives. They highlight potential applications of technologies in the fields of the Internet of Things, robotics and automation, information processing, communications, and legal programming in new sports.

Finally, in “Beyond 2030: What Sports Will Look Like for the Athletes, Consumers and Managers,” Katsume Stoneham and I pick up the reins once again to investigate a more distant future and, with the help of our authors, discuss how technology will influence sports up to 30 years from now. We explore this far-out future from three perspectives: the athlete, the consumer, and the manager. In the end, we even dare to think beyond this 30-year mark in sports and the upcoming opportunities and threats presented by technology.

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Sascha L. Schmidt is Director of the Center for Sports and Management and Professor for Sports and Management at WHU—Otto Beisheim School of Management in Dusseldorf. In addition, he is lecturer at the Massachusetts Institute of Technology (MIT) Sports Entrepreneurship Bootcamp, a member of the Digital Initiative at Harvard Business School (HBS), and co-author of various sports-related HBS case studies. Earlier in his career, he worked at McKinsey & Company in Zurich, New York, and Johannesburg, and led the build-up of the personnel agency a-connect in Germany. His research and writings have focused on growth and diversification strategies as well as future preparedness in professional sports. He is a widely published author and works as an advisor for renowned professional football clubs, sports associations, and international companies on corporate strategy, diversification, innovation, and governance issues. Sascha believes in the transformative power of technology in sports and hopes that the second edition of this book can contribute to a better understanding of the interrelations between sports, business, and technology. A former competitive tennis player, Sascha now runs and hits the gym with his three boys. Watching them, he is excited to see what the next generation of athletes will achieve.

The universality of sport reflects its evolutionary origins—human self-defense and survival mechanisms that provided a way to develop and practice hunting skills or warfare (Lombardo, 2012). These formed the basis for a competitive sport that has evoked deep emotional involvement in both ancient and modern times. Traditionally, athletes tested the limits of the human body, mind, and spirit. They have the desire to outwit or otherwise outperform their competitors, achieve top performances, break records, and be the best.