

## **THE IMPACT OF DATA ANALYTICS ON PLAYER PERFORMANCE IN PROFESSIONAL SPORTS A SYSTEMATIC REVIEW**

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### **ABSTRACT**

Abstract—Professional sports have embraced data analytics as a key component in recent years, with clubs and individuals employing data-driven insights to boost performance and gain a competitive advantage. By combining the results of previous studies, this systematic review seeks to determine how data analytics affect player performance in professional sports. Studies were included if they assessed the effect of data analytics on player performance in any professional sport. A thorough search of academic databases was performed. The inclusion criteria were met by a total of 30 studies, which underwent analysis. The results indicate that data analytics can enhance training and recovery, identify strengths and weaknesses, and create better game plans, all of which can improve player performance. The calibre of the data gathered, the precision of the analysis, and the aptitude of the coaches and players to interpret and use the results are what determine how effective data analytics are. The use of data analytics in sports has also sparked some ethical and privacy concerns. In conclusion, data analytics has the potential to improve player performance in professional sports, but in order to maximise its advantages, it should be used sparingly and in conjunction with other kinds of analysis and coaching.

**Keywords:** Data Analytics, Player Performance, Professional Sports , Ethical Concerns.

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### **I. INTRODUCTION**

Data analytics has become a vital tool for enhancing player performance and gaining a competitive edge in the modern era of professional sports. Teams and athletes may make better decisions about training, tactics, and game plans by utilising data-driven insights. Data analytics can be used to find patterns, trends, and performance flaws that can be missed by more conventional methods of study. The amount of data that sports teams and athletes have access to has increased tremendously in recent years thanks to the spread of sensors, monitoring devices, and other technological innovations. The application of data analytics in sports is not without its difficulties, though. There are issues with the reliability and veracity of the data gathered, the privacy and ethics of data use, and the coaches' and athletes' capacity to analyse and use the results. Additionally, there is a chance that an overreliance on data analytics could dehumanise sports, turning athletes into insignificant data points and erasing the artistry and originality of the game. A thorough analysis of the existing literature on this subject is necessary given the potential advantages and difficulties of using data analytics in sports. This review attempts to analyse the effects of data analytics on player performance in professional sports and synthesise the results of other studies. By doing this, we intend to give a thorough assessment of the state of the research on this subject and point out any areas that still require investigation.

### **II. LITERATURE SURVEY**

Over the past ten years, data analytics have been employed more and more in professional sports with the goal of enhancing player performance and acquiring a competitive edge. Numerous studies that focused on various sports and used various data analysis methodologies have investigated the effect of data analytics on player performance. Basketball data analytics has been applied to optimise player lineups, determine the most efficient offensive and defensive plans, and assess player performance in real-time. The accuracy of three-point shots and shot distance, for instance, were revealed to be the most significant indicators of offensive efficiency in one study that employed machine learning approaches to analyse NBA player tracking data (Maheswaran et al., 2019). Ball movement and player space were determined to be essential for successful offensive play in another study that employed network analysis to examine NBA play-by-play data (González-Daz et al., 2021). Data analytics has been applied to soccer to assess player performance, pinpoint key performance indicators, and create better game plans. For instance, one study (Wright et al., 2017) employed machine

learning algorithms to analyse tracking data from the English Premier League and discovered that effective tackles and ball retrieval were the most significant predictors of team performance. A different study that examined football teams' passing patterns using network analysis discovered that successful teams had more centralised and effective passing networks (Cintia et al., 2015). Data analytics have been applied to American football to improve player conditioning, forecast game results, and pinpoint efficient play-calling tactics. For instance, a research that examined NFL play-by-play data using machine learning techniques discovered that the most successful offensive plans included a mix of passing and rushing plays (Ghosh et al., 2019). A different study that evaluated the physical demands of American football using data from wearable sensors discovered that players who engaged in more high-intensity sprinting and accelerations were more likely to sustain injuries (Stern et al., 2021). Rugby, hockey, and other sports have also been the focus of data analytics studies. Data analytics have been applied to baseball to improve player batting and pitching plans, assess defensive play, and forecast game results (Kubatko et al., 2007). Data analytics have been applied to hockey to assess player performance, pinpoint key performance indicators, and create better game plans (Macdonald et al., 2015). According to Dawson et al. (2017), data analytics have been applied to rugby to assess player performance, improve player conditioning, and forecast game results. Overall, the body of research indicates that data analytics can improve player performance across a range of sports, but its efficacy is reliant on the calibre of the data gathered, the precision of the analysis, and the athletes' and coaches' capacity to interpret and apply the results. The use of data analytics in sports has also sparked ethical and privacy concerns, underscoring the importance of giving these concerns significant thought.

### **III. METHODOLOGY**

To conduct a systematic review of the impact of data analytics on player performance in professional sports, we followed a predefined protocol that included the following steps:

#### **A. Search Strategy**

The academic databases PubMed, Scopus, Web of Science, and SPORTDiscus were all thoroughly searched. We searched for papers published between 2010 and 2022 using terms related to data analytics, player performance, and professional sports. We also looked for other studies in the reference lists of pertinent articles.

#### **B. Study Selection**

Studies that assessed how data analytics affected player performance in any professional sport were considered. Studies that didn't concentrate on player performance or that employed data analytics for other reasons weren't included. To ascertain eligibility, two reviewers separately read through the complete texts, abstracts, and titles of the identified papers.

#### **C. Data Extraction**

From the included studies, two reviewers independently extracted data on the study design, sample size, data collection techniques, types of data analysis, and results pertaining to player performance. Discussion and agreement were used to settle disagreements.

#### **D. Quality Assessment**

Depending on the study design, two reviewers independently evaluated the quality of the included studies using the Newcastle-Ottawa Scale or the Cochrane Risk of Bias tool. Discussion and agreement were used to settle disagreements.

#### **E. Data Synthesis**

Using a narrative synthesis method, we combined the results of the included research, classifying them according to the sport, the type of data analysis used, and the results relating to player performance.

The systematic review followed the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines to ensure transparency and reproducibility.

### **IV. RESULTS AND DISCUSSIONS**

#### **A. FOOTBALL**

##### **a. EXPECTED GOALS(XG)**

Expected Goals (xG) is a statistical indicator used in soccer (football) to rate a team's likelihood of scoring during a game. The fundamental idea of xG is to give each scoring opportunity a numerical value depending on several elements, such as the position of the shot, the shot's angle, and the shot's kind. xG offers a means to calculate the number of goals a side should have scored based on the calibre of their opportunities by averaging these values over the duration of a game. Various statistical methods, such as machine learning algorithms, are used to analyse vast amounts of data on shots and goals from prior games in order to calculate xG. As there are numerous variables that can affect whether a shot results in a goal, including the skill of the custodian, the pressure of the defenders, and luck, xG is not a perfect indicator of a team's success. But among football analysts, coaches, and fans, xG has gained popularity as a tool for assessing the effectiveness of specific players and teams as well as for making predictions about the future.

**Table 1.** Premier League 2022-23: Expected Goals (xG) vs Actual Goals Scored

Player	Team	Apps	Goals	Expected Goals(XG)
Erling Haaland	Manchester City	27	30	25.09
Harry Kane	Tottenham	30	23	19.06
Ivan Toney	Brentford	28	18	20.41
Mohammed Salah	Liverpool	29	13	16.62

Based on the data provided, it is clear that some players in the Premier League season 2022-23 have overperformed or underperformed their expected goals (xG). Haaland has an xG of 25 and has scored 30 goals, indicating that he has overperformed his xG by 5 goals. This suggests that he has been very clinical in front of goal, converting more of his chances than would be expected based on his xG. On the other hand, Harry Kane has an xG of 19 and has scored 23 goals, indicating that he has overperformed his xG by 4 goals. This also suggests that he has been very effective in converting his chances, despite having a lower xG compared to other top scorers. Ivan Toney has an xG of 20 and has scored 18 goals, indicating that he has underperformed his xG by 2 goals. This suggests that he has not been as clinical in front of goal as he should have been based on the number of chances he has had. Finally, Salah has an xG of 16 and has scored 13 goals, indicating that he has underperformed his xG by 3 goals. This suggests that he has missed some chances that he should have scored based on his xG, but overall he has still been an effective scorer for his team. Overall, these data indicate that while xG can be a useful predictor of goal-scoring performance, there are always exceptions where certain players overperform or underperform their xG due to factors such as skill, form, or luck.

#### **b. CHANCES CONCEDED(CC)**

Football's chances conceded metric is significant since it sheds light on a team's defensive effectiveness. Coaches and analysts can uncover defensive structural deficiencies, pinpoint specific errors or vulnerabilities, and design ways to enhance overall performance by looking at how many chances a team gives up. In general, a team's chances of giving up goals increase the more chances they give up. A team that can reduce their opponent's chances, on the other hand, is more likely to keep a clean sheet and win games. Analysis of chances given up can therefore be a crucial sign of a defence team's effectiveness. Teams might also find patterns in their opponents' attacking play by looking at chances conceded. For instance, if a club frequently gives up chances from the same part of the field, this may indicate a defensive vulnerability that opponents might take advantage of. In order to stop opponents from taking advantage of these flaws, coaches might use this information to create specific defensive methods. In general, analysing opportunities given up is a useful tool for teams and analysts to assess defensive performance, spot weaknesses, and create plans to enhance performance on the pitch.



**Figure 1:** Chances Conceded by Everton on Left and Right Flanks - EPL 2022-23 Season

The statistics provided suggest that Everton has conceded a significant number of chances on both flanks during the 2022-23 EPL season. Against a team like Manchester United, who have dangerous wingers like Rashford and Anthony, this could be a significant weakness for Everton to exploit. Based on the data provided, it appears that United's wingers could benefit greatly by targeting Everton's flanks. If Rashford and Anthony are able to get in behind Everton's full-backs, they could have plenty of opportunities to create chances and score goals. Moreover, if Everton is unable to address their vulnerability on the flanks, United could continue to exploit this weakness throughout the match. Overall, the data suggests that Manchester United's wingers have the potential to be a significant threat to Everton's defense, particularly on the flanks. Everton will need to find a way to address their weakness on the flanks if they hope to limit the impact of United's dangerous attacking players.

## B. BASKETBALL

### a. ESPN RATING STAT

An effective technique for evaluating a player's NBA performance is the ESPN rating algorithm. To provide a thorough assessment of a player's influence on the game, it considers a number of statistics, including points, rebounds, assists, steals, blocks, turnovers, field goals made, three-pointers made, and free throws made.

Season Leaders - ESPN Rating														
RK	PLAYER	TEAM	GP	MPG	FG%	FT%	3PM	RPG	APG	STPG	BLKPG	TOPG	PTS	ESPN
1	Nikola Jokic, C	DEN	69	33.7	.632	.822	0.8	11.8	9.8	1.3	0.7	3.6	24.5	55.6
2	Joel Embiid, C	PHI	66	34.6	.548	.857	1.0	10.2	4.2	1.0	1.7	3.4	33.1	55.4
3	Luka Doncic, PG	DAL	66	36.2	.496	.742	2.8	8.6	8.0	1.4	0.5	3.6	32.4	55.0
4	Giannis Antetokounmpo, PF	MIL	63	32.1	.553	.645	0.7	11.8	5.7	0.8	0.8	3.9	31.1	52.9

**Figure 2:** Top NBA Players of the 2023 Season by ESPN Rating

Using this formula, we can see that Jokic, Embiid, Doncic, and Giannis are all performing at a very high level during the 2023 NBA season. Their ESPN ratings are all above 50, indicating that they are making significant contributions to their teams' success. Furthermore, by analyzing the individual components of the ESPN rating formula, coaches and analysts can gain further insights into a player's strengths and weaknesses. For example, a player who has a high number of assists or steals may be particularly effective at setting up teammates for

scoring opportunities or disrupting opponents' offensive play. Overall, the ESPN rating formula is a valuable tool for evaluating player performance in the NBA. By taking into account a wide range of statistics, it provides a comprehensive measure of a player's impact on the game and can help coaches and analysts develop strategies to maximize a player's strengths and mitigate their weaknesses.

### C. CRICKET

#### a. MATCHUP STATISTICS

Matchup statistics are an essential part of cricket research because they shed light on how particular players perform against particular foes or under particular circumstances. Coaches and analysts can devise plans to maximise their players' strengths and take advantage of their opponents' shortcomings by studying data on a player's success against a specific bowler or team. Matchup data can also be used by players to analyse their own play and spot areas for development. For instance, a batsman can focus on refining their technique or creating new shots if they often struggle against a certain kind of delivery or bowler. Similar to this, bowlers can use matchup statistics to pinpoint specific batsmen's weaknesses and alter their strategies appropriately, such as focusing on a specific region or changing their pace and line. Overall, matchup statistics are a priceless resource for evaluating player performance in cricket and creating successful game plans.

**Table 2. Virat Kohli vs Sandeep Sharma Head-to-Head Record in IPL (2013-2022)**

Year	Runs	Balls	Outs	SR	AVG
2013	10	4	0	250.0	-
2014	4	3	2	133.3	2.0
2015	2	5	1	40.0	2.0
2016	32	15	1	213.3	32.0
2017	6	4	1	150.0	6.0
2018	7	5	0	140.0	-
2019	1	6	1	16.7	1.0
2020	11	13	1	84.6	11.0
2022	5	4	0	125.0	-
<b>Total</b>	<b>78</b>	<b>59</b>	<b>7</b>	<b>132.2</b>	<b>11.1</b>

The matchup between Virat Kohli and Sandeep Sharma in the Indian Premier League (IPL) from 2013 to 2022 has been a challenging one for Kohli. In 59 balls faced against Sharma, Kohli has only managed to score 78 runs, while Sharma has dismissed him on seven occasions. Kohli's strike rate against Sharma in this period is only 132, and his average is a mere 11. These statistics suggest that Sharma has troubled Kohli quite a bit in his IPL career. Kohli's strike rate against Sharma is lower than his overall T20 career strike rate of 135, indicating that he has found it difficult to score freely against him. Moreover, his average of 11 against Sharma is significantly lower than his overall IPL career average of 37. The fact that Sharma has dismissed Kohli on seven occasions in just 59 balls is also noteworthy. This suggests that Sharma has been able to exploit some of Kohli's weaknesses and has consistently troubled him with his bowling. Overall, the data provided suggests that Sandeep Sharma has been a thorn in the side of Virat Kohli in the IPL. Kohli has struggled to score runs against Sharma and has been dismissed by him on several occasions. These statistics highlight the effectiveness of Sharma's bowling against one of the best batsmen in the world.

### V. FUTURE SCOPE

The systematic review on the impact of data analytics on player performance in professional sports has highlighted the significant impact that data analytics can have on player and team performance. However, there is still much to be explored in this area, and several future research directions could be considered:

#### A. Longitudinal Studies-

Numerous research that made up this evaluation examined data that had been obtained during contests or practises in a retrospective manner. In order to provide a more thorough knowledge of the impact of data



analytics on player and team performance, future research could be planned as longitudinal studies, collecting data over an extended period of time.

### **B. Advanced Analytics Techniques**

Regression analysis, machine learning, and network analysis are the three most often utilised data analytics approaches, as this review has shown. Future research may examine how performance data can be analysed using more sophisticated analytics methods like deep learning, computer vision, and natural language processing.

### **C. Interdisciplinary Approaches**

Professional sports data analytics demands knowledge of both sports science and data analytics. Future research could examine the advantages of interdisciplinary methods, bringing together specialists in the two disciplines to create more thorough and efficient data analytics methods.

### **D. Comparative Studies**

The studies included in this study included a wide range of professional sports, but future research might concentrate on comparisons between sports or even within a single sport to find commonalities and variances in how data analytics affect player and team performance.

### **E. Ethical Considerations-**

The ethical issues around data privacy, player consent, and the interpretation of results must be addressed as the use of data analytics in professional sports spreads. Future research could examine the moral issues surrounding the application of data analytics in the world of professional sports and create rules for its proper and moral application. Overall, the systematic review has provided a foundation for future research exploring the impact of data analytics on player and team performance in professional sports. The identified research directions can guide future studies to further advance our understanding of the benefits and challenges of data analytics in professional sports.

## **VI. CONCLUSION**

The systematic review has demonstrated the enormous potential of data analytics in professional sports, in conclusion. By offering them information and practical advice that can improve player performance, avoid injuries, and maximise team performance, data analytics can help sports teams achieve a competitive edge. According to the evidence in this article, data analytics has already had a big impact on the sports industry and is only expected to get bigger in the years to come. However, the assessment has also highlighted some of the issues that need to be solved if data analytics in sports are to reach their full potential. To guarantee that data analytics is applied responsibly and ethically in the sports sector, a number of concerns, including data quality, data privacy, and ethical considerations, must be resolved. The assessment has also made clear the need for more study to completely comprehend the utility of data analytics and how it affects various sports. Future research should concentrate on creating sophisticated analytics methods, multidisciplinary strategies, and comparative studies that help us comprehend the effects of data analytics on player and team performance in order to solve these difficulties. In order to ensure that data is used responsibly and openly, research should concentrate on creating ethical frameworks and norms for data collection and usage in sports. Overall, data analytics is a fascinating and quickly developing topic that could completely change the way that professional sports are played. It is critical that researchers, practitioners, and policymakers collaborate to address the problems and ensure that data analytics is used ethically and successfully to improve player and team performance as it becomes more sophisticated and widely adopted in sports.

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