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The Application of Sports Technology and Sports Data for Commercial Purposes

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Additional information is available at the end of the chapter

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Abstract

Contemporary professional football (and sports) entities have embraced technology and data to boost sporting quality. However, this development has gone beyond the playing field as technology and data also start to play a larger role in improving business performances in the football (sports) industry. This chapter looks into how technology and data in the form of sports tracking systems, cf. based on (but not totally limited to) the case of the ZXY sports tracking system, are capable of helping to translate improved sporting performances into enhanced business performances. The intensified commercialization in football from technology and data takes fandom to new heights and bring about new revenue generating opportunities. However, harnessing the increased amounts of data is associated with technical challenges and financial and human resource constraints. In some instances, the context of applying 'big data' in football is still premature. Therefore, the technology and data implementation in professional football needs to undergo a qualification process to secure that the applied data co-exists with a context of competent knowledge-sharing, individual and organizational learning in order to positively develop sporting and business performances.

Keywords: football, soccer, big data, commercialization, technology, sporting performance, business of sports, fandom, sponsorship, sport experiences

1. Introduction

Sports technology and sports data have become integral parts of sports development and performances [1–4]. As seen in relation to how technology and data play a role in improving player development and sporting performances, the business side of sports has also embraced the upsides of technology and data analytics [5]. The purpose of this research is to study the

application of sports technology and sports data from the ‘sporting side of sports’, e.g., data from sports tracking systems. In doing so, focus is primarily on football (soccer in the US) but the study also integrates relevant perspectives from this context associated with other sports. In addition to ‘the sport of sports’, the study discusses how sports technology and sports data act as a commercial vehicle, which can guide and drive content production for a sports property’s commercial stakeholders in the ‘business side of sports’, e.g., fans, sponsors and the media.

2. Methodology

This chapter is based on case study methodology [6–11], in which the case of the ZXY sports tracking system is the focal point. The chapter also includes data regarding other tracking systems than ZXY for a broader discussion and understanding of the context of sports tracking and how that influences sports, e.g., sporting and business aspects. The chapter involves critical methodological reflections and takes the commercialization and professionalization of the football economy into consideration as vital contextual factors, i.e., incorporating the application of technology and data in relation to sporting performance as well as business performance in professional football (sports). The case study applies an in-depth qualitative approach, which encompasses the dynamic context in which sporting actions and experiences take place [12]. Hence, research cannot be isolated from time and context [13]. The relevance of the case study is grounded in the methodology and its qualitative nature, i.e., based on two semi-structured focus groups and one semi-structured face-to-face interview. The qualitative foundation bridges a knowledge gap in sport management research as this case study goes beyond the explanation of statistics to investigate and understand a dynamic sports context at a time where technology and data are on the rise.

2.1. Case description

The ZXY sports tracking system was originally developed in Norway by ZXY Sport Tracking AS. The system went through a development process in collaboration with Norwegian Olympic Sport, the Norwegian top football club Rosenborg Ballklub and Radionor Communications. The method to develop the data measurement has its roots in technology linked to military radio signals [14]. The first generation of the system was released in 2007 and tested by the collaborative partners. The second generation of the system saw its release in 2012 in relation to a project with the Dutch football powerhouse Ajax Amsterdam. In 2014, the Danish top club FC Midtjylland, which is known around the international football landscape for its strategic data analytics approach [15, 16], invested highly in the ZXY system in order to enhance its sporting decision-making processes [17] and thus to elevate the quality of the club’s cohesion between sporting and business performances.

In 2014, the American corporation ChyronHego bought ZXY. ChyronHego works on a global scale on broadcast graphics creation, layout and real-time data visualization [18] and found increased opportunities to develop a stronger and more applicable product by combining ZXY’s very precise¹ sets of data with ChyronHego’s existing tracking system Tracab. The latter already

¹According to ChyronHego, ZXY provides coaches and sports scientists with “the most accurate and repeatable set of performance metrics for any type of Electronic Performance and Tracking System (EPTS) on the market” [19].

functioned as an established part of many football clubs and leagues. In practice, the ZXY solution works by players carrying a belt around their waistline, e.g., incorporated in their shorts. The belt is ultra-light to show regard to the players' functionality. The system incorporated in the belt sends data to the radio receivers, which are installed in the venue or at the training facility (as the system is functional for game as well as training situations). The quality of the data transmission is enhanced by the fact that data transmission takes place 20 times per second². The data pool becomes available through the operation of ZXY's software, which is accessible via an online web site or an app designed specifically to process and present the data (**Photo 1**).

The user experience is adaptable by allowing physical trainers or other specialist staff at clubs, leagues and federations to determine what to measure and how to apply and present the measurements. Additionally, the system is able to incorporate the use of video cameras to increase the focus on players. Personalized video measurements provide data synchronized in time from body sensors combined with position sensors in the venue or at the training facility. The following are examples of data provided (**Figure 1**):

- Positional updates at least 20 times per second (=20 Hz).
- Distance in relation to different types of movement, e.g., jogging, ordinary running, high intensity running, or sprinting.
- Acceleration vs. deceleration.
- Performance index, e.g., total vs. under acceleration or deceleration.
- Frequency of steps.
- Speed of turning.
- What direction does the player face (e.g., heading).
- Run characteristics (offensive or defensive).
- Heart rate.



Photo 1. An illustration of the ZXY sports tracking system installed at a football stadium [14].

²The ZXY Arena system can be configured to operate with different report rates. The most used is 20 Hz but a 100 Hz setting is also available. Each transponder can be configured independently and dynamically over the wireless control link, which means that if it is raised to special requirements to have a high-resolution sampling, the system user can assign 100 Hz to this user(s).

Play creation Won passes Lost passes Long passes Short passes Dribbling Assists Crosses	Ball possession Won dribbling Lost dribbling	Defensive actions Won tackles Lost tackles Blocked shots Blocked crosses Blocked passes Clearances Ball recoveries
Strategy plays Corners 'Short' Corners Side fouls Direct free kick Direct free kick to goal Won Throw-ins Lost Throw-ins	Shots Goals Shots to goal Shots out of goal Shots blocked Head shots to goal Head shots out of goal	Goalkeepers Saved balls Punches Non-blocked balls Won keeper sweeper Lost keeper sweeper

Figure 1. Examples of measurement functions of Tracab as a position sensor system.

Figure 2 below illustrates the added value and functionality from combining Tracab’s position sensor system and ZXY’s body sensor system. The combination of the two technologies helps to automate Tracab as the ZXY system constantly and precisely knows the position of the player on the playing field.

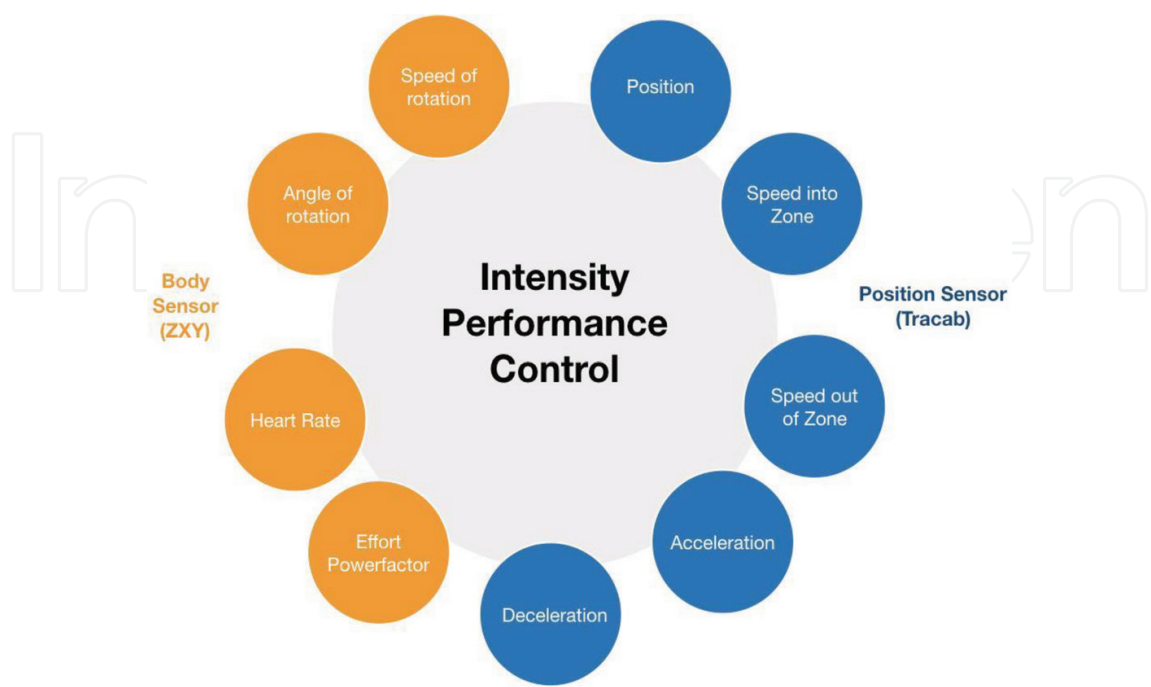


Figure 2. Value creation from combining Tracab and ZXY technologies [14].

2.2. Research design and data collection

A qualitative methodology was selected as the most applicable practice to explore the experiences and understanding of the meaning related to technology and data in sport [20, 21]. The chosen data collection method is 'interviewing' in the form of two semi-structured focus groups and one semi-structured face-to-face interview.

In validating the results of the interviews, it is essential to critically reflect over the fact that it may be challenging to 'generalize' the findings of a case study in a larger sport management context [22]. Nevertheless, the purposively selected sampling process [23, 24] in this instrumental case study³ is chosen to enhance the context-specific validity of the findings and thus to expand the interest for and application of the results within the context of technology and data in sports beyond the case of ZXY. However, the intention of this research is to emphasize a paradigm shift in research methodology, which stresses the shift from 'generalization' to 'contextualization' under the premises that knowledge is heterogeneous and contextual rather than universal or individually unique [22]. Therefore, the metatheoretical nature of this research takes a stance associated with scientific traditions from pragmatism [25] and symbolic interactionism [26, 27] to explore the experiences, thoughts and meanings of the respondents regarding the application of technology and data in a context of sports and in particular football. The purposive selection of respondents is influenced by the reasoning that these respondents have complementary competences while possessing relevant and applicable contextual, professional and/or educational experience from the football industry.

The respondents from focus group 1 are listed below (anonymous) in **Table 1**.

The respondents from focus group 2 are listed below (anonymous) in **Table 2**.

The respondent from the semi-structured face-to-face interview is listed below (not anonymous) in **Table 3**.

The qualitative design of this research provides insights from experienced industry professionals in the form of their experiences from utilizing technology and data to improve sporting performances and to enhance commercialization in football. This supports the chapter's production of relevant meaning and realm of understanding in order to inductively construct new suggestions for how to advance and boost the application of technology and data in the form of sports tracking to improve sporting and business performance in football. So, the aim is to let the data speak for themselves, but to do so while systematically, critically and contextually analyzing and interpreting the data. Grounded theory and qualitative open coding are used to analyze the transcribed interview data based on analysis, study, comparison, conceptualization, and categorization of the data [22, 28]. The two focus group interviews were completed in the same venue to accommodate a constructive interaction between all respondents, which is significant for new idea generation and to illustrate meanings and experiences of respondents. The interpretivist research paradigm emphasizes the importance that the coding and data analysis is grounded in context-relevant literature, theories, knowledge

³The instrumental case study reflects the purpose of gaining more insights in the general question of how applying technology and data based on tracking systems in sports can enhance sporting and business performances in the context of sports [22].

Gender of respondent	Occupation of respondent
Respondent 1a: Male	Marketing Manager, professional football club with domestic championship and FA Cup titles, including participation in UEFA Champions League and UEFA Europa League competitions
Respondent 1b: Male	CEO, sponsorship agency
Respondent 1c: Male	Venue Data Coordinator, UEFA
Respondent 1d: Female	Commercial Director, national football association
Respondent 1e: Male	CEO & Founder, betting company and football media platforms

Table 1. Overview of the respondents from focus group 1.

Gender of respondent	Occupation of respondent
Respondent 2a: Male	Digital Manager, professional football league
Respondent 2b: Male	Lawyer & Head of Research, fantasy sports platform
Respondent 2c: Male	Partner, sports marketing, branding and communication agency
Respondent 2d: Male	Sociologist, university and IT sector
Respondent 2e: Male	Digital Manager, national football association
Respondent 2f: Male	CEO, investment company

Table 2. Overview of the respondents from focus group 2.

Name and gender of respondent	Occupation of respondent
William Spearman, Male	<p>Currently the Lead Data Scientist, Liverpool FC and former occupation as Senior Data Scientist, Hudl (a technology and data company specialized in sports performance analysis in sport). Spearman specializes in using tracking data in football to understand passing, open space and scoring opportunities.</p> <p>After completing a Ph.D. from Harvard University in physics and inspired by working with tracking data from the English Premier League, Spearman developed a pitch control model, which was presented at the 2016 Opta Pro Forum.</p>

Table 3. Overview of respondent from the semi-structured face-to-face interview.

and professional experiences and competences. The intent is to create a knowledge-producing process associated with the capability to contextualize and recontextualize a context of technology and data application concerning sporting and business performance improvements in professional football (and other sports). In that regard, the chapter’s discussions are influenced and guided by the methodological stance and the empirical data. Therefore, the discussions are not covering the application of technology and data from a holistic angle; this is a reflection

of the fact that many different metrics drive decision-making in football. For instance, there is a difference between the tradeoff between a risky pass versus the consequences of losing possession versus the potential benefit of a scoring chance that may be created just to mention a few focal points from decision-makers in the world of football. The point in this chapter is to illustrate that the use of technology and data may improve on-field performance assessment in football (and sports) and this may also have positive spill-over effects on the sport organization's business performance.

3. Setting the stage: connecting sport, business, data and technology

Today, professional sports are characterized by the search for new paths concerning how an athlete or a team may apply new technologies and sports performance data to gain the cutting-edge competitive ability that will elevate them to the top of the podium or to win major league or championship titles [29–31]. Therefore, professional sports properties are left with massive data pools that (without giving away competitive sporting advantages) can be utilized to assist athletes and teams in monetizing on their relationships with commercial stakeholders. In reflections over why the application of technology and data is important in sports, there are clear benefits in terms of optimizing decision-making processes on and off the playing field and thus sporting quality. William Spearman notes that *"It's been a way for intelligent teams to gain a competitive advantage to be able to use perhaps less money, less resources but still have a competitive team."*

There is no doubt that the application of technology and data is beneficial in professional sports. Kerr and Gladden [32] argue that connected technological environments to some extent provide an open-source approach for sports teams to interact with their stakeholders. For instance, this may take place via mobile apps of the teams as suggested by Watkins and Lewis [33]. Reasons to go in that direction are clear. One practical example is the current Danish football champions FC Midtjylland that invested in an app solution in 2017 to boost engagement with fans. The idea was to bring fans closer to the club and to produce good fan experiences by providing fans with exclusive news and better insights about the players and their performances. The financial situation of professional sports teams is boosted by good sporting performances. Better sporting performances may be supported by technology and data and can help to enhance the entire business model and the backing from fans and other stakeholders in relation to revenue generation from various sources [34], e.g., ticket sales, broadcasting contracts, merchandise sales, good sponsorship activation and the increased value of fan engaging content production. Couvelaere and Richelieu [35] consider the importance of sports teams engaging themselves in a way that is synergistic with the lives of their fans in order to bring the brand of the team to life by letting fans live it. Now, years have passed since the publication of their scientific article. Therefore, it serves a purpose to acknowledge the growing weight of technology and data on people's lives and in sports [33], which provides a good grounding for putting additional focus on this intersection as highly identified fans show likeliness to engage with teams, athletes, and other sporting stakeholders via online and digital platforms to gain more in-depth information [36].

4. Sporting performance

Technology and data have become manifested elements of professional sports in the hunt for enhanced and elevated performance platforms. Additionally, their application reaches beyond that of professional sports and even targets fans and consumers outside the spotlighted playing fields in professional sports. In the aftermath of this development, actors in the professional sports industry underline the importance of technology and data as being directly associated with winning titles. However, the vital role of technology and data in influencing sporting performances is clear but there is reasonable meaning in acknowledging that technology and data are only tools and not a universal quick fix to performance challenges in professional sports. Consequently, technology and data do not solve cultural problem areas in sports. For instance, such complexity is apparent in the management of professional team sports and one may similarly argue that the same difficulties exist in professional individual sports, e.g., tennis or golf, in which the professional athletes are supported by an entire team of physical therapists, coaches, fitness trainers, etc. Yet, the point of this discussion is that technology and data may support decision-making although not being the solution in their isolated capability. Spearman notes that *“So with MLB baseball or basketball, it’s been a way for intelligent teams to gain a competitive advantage to be able to use perhaps less money, less resources but still have a competitive team that performs at a level that either supersedes their talent level or perhaps even changes the game a bit in terms of prioritizing maybe certain skill sets that are currently undervalued but can be used as much as another skill set that might cost more when trading for or transferring for a player or paying a player.”* Managing performances on the sporting field or in the business of sports is a dynamic and complex phenomenon. Spearman’s comment highlights the additional complexity, which is evident in and between the two spheres of sports, i.e., sporting and business performances. The cohesion was portrayed in Michael Lewis’ book *Moneyball—The Art of Winning an Unfair Game* about how the Oakland A’s MLB baseball team utilized systematic data in the form of ‘qualified’ statistics, e.g., ‘sabermetrics’ and thus scientific methodology, to gain competitive advantage in managing the team’s sporting performances and thus also managing and influencing its business performances. In the book, Lewis cites the team’s General Manager Billy Beane: *“There was no simple way to approach the problem that Billy Beane was trying to solve. It read like an extra credit question on an algebra quiz: You have \$40 million to spend on twenty-five baseball players. Your opponent has already spent \$126 million on its own twenty-five players, and holds perhaps another \$100 million in reserve. What do you do with your forty million to avoid humiliating defeat? ‘What you don’t do,’ said Billy, ‘is what the Yankees do. If we do what the Yankees do, we lose every time because they’re doing it with three times more money than we are.’ A poor team couldn’t afford to go out shopping for big league stars in the prime of their careers. It couldn’t even afford to go out and buy averagely priced players.”* ([37], p. 119). As pointed out, sports organizations may benefit from theoretical grounding and scientific methods to understand and influence sporting performances positively and thus to enhance business performance as a derived effect. For instance, the transfer of players is a function of this in that it provides positive or negative transformation on the sport organization’s on- and off-field performances [38]. So, science and knowledge create the platform for understanding

but as demonstrated in the 'Moneyball' example and by Blumer [27], p. 143, "*Theory is of value in empirical science only to the extent to which it connects fruitfully with the empirical world.*"

This illustrates the value of technology and data in lifting sporting performances, but with the hint that sporting tracking and positional data must be 'qualified' to be applied intelligently and effectively in order to positively reinforce sporting performances in practice. For instance, it holds essential meaning that the application of technology and data is based on a solid understanding of the interplay between various contextual factors and the importance of timing when executing performance-based decisions, e.g., the technical and tactical capabilities of the individual players in contrast to the team's tactical game plan, the strength and weaknesses of the opponent or the fact that the coach has only a short window to receive, interpret and execute on data during the game. It is imperative to have a platform of knowledge before decisions are made. This knowledge is often mixed with intuition and passion, e.g., from a coach, in reality in professional sports, which helps to determine the perception of decision-making and therefore adds an extra complexity level in dealing with the intersection between technology, data and sports.

From a critical perspective, the quality of the application of technology and data in professional sports is also subject to bias as there is always a person behind the data. Therefore, applying technology and data may sometimes risk being subject to what Vamplew [39] coins as 'reverse research' in which sport organizations know the desired conclusions beforehand and aim for evidence that will back these conclusions or look to apply conclusions that are not fully backed by the empirical data collection. This may exist when the sport organization applies technology and data to find evidence, which supports predetermined conclusions about a given athlete, who hypothetically underperforms on specific parameters. It may be associated with predetermined conclusions that there are lazy players on the roster for what reason it becomes a way to punish all players with a salary cut. This is a risky management path in sports, which is associated with a negative 'documentation culture' and not a sound application of technology and data in sports. Despite this managerial complexity, the application of technology and data adds value to sporting performances in team sports, e.g., football, by offering tracking opportunities concerning the positioning of the athletes and how that changes dynamically in the game and how that affects the possibility of scoring or improving one's team position over another. This inspires the potential to optimize sporting performances via positive influence on the sporting quality, on the outcome of the game, and the associated learning.

Managing sporting performance through the application of technology and data also stresses the significance of differences between sports. For example, the sport of football is a complex sport. One may argue that it is more complex than some other team sports, e.g., basketball, or definitely more complex than many individual sports, e.g., golf and tennis, as the game of football is characterized by having 11 players on the pitch and rules like offside. This means that the players are not necessarily close to the goal for what reason decision-makers on and off the pitch have to figure out how to get into situations with the opportunity to score. That is different in other team sports such as basketball, baseball or team handball. In football, all of the players except for the goalkeeper have to do all the skills, unlike American baseball, where an outfielder does not really handle ground balls that are moving quickly. Basketball

has become more like football in that even big men are expected to be better dribblers, passers, etc. Spearman admitted that football *“is a much more complicated game especially than baseball and even basketball, which has seen a lot of success with data [...] You’ve got 11 players versus 5. You’ve got a pitch, which is much, much larger. You have so many more phases of play.”* Phases of play refer to transitions, buildup play, working into the penalty area just to mention a few. Spearman adds *“That’s maybe why there hasn’t been kind of this sort of public awareness breakthrough concept that’s really impacted the game in the way that you’ve seen in basketball with ‘WAR’⁴ and baseball with pitch framing and you know sabermetrics and some of these simple statistics that changed that in a big way.”*

5. Improving sporting performance needs the right framing

The complexity of some sports over others, e.g., football over basketball and baseball, does not mean that there are no opportunities but merely more work to be done in qualifying the data. There are also more naturally occurring statistics in basketball such as field goal percentage, rebounds, steals, etc., that are more difficult to generate or track in football. Basketball is now tracking passing in a way similar to how football does, which looks at how the pass improves the situation on the field (not just whether it was received or struck cleanly). Moreover, it means that there is a lot of potential for technology and data since there are many opportunities that have yet to be fulfilled. The world of football has not seen the full implementation nor value of investments in technology and ‘big data’.

The points regarding football is rooted in the debates, discussions, decisions (also for qualified application in professional clubs) and consumption⁵ of the sport. However, technology and data applicants with a deeper understanding of the game know it is fine to run a lot, e.g., football is a ‘running game’ (legs feed the wolf), but they also know that it is not about the quantity! The quantity must be ‘qualified’ in the sense that football is about tactical positioning. Therefore, players should run intelligently. It helps to be fast in football but not if you run out of the stadium with the ball. Spearman supplements in that technology and data should be applied in helping players to strive to avoid an action if *“it doesn’t help your team at all.”* He adds that *“A lot of this comes into, you know, there are numbers, which mean nothing. And so, for a number to mean something you have to correlate it. And to correlate it in a proper kind of way, you have to build a model and the best models out there use Bayesian inference⁶.”* With this in mind, working with ‘big data’ is not sufficient. The big challenge for sport organizations is to incorporate the data to a more qualified extent on and off the playing field. It can be done by raising the expectations for the positive outcome of working with technology and data by qualifying data via further sophistication and holistic analysis in the form of data correlations.

⁴WAR is a synonym for ‘wins above replacement’ and articulates how many wins a player provides to a team’s accomplishments related to the likely number of wins the same team would have accomplished with a replacement [40, 41].

⁵When one watches UEFA Champions League games on television, it is portrayed that Cristiano Ronaldo or Lionel Messi have run a specific distance, have a certain percentage of successful passes or have had a specific maximum speed during the game.

⁶Bayesian inference is a scientific statistical inference method, which applies probability updates regarding a hypothesis in alignment with the availability of information. The method’s focus on updates considers the active breakdown of series of data, so as new information is available, it updates the model.

Spearman stresses that a good model *“very closely mimics the way the human brain works, which is, with my experience, I found these correlations with certain probabilities [...] Like my mind, when I see you know like a car driving down the street. In my mind, I build a Bayesian model and I’m like OK 99.9% of the time this car is not going to crash but maybe 0.1% of the time it might crash into something because of user error or something like this. So, I have a set of outcomes that I expect whenever I see something because of my internal mental model.”* So, a number in isolated fashion does not tell people anything but when being associated with a specific context and its fundamental contextual factors it makes more sense just like the number 10 makes more sense on the back of Pele’s or Maradona’s shirt. Thus, working with data and incorporating them into a specific sports context and thereby bringing them to life makes a meaningful difference. Spearman supplements this: *“If I’m watching a football match or a soccer match. My mental model might say that when Manchester City plays Wigan [...] I expect maybe a result like 4-0 like maybe 20 times out of 100, I expect a result 5-0 maybe 10 times out of 100, 6-0 5 times out of 100 and I expect like a Wigan 1-0 defeat of Manchester City maybe 1 time out of 100 [...] By having that set of possible outcomes I’ve built this mental model.”* Framing in the form of models is a way to give meaning a certain direction, which is necessary in working with data in sports. Spearman says *“The problem is like I have to have that model before you can really say anything. So, like saying a number like: this person ran 14 kilometers, that’s just numbers that doesn’t tell you anything at all. So, you need to say: like teams that run 14 kilometers have these outcomes or something but because and then the person who’s reading that statistic can recognize: well this model only took into account one variable: distance run. That doesn’t mean anything.”* This influence of technology and data in sports integrates working with and affecting the expectations of the sporting performance while going beyond the playing field. The latter includes becoming a powerful touchpoint for fans watching the game in the stadium, on television or on a second screen and thus getting a richer fan experience, e.g., a better comprehensive experience when the sporting and business performances of the sport organization are blended.

Concerning the sporting performance, technology should not only be a means to collect data to tell a story. The purpose should be to gain a more complete understanding of the sport, e.g., football, and thus how we get in a situation with higher probabilities for scoring or other elements that may increase a team’s winning chances. Football is, as mentioned before, a very complicated game in that sense. For instance, data may reveal that there is evidence that the opponent’s strong left central defender goes aggressively to cover the area around the first post to defend crosses from the right flank. Combined with tactical understanding, the data stimulates other play solutions than the area around the first post when crossing the ball from the right flank. Vamplew [39] argues that theories or suggestions without validated evidence just function as competing hypotheses. This means that they may assist our understanding but cannot entirely explain the dynamics of a context. It is complicated to guide sport organizations to apply technology and data as there are many elements to be studied; this is especially true in complex sports like football. Therefore, it serves a purpose to critically discuss counterfactual studies. For instance, football and other sports are contexts filled with clichés, e.g., if he/she had been fast, he/she would have become a professional football player or if Denmark did not have Christian Eriksen on their Men’s National football Team, they would not have qualified for the 2018 FIFA World Cup. From a critical stance, one can definitely discuss the validity of studying such hypotheses.

6. Qualifying data

The ‘quantifiable’ element is applicable in the ‘sport of sports’ and in ‘the business of sports’. However, it should be ‘qualified’ to be applied in an effective manner in practice. The guiding premise of this chapter is that one effective roadmap for understanding sporting and business performances in professional football is associated with technology and data. The bridges between new and existing knowledge that are produced within this intersection can be a reinforcing force for future performance levels. So, this chapter will discuss specific approaches to how technology and data in sports can help to facilitate improved sporting and business opportunities in professional sports.

In this context, tracking systems may help to understand the positioning of the athletes in football and how that affects one’s team groundwork to win the game. Qualifying data is vital in that process. The distance covered in a game cannot stand alone and neither can data about a player’s change of direction, the intensity of his/her running, moments when he/she stands still (it may happen because the flow of the game is one-sided) or the areas in which he/she moves. In qualifying the performance data, it makes sense to critically assess the tracking system and thereby how the pool of ‘big data’ is generated, e.g., is the system based on radio receivers (originally the technology of ZXY), GPS (the technology of Tracab) or video cameras (ChyronHego’s acquisition of ZXY opens up for a more holistic tracking solution capable of combining the three technologies)? Decision-making in top football is associated with big business and large amounts of money. A wrong decision may be very costly. Therefore, it is imperative to have a valid notion of whether or not a player performs to the level of his/her ability or below or above the expectations before decisions about substituting a player in a game or buying or selling a player on the transfer market is made. Of course, the decision-making process is influenced by complications as performance in football on the pitch is a reflection of a player’s opportunities to unfold a combination of physical, tactical, technical and mental elements and putting these in play in co-creation with other players.

Technological advancements have brought even more data to the surface in the context of sport and have influenced the evolution of specific sports. Professional football is one example. Years ago, the prevailing statistic measurement was the amount of goals scored. Along came elements like the number of passes and assists. However, contemporary professional football adopts more sophisticated data and metrics. Spearman emphasizes that *“Now, we’re starting to build advanced metrics that kind of take in a few counting metrics and give you another metric like expected goals. Now, with the tracking data, we’re not even counting anything we’re just measuring where people are and we’re using that to come up with new metrics. You know, there is so much that goes into the game [...] The data can always be more.”* So, the importance of qualifying statistics is a matter of acknowledging that ‘big data’ cannot do everything for you but it is a basis for including thoughtful sophisticated solutions. With that recognition, the next question becomes a matter of questioning the challenges of technology and data application in specific contexts. Spearman adds that *“With tracking data, you just have the position of the players. You don’t have the facing, you don’t know what direction they’re facing. You don’t know which foot they’re on. You don’t know their weight distribution. You don’t know what their mental state is.”* Thus, qualification of technology and data is ‘training’ the skills of finding and working with

the limitations of 'big data'. In following up on this, Spearman admits that *"There are so many things that even this like very, very cool tracking data doesn't measure. [...] We're measuring humans. There is no way to finish this. Humans are extremely complicated and you're never going to be able to capture all of that with data but, you can always keep capturing more."* This is a fascinating discussion as the junction between human beings and (professional) sports continues to find new methods to raise the bar for performance and performance measurement. A good example is linked to a professional research visit to global technology and data powerhouse SAP's corporate headquarters in Germany and an included visit with the affiliated Bundesliga club TSG 1899 Hoffenheim. The club's training facility reflected an innovative football-data-hub with the 'Footbonaut' playing a central role, e.g., a machine that trains a player's technical handling of the ball and his/her response skills. More impressing, the training center offered access to SAP 'Helix', which is a technological solution that trains a player's cognitive skills, e.g., the player's perception of the game in specific game situations [42].

Qualification of data to be applied in football is subject to challenges and downsides. More knowledge about these constraints may guide football entities to construct better interactions between technology implementation, data management and sporting and business performances. For instance, if you take a picture but it is fuzzy, then it is beneficial to apply digital technologies because you get instant feedback. Spearman notes *"There are two advantages I can see coming from Sports Analytics. One of them is the ability to apply the scientific method and overcome your biases. That might be long held biases that come from one reason or another."* Consequently, this scientific approach may prevent football entities from being negatively influenced by 'fundamental attribution errors'⁷. Situational contexts of behavior are a strong influencer in which people when interpreting behaviors or performances of others may tend to overestimate personal elements, e.g., he/she is a very good player, over the impact of the situation, e.g. yes, but he/she did not actually perform well in that concrete situation. The example portrays a common bias that may lead to strategic decision-making being unstrategic decision-making. Spearman illustrates other advantages of qualifying data, i.e., *"You can use the scientific method to overcome, you know, something that's maybe a bias that you might come in with [...] The other thing that analytics can do is it can be a force multiplier."*

Qualifying data implies the vitality of the interplay or the co-creation⁸ between 'human and machine' in the sense that Spearman stresses that *"If you have the best scouts and the best analysts, they are going to be better than even the best models because their mental model takes into account many factors that the data doesn't control for."* However, football governing bodies, leagues and clubs have different resources and resource allocation is a constraint for many clubs in the competitive war for talent. This is in alignment with Spearman's notion that *"You can't have a hundred thousand scouts, who are looking at every player and watching every minute of their film and analyzing it with that domain knowledge. There's just not enough of them in the world and there's not enough really good ones in the world."* This statement reflects the point that (1) data must

⁷The Fundamental attribution error is the *"tendency to focus on the role of personal causes and underestimate the impact of situations on other people's behavior."* ([43], p. 106).

⁸Co-creation in the context of this chapter means a collaborative process between different parties involved in the work with technology and data, e.g. data suppliers, system, data analysts, coaches, players, fans, and sponsors as co-producers, which jointly create mutually beneficial value with the strategic advantages that may be attached [44–46].

be qualified and (2) data cannot replace human beings, e.g., coaches or scouts, but it can be a very helpful tool that leads to positive reinforced performances if managed competently. In terms of data being a football management tool, Spearman mentions that *“If you’re a club, you can take that information you have from your scouts. You can use that to train a model, which lets you multiply the number of players you look at or if you’re trying to do pre-match analysis for an opponent [...] You can’t have enough pre-match analysts to watch those all in the detail required. So, again data is a way to let the computer save you time.”* Concluding on the qualification angle, data management in football becomes a helpful tool that saves time that may be used elsewhere in the performance cycle of the governing body, league or club. So, qualifying data takes decision-makers from the somewhat automatic and irrational first step of decision-making to a more rational, effective, and strategic second step of decision-making, which may produce competitive advantages in which ‘technology and data’ multiplies the force of humans.

7. Making sense with technology and data

Taking the qualification of data towards a higher degree of organizational, economic and commercial sense-making, data management works as a vehicle of positive strategic change that sometimes may be associated with some extent of risk aversion. No matter what you’re doing with a sports team, unless you are winning, there’s going to be upset fans. Spearman touches this essential stakeholder consideration when arguing that *“At least you can then point to some objective reality and say: well this is our decision-making that’s based on [...] One of the big criticisms lot of times leveled against management or ownership is they’re not willing to invest in the club. If you have this transparency, you know, we’re investing this much, we’re making the decisions in this sort of way, it’s going to be a lot easier for the ownership to convince the fans that we’re not just trying to suck money out of the club.”* Hence, quantification of performance metrics in football is fueled with managerial power when being qualified in the sense that it constructs a pragmatic tool to manage stakeholder relations and to co-create a fruitful relationship between sporting and business activities of the club and its internal and external environment.

Finding a point in time where technology and data become even more decisive in football is a derived effect of how governing bodies and other rights holders play along. For instance, an extract from FIFA’s *Laws for Players’ Equipment* [47] stresses that *“a player may use equipment other than the basic equipment provided that its sole purpose is to protect him physically and it poses no danger to him or any other player”*. With this in mind, it makes sense that governing bodies allow players to take advantage of properly designed tracking systems in a game to prevent themselves from getting injured.

Football’s global governing body FIFA allowed the use of technology and data during the FIFA 2018 World Cup in Russia so that coaches were permitted to receive real-time technology and data support from data analysts throughout the duration of games. However, it should be noted that the teams choosing to use this opportunity had exactly the same capacity to provide visual and statistical data⁹ to inform in-game decision-making [48]. Therefore, the point

⁹During the 2018 FIFA World Cup, the movement of players could be tracked by two optical cameras. Analysts could send interpreted video clips about the team’s performance to coaches on the bench via a tablet device [48].

of differentiation comes down to how intelligently and competently teams can apply the technology and data to make decisions. As the CNN article points out, the Dutch football legend Johan Cruyff once stated that football is a sport that you play with your brain. However, the current development proves that top football is highly associated with technology and data as supporting performance tools. Although sports tracking data may be optimally applied before and after a game given the complication of the 'stressed time slot' for coaches to manage their team comprehensively through data during a game, it is definitely means to an end in terms of fully preparing a team for an upcoming game or for constructive feedback after a game to influence future game preparations. There are always critical moments during a football game. For instance, it is interesting to assess what happens right after a goal scored, what happens right after halftime or what happens in the end of the game. Some players may be tired in the end of the game while others are not. In that sense, sports tracking plays a role in injury prevention but also regarding substitutions where some fresh players with competent offensive skills may enter the pitch with a positive determining impact on the outcome of the game. For example, Craig Duncan, a prominent sports scientist, argued already before the 2012 UEFA European Championship (EURO) that sports tracking systems (i.e., GPS in the case) worn during a match can help to prevent soft-tissue injuries [49]. The focus on technology and data to prevent injuries is backed by leading football physiologist Raymond Verheijen, who worked with Russia's team during the 2012 EURO. He said that up to 80% of injuries are preventable. Verheijen blames fatigue from overtraining in that matter, which is supported by evidence from a study analyzing 27,000 football matches demonstrating that teams playing after 2 days of recovery and facing opponents with a minimum gap of 3 days were 39% less expected to win at home and 42% less expected to win away [50].

Consequently, it is vital that players who do not play that much are kept fresh during the duration of a tournament whether it is the World Cup or for a club team; this is especially interesting in contemporary top football where the best domestic teams are expected to do well in domestic as well as international (e.g., UEFA) competitions. Therefore, the methodological constraints in applying technology and data are associated with the quality in which these factors are integrated in the daily operations of the club. For instance, FC Midtjylland bought and installed ChyronHego ZXY sports tracking system in their stadium as well as their training facility. The same technology for data use and data management for games and training session is methodologically important from a practical application standpoint because it makes it easier to compare the performance of players (it is also difficult to compare apples and oranges) while accumulating data for longitudinal studies [14].

8. Business promotes technology and data application in sports

The intersection between sport, technology and data is also a matter of segmented market places. Sport is dependent on fans. Without fan appeal, top football would not have the same economic scope. Global fan identification makes professional football a relevant commercial cocktail. The scope of the economics of football is very impactful from minimizing the level of player injuries, which may lead to better sporting performances and thus to an improved business model, to taking the data from the application of technology and turning that data

into fan relevant content. Spearman believes that the articulation of successful data narratives may lead to additional focus on technology and data management. He notes that *“One of the things you see in other sports that is really enhancing the application of technology is the success stories and I think the more public teams are with, you know, why they are succeeding using data, the more well known that becomes, the more of a market there is going to be for league wide deals for, you know, having that data so that you are not behind the curve.”* Spearman implicitly tones the interaction towards teams not just gathering pools of ‘big data’ but rather putting data in play for strategic reasons and in a qualified manner.

The awareness about the potential of technology and data in football from a holistic perspective, which blends performance on and off the playing field, can affect demand. This is evident in what took place in professional baseball, i.e., when for example the Oakland A’s and baseball became very successful using data, immediately the Red Sox became interested in the exact same ideas, so a team’s success with ‘big data’ thrives in the competitive environments of top sports and business. Respondent 2c continues along this line in that *“The football world is a very wide term [...] As a club, it is interesting to be able to measure all the actors, all the players in which one invests so that one can measure them against each other and say that one has a need for a specific playing type as left back [...] Search the data and find what type of player one needs, his physical appearance, what kind of competencies he should possess, tactically as well as physically? So, I can see a lot of benefits in relation to this system (ed. ZXY) concerning giving them, who follow the sport additional experiences [...] One can give them a range of data to ‘nerd out’ or, which one can continue to work with and then there is the last part, which is the commercial part, which one can couple with some corporations, which may enjoy this data in synergy with their own brand.”* Concluding on this, professional football (sports) may face potent future opportunities in terms of tracking-driven and thus performance-generated commercialization.

In critically discussing and considering how to put technology and data to work in professional football in this context, the argument of ‘qualifying’ data becomes even more central as success in competitive settings is a matter of the quality of the process rather than the quality of the outcome. However, technology and data will most likely appear as prominent drivers in professional football in the future. The reasons for that may be contradictory; one stimulating reason may be ‘the fear of missing out’ in professional competitive settings as Spearman notes that *“Other teams were like: let’s do it the good old way. But once they got left behind as dinosaurs, there is no way for them to continue with that mindset”* while another reason speaks to all the performance advantages associated with technology and data whether that’s concerning sporting or business performance for football teams. Harrison and Bukstein [51], p. 3, argue that *“The core purpose of ‘sport business analytics’ is to convert raw data into meaningful, value-added, and actionable information that enables sport business professionals to make strategic business decisions”*, which is in sync with teams being triggered to apply technology and data because they know that otherwise they will fall behind. This development sparks new horizons concerning the perspectives on sport performance and sport business performance and thus allows for growth in the (digital) market opportunities in sports. Spearman adds that sport teams *“had to go out and invest in data, either acquiring the data or hiring people to analyze the data. Forming partnerships with data providers and with the media in order to kind of share that data as the fans became engaged with that.”* From a business perspective, this requires investments by sports entities in one way or another, but the qualification process is a roadmap for strategizing future income potential

by building a bridge between ‘big data’ application on and off the playing field, e.g., through elements like fan engagement innovation, media content or clever sponsorship activation. Technology and data is a good proactive playing pattern to build better overall performances in football as there is a clear correlation between financial performance and sustainable competitive advantages [51]. However, many clubs have data but find it problematic to establish good articulation and narratives to enhance overall performance. Spearman notes that *“You really need that kind of success stories in soccer and I think there’s been some examples like you know Ted Knutson at Brentford (ed.: Former Head of Player Analytics in the English Championship club and Founder of leading data and analytics platform StatsBomb), you know, had some success with data there, but I don’t think any of them have been at this high profile kind of level where it’s like this was a club that was bad and then they went and invested in data and now they are not.”*

9. Paving the way for more comprehensive sports experiences

Better performances on the playing field and thus higher sporting quality most likely leads to better sporting experiences. Similarly, decisions based on data hold promising potential to establish good synergistic effects between the sporting and business experience. From data on local traffic patterns affecting fan transportation to games measured against scheduled game times and ticket sales and various other revenue generation categories within that context, e.g., merchandise, food and beverage sales etc. [51], to data on successful sponsorship activation slots during games, there are significant commercial advantages in data management. Building on the ‘qualification’ analogy, sports entities should aim to understand the practice and science of data analytics to sustain competitiveness. In striving for good business opportunities in this context, Spearman points that *“For business purposes, one of the key things is that fans in pretty much any sport, you know, really love their sport and they want to know as much about their favorite athletes or their favorite teams as they possibly can.”* Data is a well-suited application for marketability purposes in the football industry, e.g., fan engagement, promotional efforts, and mediated content. Spearman finds an opportunity in the fact *“that so many people play Fifa, play Football Manager is just evidence of the fact that you want to engage with the athletes, not just by watching them on the television, and you know, drinking a beer at the pub with your mates, but also like know everything you possibly can about them.”* This thought is in alignment with the focus group data, i.e., respondent 1a saying that *“There are bigger and bigger requirements from fans to get closer and obtain more knowledge”*, respondent 1e pointing out that *“The other super trend is the live element and that you can take something, which happens now, and touch it and create commercial constituent parts”*, respondent 1c building on the momentum of the discussion by adding *“That is heightened user involvement to an extremely high degree and it creates renewed interest leading up to the games but also during the games. There are more, who have the desire to come and watch the games because they become more engaged”*, while respondent 1d brings an interesting thought in terms of *“The fact that one can make own choices, you know, we give the user the opportunity to make some additional choices in relation to what they want to watch. That goes for a coach, who wants to know more about the physical aspects, it goes for a fan, who wants to know more about running patterns precisely regarding the weekly favorite player etc. That is a huge plus.”* Professional football (and sports) falls under the umbrella of the ‘experience economy [52–56] for what reason a principal purpose is to design and orchestrate comprehensive experiences for all relevant stakeholders.

Scholars [57] have concluded that sport organizations are not immune to profit motives and good stakeholder relationships and that trying to manage that involves the process of staging good experiences that are subjective in nature and a reflection of the interplay between consumers and the environment. A managerial objective is to boost the interactions from this interplay. Respondent 1c highlights that tendency in expressing that *“The competitive element in football has been considerably enhanced because there is fight for sponsorship money, prize money, rank in the league and all of it, and therefore one must optimize all the circumstances that mean that one can better win football games and maybe also attract more fans in the stadium by offering some other services. So, it is like respondent 1a says, ‘big data’, and it is statistics and numbers. We want to know more about all things.”* Funk’s [58] notion that sport consumers’ situational experiences, e.g., experiencing a football match or fan-related content from a football club, are associated with a network of interdependent nodes of information about a specific sports brand, are in alignment with this managerial objective [59]. For instance, a football experience may be associated with nodes such as the legacy of the team, the quality of a star player, the cost of the ticket, the perception of club management, the value of entertainment, the decisions and the personality of the coach, team and player performances, social bonds related to the club, the size and comfort of the venue, the esteem linked to club results, and the escapism of being part of a tribal football community. These interrelated nodes of information inspire to emphasize an interesting discussion from the focus groups concerning the appeal of the football product on and off the playing field for stakeholders, which corresponds well with Cortsen’s [13] point that research cannot be isolated from time and context. Respondent 1e voices that *“In this context, I am quite commercially thinking within my area [...] When and during what time span can one use the data? There is, you see, the data, which the coach should have, which the fans shouldn’t have. And then, there is the data, which the fans should have, so one can look back at the year before, which you also touched on with Kasper Kusk (ed. Danish professional footballer with national team experience), and then one could start to build more on individual players and then bring it into the following year.”* Respondent 1b supports this articulated importance of time and context by using a relevant football analogy in stressing that *“Yes, very interesting. [...] In football, whether one is on or off the pitch, is about the sense of time and space.”* Respondent 1d goes on by categorizing football lovers, e.g., fans, sponsors, players etc., as content producers and viral platforms in that *“One is almost the journalist oneself in that context and then one looks at it and then it may happen that one uploads one’s knowledge on social media and then something happens.”* Respondent 2e continues in this direction and thereby seems to recognize that the strength of branded experiences are partly elevated by the football consumers, e.g., fans, sponsors or the media, by indicating that *“It is important to extend the game for the fans so instead of 90 minutes it can have a longer duration through the following discussions, which subsequently may be consolidated by new facets [...] It’s very important that the data, which it (ed. the game) produces, is accessible on some platforms, on which it is easy to share and cooperate and hand out things and say they support my discussion with you [...] Such elements are super funny to work with and there is also a commercial potential in them.”* That way, technology and data become elements with more influential power, i.e., in terms of sporting performances but also in business developing interactions with stakeholders via traditional media platforms, sponsorship forums and in shaping commercial fan engagement solutions. Thereby, they create value in extending and intensifying the hype and life around core events such as games and tournaments and central assets like players and coaches.

10. Comprehensive football experiences equal better fan engagement

Technology and data have a great potential in professional football as there is a good level of fan identification with football brands whether these are linked to governing bodies, e.g., the brand of UEFA (in association with the Champions League as the world's most prominent club football league), leagues, e.g., the English Premier League, clubs, e.g. Real Madrid, or players, e.g. Lionel Messi [13]. The 'Psychological Continuum Model' [60] helps to elaborate on consumption patterns in sports. Its hierarchical structure of four phases: awareness, attraction, attachment and allegiance, provides a framework for how technology and data may serve to take the popularity of football to new heights, e.g., more in-depth insights related to one's favorite team or player, or to new target groups, e.g., technology and data savvy Millennials. For instance, technology and data from a sports tracking solution, e.g., ZXY, leveraged through a technology platform, e.g., an app, may improve a fan's knowledge of players from a favorite club, which creates a positive reproduction and reinforcement of the club's fan culture and fan identification level ending with 'lifetime fans'. This theoretical framework plays well along with focus group data and vice versa as the theoretical grounding assists in providing better understanding of how to create advancement from the lowest to the highest hierarchical level. However, the different phases of the 'The Psychological Continuum Model' should be subject to further qualification and thus not solely be perceived as an isolated hierarchical level, e.g., being a Chelsea fan (attachment phase) or living for Chelsea (allegiance phase) may hold variations. Interactions are vital in this approach to add meaning to technology and data application to boost comprehensive sport experiences. The opportunities to generate new narratives and in-depth engagement, of which governing bodies including leagues and associations, clubs, media, sponsors and fans may take advantage, are interrelated with an open-source mindset and conscious and unconscious co-creation and co-branding¹⁰ between these stakeholders. However, the focus group data reveals an interesting paradox in the fact that some stakeholders in this context are very innovative while others almost need to be pushed. Respondent 1a notes that *"Game statistics before the game and then raise it after the game on television; before the game one had placed this as a key match-up. How did it go?"* while respondent 1d articulates how such strategies may expand the value of the content in saying that *"I talk about it in relation to giving it a considerable story around the individual player historically as well as live."* The interactions or the interdependency between technology, data, sporting performances and business aspects linked to the sports experience like the product perception, articulation of the game, brand associations etc. are at the heart of professional sport as mediated and thus highly discussed entertainment. Respondent 2c adds that *"There is also an opportunity in extension in relation to the following storytelling (ed. after the game) that one can put in a context. Afterwards, it may be interesting to watch where Morten Bisgaard (ed. former Danish National Team player and current football expert for the media) went in and did a thorough analysis of his (ed. William Kvist, who is a current Danish National Team player) game from minute to*

¹⁰Co-branding in this context means that the purpose of branding, among other things, is to create value (also from an economic standpoint) and that co-branding becomes a manifestation of this purpose by including a 'win-win scenario' aimed to construct synergistic effects based on the branding activities [61, 62].

minute and demonstrated that his performance not at all was connected with what he was accused of in the media. So, one can say that there are also some really good opportunities for all actors, that they get to tell the story that they want to get out or to put it in a context in relation to other players.” Another dimension of this is articulated by respondent 2e in that “There are many stories [...] What one can add to a player, which maybe, there is a ‘gray’¹¹ mass of players, which are totally anonymous for the fans. They will suddenly be interesting because there are more stories that we can attach to the data in 12¹² different ways.”

What holds meaning concerning technology and data application to enhance sport experiences is the improved quality of the user or fan experience. Respondent 2a views it as a valuable add-on in that *“All this with in-game index¹³, is what they call it. It would be a nice part with push notifications [...] One would drown oneself, if one had to find this statistic”,* while respondent 2d participates in mentioning that *“We can also see fans that what they do during games, that they would like pushed information. Then, one would like that someone pushes something while one is sitting and watching the game. After the game, if one has seen the game, one would like pulling information [...] Then, one can adapt the different tracks depending on one’s situation as a fan.”* In alignment with the premise that meaning and understanding are derived from language and thoughts [26, 27], the term ‘big data’ in sports is a symbiosis of opportunities and flexibility, which respondent 2d admits in that *“In relation to the commercial perspective, then one can say that we are dealing with data, which in one way is flexible, i.e., they can be attached to many different things in cyberspace as well as in many channels. One can insert statistics in all kinds of advertising, one can place them in different contexts. One can do a lot with data as soon as they are detached from their original medium and can thus be attached to some completely new nodes of data in some completely new contexts. And it makes it possible to, one can say, to follow the game well beyond the 90 minutes but also to break into new contexts in relation to other types of events as well as other types of media channels, e.g., as Carlsberg did with a channel that runs on a television screen with some stats after the game and so on.”* Spearman supplements *“A lot of the data we have can be used to gain a competitive advantage from a competition perspective can also be something that increases engagement among the fans. [...] It increases the number of ways, in which the club can interact with the fans, increases the number of products that the fans might be willing to pay for either from the clubs or from the media in order to kind of learn more about their favorite athlete and delve deeper and really understand who’s good and why.”*

11. Knowledge-sharing between sports and business

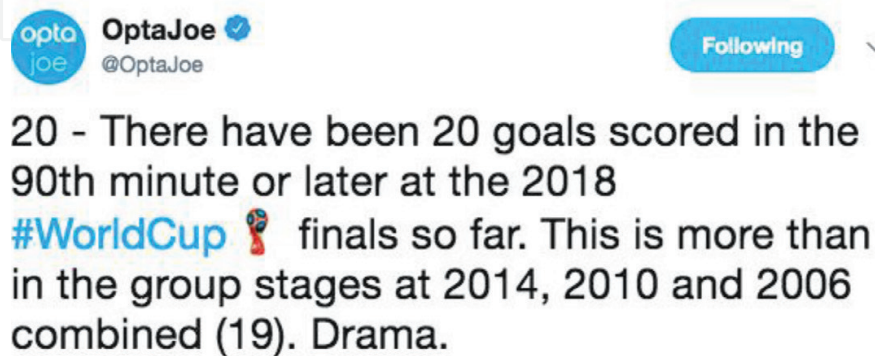
Taking the data and connecting it to the game’s multi-dimensional aspects brings an interesting level of content about clubs, players and commercial stakeholders, e.g., Real Madrid has a

¹¹The terms ‘gray’ in this context holds the meaning of the players not standing out in a significant negative or positive way.

¹²The number 12 is just a number used to emphasize that data provide many opportunities (and that these opportunities are not limited to 12).

¹³An in-game index allows data analysts to break down team video and index clips for team and player performance analysis and thus to visually present highs and lows during a game coupled with in-depth statistics.

70% possession rate and Toni Kroos has 95% successful passes and that plays along with the sponsor activation of Emirates with an average of +95% on-time arrivals. Such narrated content can assist in brand management disciplines by building, developing, and sustaining a strong level of brand equity as a 'hybrid notion' of sports branding [13] and cater a better understanding of the football entities' decisions and actions. According to Spearman, Opta Sports, a sports data provider, does "a really good job with kind of simple statistics." In a Tweet [63] from the 29th of June 2018, the Opta Twitter account 'OptaJoe' Tweeted:



A very simple Tweet like that generates a fair rate of engagement in terms of comments, likes and shares so consider the potential in more sophisticated content. Spearman adds that "The visualization element with the tracking data is going to be very powerful [...] Now, we see it a little bit where they'll be like oh did you know this guy has run 14 kilometers in this match [...] Visualizing pitch control, visualizing open space, visualizing dangerous zones on the pitch using tracking data-based models is going to be the next step there." Therefore, the qualification of data is also a derived effect of the sophistication, i.e., the use of 'big data' is more interesting when it exceeds just running statistics while taking more sophisticated sporting data and going beyond its mere sporting performance focus to seek ways to let football actors on one side, e.g., managers, coaches, and players, interact with fans, sponsors and the media.

The scope of technology and data in professional football grows when it is inserted in a context of co-creation and knowledge-sharing. SAP was mentioned as an example of adding new dimensions; e.g., the measurement of players' cognitive skills. How about the creative opportunity of measuring emotions? Such aspects are already in play in the commercial arena of sports, e.g. sponsorship effectiveness enhanced by sentiment analysis or integrated algorithms. Respondent 2f touches this in that *"In reality, this is about how one can obtain an experience, a feeling of these people while they play [...] For instance, one can measure from other sensory data just like: now, he is about to blow up¹⁴ or this guy is good at getting some emotional into it [...] Can one beforehand by the help of 0.02 seconds latency find out where the next emotional outburst takes place [...] It is over here that we need focus on our camera because it is right here it happens [...] Next time the two will meet, when they get within 5 meters, then they know that they are going to kill¹⁵ each other. Can we spot those situations?"* There is an interesting knowledge gap to fill in terms of applying technology and data to co-create better sport experiences, which may be facilitated when working strategically with gamification [14]. Gamification may be defined as the *"use of game design elements in non-game contexts"* [64]. However, the gamification concepts challenge the traditional charm of football (and sports), which is protected by fans romanticizing how it was in the old days when the game was merely about 22 players chasing a ball within the lines of play controlled by a referee and without the influx of technologies like Video Assistant Referees (VAR as implemented in the 2018 World Cup in Russia) or sports tracking systems. Nevertheless, it is part of our society and now 'part of the game' for what reason football entities should praise all the opportunities that come along with technology and data but with a strategic 'gamification' approach of thoroughly considering when technology and data act as a winning strategy. For instance, it seems like the application of the VAR-system needs modifications to accommodate teams' perception of fairness in the World Cup, e.g., why are some situations subject for reviews and others are not? Respondent 2b comments on this debate in that *"Of course, it triggers me based on our assessment of players. That is what we spend much time on. We have to assess if players are good or bad on a scale and we cannot just assess a player, who has scored a goal and say that he is better than another player. Therefore, it triggers me at the thought of making 'how good the players really are' more efficient. I also looked at the video up here and then they needed to obtain points for many parameters."* Respondent 2f states that *"Can one use these data to already during the game to get the story about the people that play. And it has to be live. It has to be like that when two just destroyed¹⁶ each other a couple of times, then the next time they get close within 5 meters of each other, then we have to be 100% sure that we have a spot on your faces because now he needs to get it [...] The story about the people, who really play this game and the life that unfolds in this game. It is just as in other sports very mental to play football. And who is in the zone and who is not in the zone? Can one see that? It is interesting to see people who perform well because they emotionally are alright and are in the zone."*

¹⁴Blow up in this context is an expression of being very emotionally influenced, e.g. a player may work harder or be irrational and commit a stupid foul.

¹⁵Kill in this context acts as a figure of speech for being on top of or winning the battles that takes place on the pitch in a professional football match.

¹⁶It is a metaphor along the same line of meaning as the 'kill' metaphor.

12. Knowledge and co-creation frame the football experience

The discussion becomes a matter of the charm, knowledge level, sporting and business value, which are vital elements attached to the game. In bridging existing knowledge gaps regarding technology and data in football, it is evident [14, 51] that there is an edutainment [52] element capable of blending education and entertainment at the benefit of enjoyment for the game's stakeholders. When watching the 2018 World Cup, it was interesting to witness how the media articulated France's 4–3 win against Argentina in the round of 16 as a celebration of fantastic offensive football. There is no doubt that the game presented excellent finishing skills and fine offensive playing patterns, but one should note that sparkling offensive skills sometimes are derived from questionable defending. If beating Argentina 4–3 in a game with 7 goals, and some great goals esthetically, serves as a quality performance indicator, there is a need for a higher sophistication level. The game was very entertaining for football lovers. However, it is interesting to look at the contrasting perceptions among the media and football fans in a tiny (definitely when measured on population size) football country like Denmark after their team's 0–0 draw against France, which qualified Denmark for the round of 16. Expressions like boring and destroying defensive football characterized part of the country. Of course, football's passionate texture covers both extremes, e.g., the very positive and praising manifestations of Denmark's success of making it through the group stage but also the very negative and complaining manifestations. That's football and that's what the passion of sports is capable of. This is something that the football world should embrace as an opportunity. The point here is that the real interesting question(s) in bridging existing knowledge gaps may exist in the form of asking 'what is at stake here?'. This question includes time and context when asking 'who are influenced by what is at stake here?' and 'what is the meaning of time in that regard?', e.g., there are relevant moments before, during and after Denmark's game against Croatia in the round of 16. If one is a football fan but also a professional coach, the dominant contextual factors when asking the question of 'what are the conditions for the game?' will entail greater nuances or sophistication. For instance, such a person may have liked more entertaining offensive football from Denmark against France but would also acknowledge the meaning of time and space in football. Thereby, this person would know that France would most likely take advantage of the opportunities if Denmark's defense was positioned by the midfield line in most of the game instead of being positioned more defensively. So, a good understanding of the game may be positively enhanced by technology and data, e.g., sports tracking data, as an engagement tool in the discussion regarding the World Cup and thus illustrating that a game and the outcome of a game may somewhat be controlled without necessarily having the ball but by controlling the space in which the opponent wants to operate or by 'tactically tricking' the opponent to operate in certain spaces in which it is tactically beneficial to conquer the ball. The successful coach José Mourinho won a couple of titles with 'underdog teams' in this manner.

Strategic application of technology and data may take different forms, e.g., defensive vs. offensive approaches to winning games on the pitch, data-driven decision-making in the business side to support strategic execution or strategic gamification elements to provide edutainment. Spearman understands that football is a dynamic phenomenon, the importance of momentum on and off the pitch and acknowledged a few vibrant development patterns surrounding the game in adding that *"One is the fact that fans are becoming more educated as time goes on [...] There are things that are measured now that may not have been measured before and fans become aware of that*

[...] Trying to think of a good example of soccer [...] In baseball, we were not used to measure on-base percentage. We were not used to measure these advanced statistics [...] When you mention them, people would just go out and zone out because it's not part of their comprehension. The same with the expected goals, like you know, three years ago if you said expected goals to anybody outside of somebody who's, you know, in soccer analytics, they're just going to be I don't know what that is. Now, it's on sky sports and so the fans are becoming more educated about these different concepts, which allow them to appreciate it and enjoy it when they see it. That being said, I think there's also, you know, the fans are never going to be. You don't want the fans to be like 'mathematically' in their appreciation of the game, it needs to be intelligible. Respondent 1b supplements this notion in that "Very simplified, it is self-evident of course, but can the commercial partners and suppliers, you know, associations, clubs and what there may be, if they can figure out to collaborate about it and develop content, which X (ed. respondent 1d) touches on, well then it will be well received by the target group in the end and then you will to a far higher extent create a pull-effect." Both Spearman and the focus groups agree that competent and user-friendly co-creation between various relevant stakeholder groups in football may elevate this opportunity. Spearman notes that fans "are not going to be mathematically inclined necessarily, so you don't want to be showing equations or models. Things need to be understandable just from first glance [...] The visualization component is extremely important and good visualization has always been an important part of communicating with the coaches and the athletes themselves. [...] It's even more so with the fans, I think, because it's not their job to understand complicated models. They just want to appreciate the game." The strategic embracement here by football clubs lies in that there is now a good (or at least better than 5 or 10 years ago) awareness level of the existence and importance of technology and data in football but football's stakeholders should work together to accommodate the expectations about applying it. The digitization of sports is a good option for football's central actors, e.g., governing bodies, clubs, coaches, players etc., and their commercial stakeholders but the possibilities of technology and data application should be comprehensive and founded in competent people with thorough understanding of the relevant contextual factors making it sophisticated in the back-end but simple and user-friendly in the front-end.

13. Bringing data, knowledge and strategy to life: recontextualizing football economy

The ZXY system is capable of commercially intensifying the knowledge gained from sports technology and data and thereby to help football teams realize their strategies in this sense. Inductively, the research data provides sufficient grounding for proposing a conceptual framework, cf. **Figure 3** below, which portrays how technology and data recontextualizes traditional sports (and football) economic models [65–69]. This case of investigating data from sports tracking technology in football shows the point of professional football clubs investing in sports tracking technology and data primarily to improve the conditions for sporting performance. The sporting performance of a football club is based on prevalent dimensions such as physical, technical, tactical and mental dimensions but in this context, it is imperative to underscore that the complexity of football is also linked to football being a team sport. Therefore, the social and hence culturally influencing dimension regarding the cohesion of and the relationships within a team matters in football performances [70]. In this context, so does the sport specific technological dimension. For instance, in cycling or motorsports, it is common to work with minimizing wind

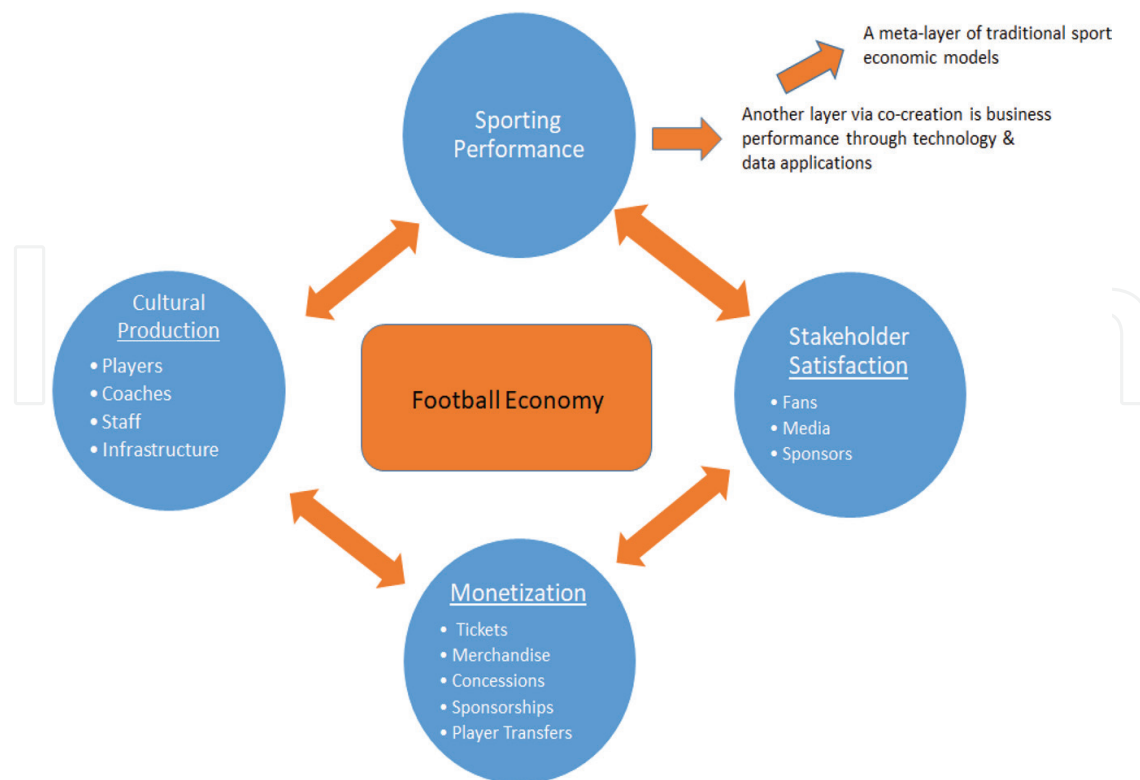


Figure 3. Conceptual framework - recontextualizing the football economy via technology and data.

resistance to influence performance. In sailing, it is common to look at the construction of the boat. In football, technology (and thereby data) also plays a vital role in influencing performance. However, the difficult part is to work on the social and cultural dimension. The relationship between data, knowledge and actions is vital for football entities. Football entities are working with 'big data', i.e., large data sets, which produce lots of knowledge. However, knowledge is not enough in itself. Everything must be qualified and inserted into a set of actions, which in the end determine the outcome of a game. Consider Germany's football team, which came to the World Cup in Russia as reigning champions. The German team works intensively with data, has qualified and effectual knowledge within this field but the team seemed 'saturated' (many players had already won the tournament in 2014 and also played many games throughout the year for the respective top club teams that they represent) and not engaged enough in the actions on the pitch, which may help to partly explain the team's early exit of the tournament.

Clubs succeeding in enhancing the quality of sporting performances will face improved stakeholder engagement and satisfaction, e.g., higher attendance levels, better media articulation, and increased sponsorship interest. All these elements may serve as positive influence on sporting performances, e.g., happy fans may positively influence the confidence level of players, while also influencing monetization opportunities. For instance, clubs can capitalize on more fans coming to the home games in terms of increased ticket, merchandise, and sponsorship sales. In addition, players that perform above average may be subject to positive articulation and may translate 'being talk of the league' into lucrative transfer sums. These capitalization dynamics of a football club lead to cultural production, i.e., a process that may also include negative and positive reproduction of culture [71], in which the club will invest in shaping the culture of

the club, e.g., investing in the roster, the team functions or the club infrastructure. Just like the monetization aspects can be traced back to the stakeholder satisfaction, e.g., better profit margins may spark the club to re-invest in fan engagement solutions, the cultural production also influences the monetization aspect in that a football club constantly evaluates the ‘strength’ of its culture, i.e., if there are irrational investments in the cultural production (buying the wrong players), this fact will affect monetization negatively. The cultural production implicates that investing in the right coaches, the right players and thus building a strong level of cohesion in and around the team with the right relationships on the pitch (in and between the various lines on the pitch) will influence sporting performance positively. Of course, this conceptual framework is a construction, which to some extent takes a ‘ceteris paribus’ perspective, because the practice of running a football club is highly dependent on different parameters. One vital parameter is competition, e.g., there is intensive competition for the best football players, which increases the costs of investment in fully developed quality players (another reason for investing in technology and data to optimize performance enhancing details from this investment such as optimization of talent development or of purchasing fully developed players). Another important parameter is the market size and constraints, e.g., is it a club like FC Bayern Munich, which is operating globally, or is it a club like Werder Bremen with a smaller market size? Additional parameters like the club’s facilities or stadium, its commercial competencies, the strength of its league, the appeal of the league’s competition format, the level of competitive balance in the league, the strength of the league’s media deals may be decisive factors influencing the various parts of the framework. However, the interesting recontextualization aspect of the conceptual framework is associated with technology and data, which constructs a meta-layer that emphasizes the importance of co-creation and co-branding due to the application of technology and data in this performance-related management of the sport and business nexus in football clubs. As mentioned earlier, the qualification of technology and data use (including competence development of the organization) and the derived co-creation and thus the co-branded and ‘hybrid’ branding activities build a fruitful bridge from improved sporting performance to optimized business performance in the club. Thus, the business performance is also depicting an interdependence with the different parts of the conceptual framework, i.e., stakeholder satisfaction, monetization, and cultural production. This is a somewhat artificial construction grounded in the empirical data and in relevant theory but it depicts the demand of the football industry in terms of the constant hunt for performance improvements in a very competitive and dynamic environment, which is highly influenced by technology and data.

This development gets a more lively and vibrant strategic meaning for clubs, players, fans and other sporting and commercial parts of football’s eco-system [14]. All these parts should be interrelated in ways, in which technology and data may bridge the gap to more thoroughly understanding football performance, at the cognitive level and concerning tactical, physical, technical and (perhaps) social¹⁷ and technological aspects. One development that Spearman saw influence this context was the framing of pitches in baseball, i.e., *“A good example comes from baseball with the pitch framing [...] One team kind of recognized that the way, in which a catcher catches the ball can influence the umpire in deciding whether it’s a strike or a ball. So, something that’s*

¹⁷Football is a team sport so the social capital may be relevant to discuss in relation to how technology and data are integrated to influence sporting and business performance. Putnam articulates the significance of social capital *“To build bridging social capital requires that we transcend our social and political and professional identities to connect with people unlike ourselves. This is why team sports provide good venues for social-capital production.”* ([72], p. 411).

in the strike zone or without. And this was not something that was being measured by too many people. They realized that this could actually result in, you know, maybe like three to ten wins above [...] By finding somebody who's good at this pitch framing. And because nobody was really measuring the statistic, it wasn't something that cost a lot of. So, they were able to go find somebody, who was really, nobody thought was a terribly good player [...] Pay the team to trade for him and then go and become very successful with this player." However, this vitalized notion of technology and data goes beyond coaches and players and into the sporting and commercial strategies, i.e., looking at the long-term sustainability of the club, in football and sports. There are clear business benefits of increased data and economic advantages of more decision-making on 'qualified' data. Respondent 2b emphasizes this in that *"If one had this equipment oneself, then I could imagine that one could set it up at a sports field or something like that and then one could try to reproduce a free kick goal, Ronaldo's running pattern, how high he jumps and then one could get some rating that now, you are 50% Ronaldo and then one could compare oneself with friends, who may be 60% Ronaldo."* This is value creation in real demand created around the game of football and its application of technology and data that may inspire football fans of various ages and across international borders to 'Play Like A Pro' [14]. Such concepts are well aligned with current trends and tendencies in the football landscape, e.g., promoting the crossroad between football fitness, physical activity, and public health benefits [73, 74]. Hence, it may also unfold in relation to strategic sponsorship activation¹⁸ like seen in the 2010 World Cup in the form of Castrol's 'performance index' showcasing the skills of Cristiano Ronaldo and other top players and to set the agenda for what these top players are capable of regarding football performances [14].

To strategize this context, there is an obligation for stakeholders in football to intelligently co-create and co-brand. One challenge is that the strategic organ in football organizations is all too often too distanced from the operational and daily contexts to understand how to construct or shape the knowledge and skills, which can guide competent 'qualification' processes of data and data-driven decision-making in the organization (if decisions really are made on that foundation?). For instance, there is interesting potential in trying to 'qualify' technology and data in a context of 'hybrid' sports branding [13], e.g., taking the economic benefits of finding the 'right players' with the 'right competencies' but understanding how to leverage the branding interplay. The latter refers to the hybrid element(s), which may beneficially be orchestrated across various platforms when there is a 'qualified' construction of the specific player brand in the context of the sport (football), the league, the club, and its commercial stakeholders. This working approach will construct 'new meaning' in terms of talent identification, recruitment, and development from a 'sport of sports' and from a 'sports business' perspective.

Technology and data can help to demonstrate somewhat hidden qualities of players and assist clubs in winning and players in developing and it can be used by the clubs for various sporting and business purposes, e.g., creating positive transformation¹⁹ on the transfer market and expanding the club's economic transfer balance and entire valuation from these transactions [38]. Spearman indicates that *"For example, with expected goals, which is one of the more prevalent statistics in soccer, if you're able to identify a player [...] So, with beyond the expected goals where you're looking at a player, who is able to put himself, create space in dangerous situations, but maybe*

¹⁸Strategic in the sense that it is aligned with Castrol's strategic foundation and brand.

¹⁹This element of transformation is integrated in the 'cultural product' of **Figure 3**, cf. below.

the team doesn't, is either incapable of getting him the ball while he's there or doesn't recognize him as a player to feed the ball to. But because he's creating this space in dangerous scenarios he's creating an advantage for his team, that his team may not be recognizing. So, if another team were to go identify this player, you know, transfer him in, and then potentially could be very successful if properly fed the ball so that it's something where you might find an undervalued player in that way in soccer."

14. Segmented marketplaces and learning to spark football's innovation

Football is a segmented marketplace. Budzinski and Satzer [75] argue that the business of sports is characterized as multisided markets, in which there is a strong interdependence between different business markets²⁰, e.g., sponsorship income may be affected by ticket sales and vice versa. Spearman notes the interesting aspect in this in that *"One thing that a lot of clubs may not be thinking about is how to leverage nationalities in order to kind of bring in more revenue for the team. So, when you're thinking about a transfer, you're thinking about how these players can impact a locker room, how this player is going to impact the team. Sometimes, you might not be thinking about how this player is going to impact the viewership."* There are market specific examples according to Spearman, e.g., *"A player like Christian Pulisic. Nearly every American heard of him, who knows anything about soccer player. The Dortmund player. He's a player that you know. He might not be the best player at his position, maybe not even in the top 20, but if you bring him into a big market team like Manchester United or Real Madrid you're probably going to see a revenue spike from the United States segment of the population, just because that's a huge market. And people love this player and they're very likely to take an interest in your team and support it in a financial way. If you have a player like that, I don't know if that's something that a lot of front offices are thinking about necessarily. Sort of, you know, the kind of players that would engage the fans rather than just..."* This citation speaks well with strategies like that of Manchester United, which aimed to strategically capitalize on players with good grounding in various market places, e.g., Park Ji-Sung from South Korea or Javier Hernández from Mexico. It is evident in the data that there is an interesting dynamic between how data influences team and player performance dynamics while influencing business dynamics, e.g., the multisided market analogy, and football economic factors as well. For instance, it sparks strategic questions as to how this may open up for new segments or how data can help to project who may become a superstar on the pitch and assist in starting the process of capitalizing on that off the pitch, e.g., Christian Pulisic may be a good bargain for current American brands? Football as a segmented market place works with the notion that without engaged audiences, it is not as interesting from a commercial angle and data can create new blended commercial cocktails with clubs and their actors, e.g., players and coaches, and fans, sponsors and the media. However, bringing things to life in the right (qualified) version is significant (keep Mead

²⁰"The name 'two-sided' market was originally chosen to characterize the two sides of demand (customer groups) a supplier on such a market must deal with. However, since every market consists of 'two sides' in a different sense (supply and demand), the adequateness of this name is subject to controversy, e.g., [76]. Next to the simple enhancement towards cases of more than two distinct customer groups ('multisided' markets), the term 'platform' markets is preferred by some. Yet, 'two-sided' or 'multisided' respectively seem to be the established terms, wherefore we will use them in the following" ([75], p. 69).

and Blumer's notion of meaning, language and thought in mind). Spearman sees that connection too in stating that *"You're teaching a language too, I guess, like with the schematics on the tactics board. You know like, if you see tactics board the first time you have no idea what these X's and O's mean but then you learn the language and so I think. Coming up with a good language visually and then teaching it to the fans and to the athletes and to the coaches."* So, strategically, this is an acknowledgment of the fact that football is about 'learning'. The powerful analogy of a teacher being the smartest mathematician but not knowing how to convey and articulate his/her professional knowledge to facilitate learning for his/her students does not meet any ROI, ROO or ROE indicators. It is the same in football. For instance, data analysts must be able to arrange and communicate their professional knowledge to coaches and players and just like the business side of a football club must do the same towards stakeholders like fans, sponsors and the media.

Football clubs are starting to work even more strategically on influencing customer-driven innovation. Spearman notes that *"You've seen a little bit of this with hackathons [...] FC Nordsjælland recently had a hackathon where they gave people access to tracking data. Some fans and analysts and let them see what they could create. Manchester City did the same thing a few years ago. Bayern München has done it before. It's a way, it's not going to engage with the community at large necessarily but it's kind of a first step I think in that process because you're basically saying here's some data let's get the people who are real nerds about this and give them a chance to interact with it. I think you can go well beyond that because you kind of see, you know, once you build more tools in terms of how to interact with the data, it lowers the bar for how technical you have to be in order to kind of develop new ideas with that data. So, when you have like ways to visualize it when you have a kind of, you know even video games, where you can kind of try out new things with the data, with historical data and see like if we had done a different tactic of these 2016/2017 season. So, I mean, I don't know if this is how it's going to go but it would be interesting if in the future, you know, like say. Say Manchester United released kind of like a simulation sort of Football Manager style that let fans try different tactics during that season to see if they were able to come up with better results and then you know crowd-source that sort of thing."* It engages the stakeholders and connects 'big data', stakeholder communication and new innovation, e.g., in involving new segments from the eSport crowds that now have become part of some professional football clubs. It is also seen in the sporting performance side, e.g., the Dutch company 'Beyond Sports' uses virtual reality to enhance tactical development.

15. Better understanding of sports and increased marketability

Along with the 'qualification' discourse in this chapter, technology and data businesses also move into a more crowded market place so simple data does not provide much relevance in terms of marketability and providing more in-depth understanding of football for the coming generations of prosumers. Spearman supplements in *"That's why I hate things like possession stats, because it's just a single number [...] It's not taking into account any of the domain football knowledge that you have [...] So, building a model based on possession and saying like teams that have 70 percent possession win 70 percent of the time is pointless."* This is certainly seen in how less understanding of the game may lead to misinterpreted conclusions that the team with extensive ball possession on the opponent's side of the pitch deserves to win without taking into consideration that the defending team had a clear tactical plan based on own strengths and weaknesses and

focused on transition opportunities. Or you can have statistics showing that one team plays the ball forward a lot without taking into consideration that these passes primarily stem from the right back kicking pointless long balls without seeing intelligent opportunities based on second and third movements (ed. from other players than the player in focus for ball reception).

The market expects more from technology and data solutions in football today and that is a relevant interplay. Spearman adds that *"You're not taking into account any of that information in building the model because it's based on one number. So, any model you have, you have to be very clear about what's gone into it. So, that's why, like with my approach, I don't like using neural networks because I want to be able to explicitly say, this is what's being accounted for, and this is how it's being accounted for, and this is why, when it's wrong, it's wrong. So, I guess with, you know, creating opportunities you have to say like with an expected goal's model, if you just take into account the location of the shot you say; well, I think given the shots they took they should've scored three goals but I'm not taking into account the location of the defenders because I am not using tracking data for this model, which means that if they park the bus and there are 11 defenders behind every shot. Even if the shot came from 10 yards away, it doesn't matter. You know it's gonna be a terrible shot because there are 11 people there."* So, this proves the importance of qualifying the chosen methodology, it proves the importance of qualifying the data and it paints a picture of the vitality of clearly understanding opportunities and limitations of technology and data application in professional football. For instance, to go on with Spearman's example of the expected goal model. Other factors of interest may be 'who is taking the shot?', 'who is the keeper?', and 'who are the defenders?' The round of 16 game between Portugal and Uruguay showed Portugal having lots of possession in front of Uruguay's penalty box in the second half and even when Portugal came into that zone Uruguay defended quite well led by defensive star Diego Godin. In that sense, it also interesting that Fabio Cannavaro was the last defensive player to win Ballon d'Or, which dates back to 2006 as there is high focus in football cultures on the players, who score the goals. Spearman highlights the importance of clear communication when presenting the data, i.e., *"When you're saying things about your models, never say it with too much forcefulness, because you have to be explicit with the things you're not taking into account in addition to what you are taking into account."*

In that sense, Spearman also stresses the many opportunities in tracking data influencing the future of technology and data in football. *"Yeah, I think the tracking data is huge. So, I think the tracking data really is the way of the future [...] Any team. Even any media provider that's not trying to kind of, represent the game using tracking data is going to be behind the curve [...] There are a lot of reasons for that [...] You are seeing a lot of new models come out that involves the tracking data. A lot of new approaches with space and so we're beginning to quantify things that coaches, and analysts and athletes have known for a long time about space creation [...] One of the biggest kinds of disconnects between the fan experience and the people inside of clubs, is being able to see the game in a spatial way. Like our fans are going to watch the match and be like OK, well our guys took a lot of shots, they should have won, or our guys just looked better today. And that's kind of oftentimes influenced by the final score line you know."* Thus, the data presents marketability opportunities in bridging the knowledge gap between the sporting side and the stakeholder (fans, sponsors and the media) experience and in understanding the importance of time and context or written in football language: 'time and space' are crucial. Spearman touches on that, i.e., *"The current data we have that's presented on Sky Sports is not spatial. And so, for the fans to really start to kind of understand the way the coach might look at it, I mean, you'll get a lot of clichés afterwards, like you know, we got out there and we pressed really hard. There are no metrics around pressing hardly so there's no way for the fans to like really fully understand, what it means to look like other*

than just kind of watching him be like OK I saw a few times when the guy with the ball was dispossessed. There's really no way to kind of visualize that pressing and with tracking data you can start saying; OK well this is how fast they were. Once a player gets the ball on average they were closed down at this rate [...] Even more dynamically, like this was the space available to a player when he got the ball. That area shrunk by this much. And then you could show kind of an average way, in which that occurs to visualize how that pressing happened." So, this chapter should motivate stakeholders in professional football to look at how they develop and apply technology and data. Blending these data with knowledge of the game is both interesting and complicated; just imagine when a player receives the ball on the last offensive third of the pitch. Does the defender(s) fall back or does one of them push up to press the player with the ball. Spearman underlines how conveying the data competently makes it less complicated and more marketable in stating that "One of the big ways, and this is something that I've done a decent bit of research on, is kind of making it easy to see complicated domain knowledge [...] Simplifying some of the domain knowledge, not necessarily removing information but making it easier to see. [...] A good analyst, a good scout is going to be able to watch a match and see when there's space when there's like a region of space that's being controlled by a player. As a fan, I may have some sense of that, but it's going to be very difficult for me to have the same level of knowledge that the analyst or scout might have. However, that analyst or scout, the reason they have the knowledge they do is because they spend so much time watching this match, you know, putting this information through their own mental model. And theoretically, if there is a mental model there, which I would argue that there is, one could use data to build a data model and then visualize that in a more meaningful way. So, getting back to the notion of pitch control. The pitch control field is something that could be easily overlaid kind of in a, you know, a video feed setting, that would allow the fan, who maybe doesn't have those 30, 40 years of experience in the sport to see; ok well right now Messi has moved this direction, which has opened up this huge space for Neymar or Suarez to move into and to receive a through ball from the midfield or something." Making it easier to comprehend relevant parts of the game offers opportunities for commercial stakeholders to interact so that all parties come closer to the common denominator of what's at stake in the game. But 'big data' also provide the heterogeneous market dimension that the data can go in many directions depending on the eye of the beholder for what reason qualification also becomes a matter of competent 'framing'. Football is a multidimensional game with much decisive randomness²¹ for what reason technology and data can facilitate relevant debates and more importantly learning.

One of the main changes to the understanding of football, which technology and data provide, is that this context creates a relevant cohesion between the sporting and commercial focal points and how to strategize and capitalize on that. For instance, Spearman mentions that "I will start with the stakeholders. So, one of the things a lot of times, you know especially with a game like soccer, which has a lot of elements of randomness. It can be very easy. And you see it a lot where you know a coach has a bad record [...] Everybody wants to string the coach up, to get rid of him [...] Having a common language that's maybe a little bit more objective and that's kind of what I was saying about the data. You can overcome biases. So, having that common objective approach can allow the fans and the owners to say; OK yeah, we've lost three of the last four games, but if we look at our expected goals we've been performing really well. Data can help clubs strategize decision-making, communication, fan engagement, sponsorship work and it becomes a risk management tool as well to minimize damaging managerial

²¹Look at the outcome of the games in the World Cup, e.g., shots deflected ending in a game-winning goal, the influence of the VAR system, a linesman missing the offside, etc.

decisions. Spearman mentions this example, i.e., *There's no point in firing this manager, whom we have spent tens of millions of dollars to bring in. Just because of a few bad results that were unlucky. And you can now define unlucky rather than just saying we think it's unlucky. So, I think from an ownership stakeholder perspective, that's going to be really useful in avoiding these sorts of bad decisions that lead to, you know, okay you've had a 10-million-dollar contract for this manager. Now we have to still pay him that, but we have to pay this new manager another 10 million dollars. This is just a waste of money.*"

16. Concluding remarks and future research

Technology and data improve the commercial outcomes for teams, not only by raising the sporting performance of the athletes (and thus winning more often), but also by allowing the data to be commercialized. This includes technological innovation, biostatistics, movement data, and other game-based information, which improve how a football club manages performance and enhances the circumstances for unfolding its talent on and off the pitch. This commercialization creates still more fandom above and beyond what's driven by the sporting outcomes and thereby opportunities for better comprehensive fan experiences and innovative commercial solutions that can support revenue generation. Currently, though, the sheer amount of data that is becoming available to sporting enterprises is difficult to harness and use effectively both for technical reasons, but also due to a lack of financial and human resources. Yet, the fear of missing out (FOMO) is causing some organizations to prematurely (that's not good strategic execution) engage the data anyway.

Commercial sub-optimization may be prevented with the use of technology and data. However, what needs to happen is that the data needs to be qualified so that knowledge-sharing, individual and organizational learning co-exist along with the aim to apply technology and data to improve sporting and business performances. If there is a lack of resources, e.g., in terms of financial and human capital, one way to overcome this constraint is to strategically invest in technology and data to optimize the utilization of these forms of capital. In such, technology and data are potent vehicles that can change performance in the sport and business nexus and by catering to new audiences and improving the engagement with existing audiences, there is a good chance of increasing profitability. In the tracking-driven and thus performance-generated commercialization in football, data accuracy is central so qualification should become a matter of: circumstances for data collection (e.g., methodological conditions), persons behind the data (who collected the data?), avoiding to fall in the trap of 'data for the sake of data' (quality of data should outshine 'quantity focus'), and of creating effective platforms for user involvement to bring the data to life in a wider football context.

Future research should include a better understanding of the intellectual property issues of who owns this data—the athletes, the teams, the governing bodies (e.g., FIFA, UEFA, national football associations, and leagues like the English Premier League), media companies, the public (is it public data like boxscores), the technology companies themselves? In some sense, whoever owns or co-owns the data will be able to profit off of it, yet based on the Coase Theorem, the data *will* become commercialized if there are economic reasons to do so²².

²²Coase [77] noted that, under various assumptions, regardless of who owns an asset, that asset will be used in a way to maximize its net value.

Additionally, research on the strategic tradeoff between generating profit off of the commercialization of the data and whether the release of the data becomes an advantage for rivals.

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