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Trends in performance indicators of English Premiership Rugby teams

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Abstract

Introduction. Sport continuously evolves in response to modern challenges, with data analysis playing a pivotal role in understanding trends and predicting future developments. In team sports, including rugby, performance indicators are critical for optimizing training processes and enhancing competitive effectiveness. Aim of Study. This study aims to identify key trends in the performance indicators of English Premiership Rugby teams from 2014 to 2024. Material and Methods. The dataset included 1,261 matches, covering 96.9% of all games during this period. A total of 25 performance indicators were analyzed. Results. The results revealed a gradual increase in points per match from 24.0 to 25.9 ($R^2 = 0.69$, $p < 0.05$), driven by a rise in tries from 2.5 to 3.5 ($R^2 = 0.90$, $p < 0.05$) and successful conversions from 1.9 to 2.4 ($R^2 = 0.85$, $p < 0.05$). The number of mauls increased from 3.3 to 5.7 ($R^2 = 0.81$, $p < 0.05$), accompanied by an improvement in maul success rate from 85% to 91%. In contrast, penalty goals declined from 2.3 to 1.1 ($R^2 = 0.96$, $p < 0.05$), while offloads decreased from 9.2 to 7.0 ($R^2 = 0.74$, $p < 0.05$). Conclusions. The findings indicate a gradual and consistent increase in match scoring and a growing importance of specific technical actions. These trends contribute to understanding the ongoing evolution of rugby and its performance dynamics.

KEYWORDS: trends, rugby, performance analysis, English Premiership.

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Introduction

Sport, as a significant element of social life, continuously evolves in response to modern challenges. Facilitated by the media, digital platforms, and international competitions, the growing globalization of sport is among the primary trends [1]. At the same time, data analysis has become a pivotal tool for understanding trends in sports. Modern technologies enable the identification of changes in the sporting environment, the evaluation of key trends, and the prediction of their impact on the industry's development [2]. This contributes to a deeper understanding of the processes shaping the contemporary sport industry and enhances the competitiveness of both individual athletes and teams [3, 4].

Modern science actively investigates the changes occurring across various sports by analyzing the performance indicators of athletes and teams [5, 6]. In team sports, researchers focus particularly on studying trends to optimize training processes and improve the effectiveness of competitive performance. These efforts

span sports such as handball [7, 8], basketball [9], volleyball [10], netball [11] and football [6]. These studies contribute to identifying global trends, which are crucial for the development of each respective sport. Rugby, as one of the leading team sports, is also a focus of scientific research [12, 13]. Over the past decades, the demands on player performance indicators have evolved [14], as have the technical and tactical aspects of the game [15], requiring continuous analysis to identify key trends. Specifically, the analysis of performance indicators, such as offensive and defensive actions, ball possession, number of contact events, and scoring accuracy, is critical for understanding the mechanisms driving team success [16, 17].

Long-term trend studies in rugby performance analysis have highlighted shifts in game dynamics, including increased ball-in-play time, faster ruck speeds, and higher scoring rates, reflecting broader tactical and physical adaptations over the years. Rule changes, such as stricter high tackle regulations and adjustments to scrum engagement protocols, have directly influenced performance indicators [18-20]. Recent research in performance analysis offers insights into game evolution and provide a more comprehensive understanding of how these changes impact team success [16].

A review of contemporary research indicates that identifying key trends in performance activity is grounded in the analysis of team performance indicators. Particular attention is given to studies that assess team effectiveness and the metrics influencing match outcomes [12]. For instance, comparing the performance indicators of winning and losing teams offers valuable insights into the significance of specific metrics and enables their categorization based on their impact on results [17, 21]. Such an approach allows for a deeper understanding of the influence of individual metrics on match outcomes.

However, the majority of studies remain limited to the analysis of isolated indicators or cover only specific time frames, which fails to provide a comprehensive picture of the evolution of the game. This highlights the importance of adopting a holistic approach to identify long-term trends and develop forecasts that can contribute to the ongoing development of rugby.

Material and Methods

Data

Data on the performance indicators of English Premiership Rugby teams were collected for the seasons from 2014-2015 to 2023-2024 inclusive. The data were obtained using web scraping techniques in Python (BeautifulSoup, requests) from open access sources (www.espn.com) and were cross-verified with the official league website (www.premiershiprugby.com). A total of 1,261 matches were analyzed, accounting for 96.9% of all matches during this period. Missing values were found in 3.1% of matches due to incomplete performance data in the 2013-2014, 2014-2015, 2015-2016 and 2016-2017 seasons. To maintain consistency and data reliability, matches with at least one missing performance indicator were excluded from the analysis. A total of 25 performance indicators were examined separately for home and away teams, considering all available metrics reported during the analyzed period. These indicators included the following: score, tries, conversion, penalty goals, kick success rate, meters run, passes, runs, scrums, scrum success rate, lineouts, lineout success rate, tackles, tackle completion rate, clean breaks, defenders beaten, offload, rucks, ruck success rate, mauls, maul success rate, turnovers conceded, red cards, yellow cards, and penalties conceded. Indicators such as kick success rate, scrum success rate, lineout success rate, tackle completion rate, ruck success rate, and maul success rate reflected the success rate of specific actions and were expressed as percentages. All other indicators were measured as the total number of actions performed by the teams during a match [3].

Research procedure and data analysis

The study consisted of two sequentially executed stages. In the first stage, all performance indicators of the teams were grouped by seasons, spanning from the 2013-2014 season to the 2023-2024 season, covering a total of ten seasons. Mean values were calculated for each performance indicator per season. Based on these seasonal means (X), linear regression coefficients, including slope, intercept, R^2, and p-value were calculated for each performance indicator. Standard deviations (SD) were also computed for all performance indicators to demonstrate seasonal fluctuations and better understand data variability. Linear regression was chosen as it is a standard method for identifying trends over time in performance analysis. The coefficient of determination (R^2) was used to assess the strength of association between time and performance indicators. Additionally, 95% confidence intervals (CI) were calculated and visualized for the mean score values per season to provide a more accurate representation of variability and reliability over time.

In the second stage, to visually illustrate the most significant changes over recent years, a chart was

created showing the growth of indicators. The growth rate was calculated only for those indicators that exhibited a statistically significant trend ($p < 0.05$). Percentage changes were determined based on the difference between the values recorded in the 2013-2014 and 2023-2024 seasons. To account for statistical uncertainty, we applied the error propagation method to compute the standard error of the growth rate and the corresponding 95% CI.

Data analysis and visualization of the results were processed in Python software, version 3.12.7. The following libraries were utilized: Pandas, NumPy, SciPy, Matplotlib, and Seaborn.

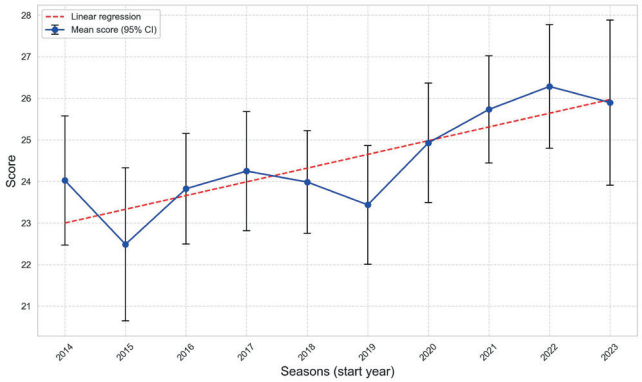

Figure 1. Average points per match with linear trend in Premiership Rugby (2014-2023)

Results

First and foremost, it should be noted that the most important trend is the gradual increase in the number of points scored by teams per match over this period, from 24.0 to 25.9 (slope = 0.33, $R^2 = 0.69$, $p < 0.05$), which indicates a gradual improvement in game performance (Figure 1).

Table 1 presents the mean values of performance indicators for the teams from the 2013-2014 season to the 2023-2024 season, along with the regression values for each indicator. The analysis revealed an increase in the number of tries from 2.5 to 3.5 (slope = 0.12, $R^2 = 0.90$, $p < 0.05$) and successful conversions from 1.9

Table 1. Trends and regression analysis of performance indicators in rugby seasons

Indicators per game		Seasons (start year)										Slope	R^2	p
		2014	2015	2016	2017	2018	2019	2020	2021	2022	2023			
Tries	X	2.5	2.4	2.7	2.9	2.8	2.8	3.1	3.4	3.5	3.5	0.12	0.90	<0.05
	SD	2.0	1.9	1.8	1.9	1.7	1.9	1.8	1.9	1.8	2.1			
Conversion	X	1.9	1.7	2.1	2.1	2.1	2.0	2.2	2.4	2.5	2.4	0.08	0.85	<0.05
	SD	1.7	1.5	1.5	1.6	1.5	1.6	1.5	1.6	1.6	1.7			
Penalty goals	X	2.3	2.3	1.9	1.7	1.8	1.6	1.5	1.3	1.2	1.1	–0.14	0.96	<0.05
	SD	1.7	1.6	1.4	1.3	1.5	1.4	1.3	1.1	1.0	1.0			
Kick success rate	X	72.7	75.5	75.9	76.1	78.3	76.6	76.7	73.2	76.1	72.5	–0.07	0.01	0.77
	SD	22.9	20.2	20.9	23.1	21.1	22.4	20.7	23.4	23.1	24.3			
Meters run	X	387.5	393.8	401.6	431.0	407.9	353.1	379.7	403.2	409.0	428.0	1.63	0.05	0.55
	SD	135.4	117.6	120.9	121.9	114.2	120.5	135.3	134.7	132.9	154.9			
Passes	X	128.2	133.7	148.1	164.9	157.1	133.7	136.6	140.1	141.3	142.7	0.22	0.00	0.87
	SD	39.1	39.6	42.8	45.1	41.2	42.4	38.3	39.5	39.6	42.3			
Runs	X	103.2	108.7	117.3	131.1	129.7	111.1	111.9	106.5	109.5	118.6	0.09	0.00	0.94
	SD	26.3	26.5	29.0	31.1	28.4	27.7	25.9	25.3	26.6	27.6			
Scrums	X	6.8	6.5	6.2	6.8	6.8	7.0	6.3	6.9	6.5	6.6	0.01	0.00	0.86
	SD	2.7	2.4	2.3	2.7	2.5	2.6	2.5	2.8	3.0	3.0			
Scrum success rate	X	83.7	87.6	89.0	92.3	92.2	90.4	89.5	77.9	79.8	77.2	–1.1	0.31	0.09
	SD	15.5	15.6	14.6	11.1	11.0	12.4	16.0	17.5	16.8	17.1			

Lineouts	X	13.6	13.1	13.4	12.9	12.3	13.5	13.9	14.0	14.0	14.1	0.11	0.32	0.09
	SD	3.8	3.8	3.8	3.9	3.5	4.3	3.8	3.8	3.7	3.7			
Lineout success rate	X	85.9	86.3	88.5	88.2	87.3	86.5	88.9	89.1	87.9	87.9	0.2	0.30	0.10
	SD	10.9	10.0	9.6	9.2	10.9	10.4	9.4	8.8	10.4	8.8			
Tackles	X	123.7	130.8	142.5	165.6	169.1	151.5	151.2	150.9	157.2	157.3	2.84	0.36	0.07
	SD	35.5	35.2	38.9	42.8	42.8	39.5	36.7	41.6	40.7	39.6			
Tackle completion rate	X	85.8	86.0	87.0	87.0	86.3	86.5	86.4	86.1	85.8	84.7	–0.11	0.26	0.13
	SD	5.1	4.4	4.2	4.0	4.1	4.2	4.2	4.2	4.1	4.4			
Clean breaks	X	7.1	7.3	8.1	9.6	9.3	7.7	9.0	5.4	5.0	5.9	–0.26	0.24	0.15
	SD	4.4	4.3	4.3	4.7	4.4	5.1	5.6	2.8	2.7	3.6			
Defenders beaten	X	17.5	18.3	18.5	21.5	23.1	20.5	20.6	21.0	22.4	24.0	0.58	0.65	<0.05
	SD	7.6	7.4	7.8	7.5	8.0	8.3	7.8	7.5	7.9	9.1			
Offload	X	9.2	9.4	9.9	8.3	8.0	6.6	7.3	7.4	6.8	7.0	–0.33	0.74	<0.05
	SD	4.7	4.6	4.7	4.2	4.0	3.8	4.1	4.0	4.0	4.4			
Rucks	X	74.0	82.6	89.7	98.8	95.7	84.8	86.7	84.4	87.3	85.6	0.39	0.03	0.63
	SD	21.2	21.4	23.5	25.7	23.7	20.5	21.3	22.5	22.2	19.9			
Ruck success rate	X	95.2	95.5	96.0	97.1	96.9	96.2	96.1	95.8	96.0	95.2	0.06	0.10	0.37
	SD	2.6	2.7	2.4	1.9	1.9	2.7	2.4	2.4	2.2	2.2			
Mauls	X	3.3	3.6	3.5	5.1	4.8	5.6	6.2	6.3	6.5	5.7	0.36	0.81	<0.05
	SD	3.9	3.9	3.7	2.6	2.6	2.9	2.8	3.1	3.1	2.8			
Maul success rate	X	84.6	87.7	86.8	85.8	86.7	86.0	88.1	89.5	90.4	91.4	0.6	0.72	<0.05
	SD	17.1	16.5	17.0	21.4	20.6	19.0	14.1	15.8	15.7	17.3			
Turnovers conceded	X	13.2	13.9	13.9	13.9	13.8	13.5	13.3	13.3	13.1	13.6	–0.05	0.20	0.19
	SD	3.6	3.5	3.8	3.8	3.7	3.6	3.8	3.5	3.8	3.8			
Red cards	X	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.0	0.0	0.30	0.10
	SD	0.2	0.2	0.2	0.2	0.2	0.2	0.3	0.3	0.3	0.2			
Yellow cards	X	0.6	0.4	0.4	0.4	0.4	0.4	0.6	0.6	0.6	0.6	0.02	0.36	0.07
	SD	0.8	0.6	0.6	0.7	0.7	0.7	0.8	0.7	0.8	0.7			
Penalties conceded	X	11.1	10.5	9.8	9.4	9.6	10.5	11.6	11.5	11.1	10.3	0.08	0.10	0.37
	SD	3.2	3.0	2.9	3.1	3.1	3.5	3.3	3.4	3.1	3.3			

Note: X – mean, SD – standard deviation

to 2.4 (slope = 0.08, $R^2 = 0.85$, $p < 0.05$). An increase was also observed in the number of mauls from 3.3 to 5.7 (slope = 0.36, $R^2 = 0.81$, $p < 0.05$), maul success rate from 0.85 to 0.91, and the number of defenders beaten from 17.5 to 24.0 (slope = 0.58, $R^2 = 0.65$, $p < 0.05$).

In contrast, the number of penalty goals decreased from 2.3 to 1.1 (slope = –0.14, $R^2 = 0.96$, $p < 0.05$), as well as the number of offloads from 9.2 to 7.0 (slope = –0.33, $R^2 = 0.74$, $p < 0.05$). All other indicators showed no clear, consistent trend of gradual increase or decrease.

Certain indicators did not undergo significant changes over the period, such as the number of scrums, lineouts, turnovers conceded, and ruck success rate. At the same time, some indicators showed variability during

the considered period but did not exhibit a clear trend throughout, such as meters run, passes, run, and clean breaks.

For a clearer understanding of the trends in indicators that showed a gradual and clear trend over time, Figure 2 presents the percentage changes for the selected indicators ($p < 0.05$). It should be noted that all these indicators had an $R^2 > 0.6$.

The analysis revealed that six indicators exhibited a positive increase, while two indicators demonstrated a negative trend. The largest positive increase occurred in the number of mauls, tries and defenders beaten, each showing an increase of more than 30%. Meanwhile, the most significant decrease was observed in the penalty goals indicator.

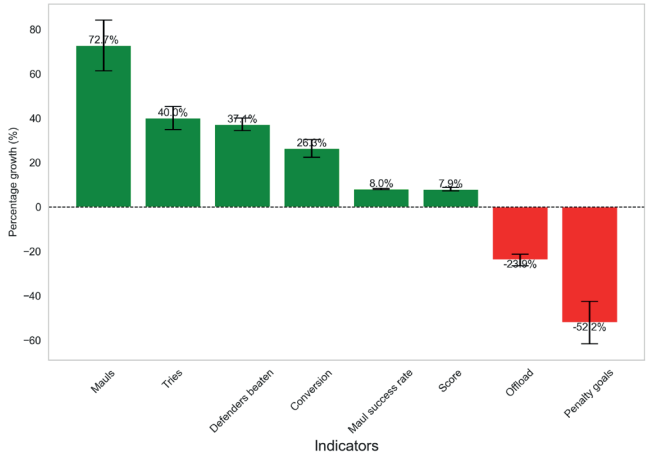

Figure 2. Percentage growth of performance indicators from 2014 to 2023, calculated based on the difference between the initial and final season values

Discussion

One of the key findings of this study is the identification of a gradual increase in the number of points scored per game by teams over the entire study period. This trend can be attributed to the overall increase in attacking actions and the growing professionalization of rugby players over the past decades.

A similar trend of increasing scoring rates has been observed in other team sports over extended periods [7], although this trend may eventually plateau [8]. This further underscores the necessity of continuous analysis to track and understand ongoing changes.

One of the explanations for the rise in points scored per match is the professionalization of rugby. This is supported by studies on players' anthropometric characteristics, which highlight shifts in coaching requirements and tactical decision-making [16]. Research on professional rugby players in the English Premiership has shown that from 2002 to 2011, players have generally become taller, heavier, and younger [22]. However, as noted in a later study [23], the body mass of male players increased initially but then stabilized after 2011. This suggests that coaching approaches have evolved towards greater professionalization: player body mass may be approaching a plateau, beyond which no further performance advantages are likely to occur.

Tracking the dynamics and trends of key performance indicators that have the greatest impact on match outcomes is of critical importance. Among these indicators, tries and conversions are among the most decisive for securing victory [24, 25]. Our findings indicate that both indicators have shown a steady increase over the studied period ($R^2 > 0.85$, $p < 0.05$), directly influencing overall match results. The analysis provides further evidence of a general trend towards more attacking play and increasing scoring rates.

Experts also identify the number of lineouts, tackles, and offloads as key performance indicators influencing match outcomes [26]. Although the number of lineouts ($R^2 = 0.32$, $p = 0.09$) and tackles ($R^2 = 0.36$, $p = 0.07$) performed by teams has increased over the analyzed period, and their linear regression trends show a positive slope, the relationships appear to be more complex than a simple linear dependence.

At the same time, the success rates of actions – tackle completion rate, lineout success rate, and ruck success rate – have remained stable, with no significant changes throughout the analyzed period.

The analysis revealed that the number of offloads ($R^2 = 0.74$, $p < 0.05$) has shown a consistent downward trend. This suggests a gradual decline in the influence of this action on match outcomes. Conversely, the number of defenders beaten ($R^2 = 0.65$, $p < 0.05$) has steadily increased, indicating its growing importance for team performance. Few studies have emphasized the importance of the number of defenders beaten for victory [16]. However, this trend may indicate changes in teams' tactical approaches.

The number of mauls executed has shown the highest relative increase over the analyzed period (72.7%). Researchers acknowledge the importance of mauls in determining match outcomes; however, this indicator is not considered to be among the most critical ones [27, 28]. Additionally, a gradual increase in the success rate of this action has been identified ($R^2 = 0.72$, $p < 0.05$).

Some studies also examine indicators such as possession and territory, which have been shown to influence match outcomes [25]. However, our study did not conduct

a comparative analysis of all performance indicators between winning and losing teams. Thus, this aspect falls outside the scope of our research.

Long-term analysis shows that [18, 19] the evolution of rugby has been characterized by an increase in match intensity, higher game speed, and greater tactical variability. Over multiple championships, teams have shifted their emphasis from traditional dominance in contact play and set pieces to a more dynamic use of space, improved ball control, and more efficient execution of attacking opportunities. Teams in modern rugby demonstrate superior ball retention, faster transitions, and greater effectiveness in territorial control. Furthermore, these trends reflect the global development of rugby and emphasize the necessity for teams to adapt their strategies to the contemporary demands of rugby. Our research aligns with these findings, showing that teams demonstrate better attacking efficiency and increased productivity.

The increase in attacking actions and scoring rates can be attributed not only to the professionalization of players but also to tactical shifts favoring dynamic play and improved offensive efficiency, as supported by recent analyses of the evolution of rugby. Conversely, the decline in offloads and the stabilization of tackle success rates suggest tactical changes and structured defensive play, underscoring the need for training approaches to optimize player development in line with these evolving trends [18, 19, 29].

Overall, it is important to note that performance analysis has been conducted across different years, with researchers selecting specific sets of indicators based on their study objectives. Moreover, these studies have been carried out at various levels of competition. This variability contributes to differences in the identification of key performance indicators for achieving victory.

Injury rates in rugby represent a significant issue that has gained increasing attention in recent years. A comprehensive study conducted in England [30] revealed an increase in the overall severity of injuries and concussion incidence. The findings emphasized the necessity of continued efforts to reduce the overall number of injuries during matches. Research [20] indicates that rule modifications regarding yellow and red cards, introduced to mitigate injury risks, have led to an increase in the number of cards issued per match. Our study supports this observation, showing a similar trend of rising card numbers during the 2020-2021 season compared to the previous one, followed by a stabilization at a certain level.

Conclusions

The conducted analysis demonstrates a gradual and consistent increase in match scoring within the Premiership, driven by the growing attacking potential of teams and the professionalization of players in rugby. Certain key performance indicators for victory have shown a linear increase over the analyzed period, particularly the number of tries and conversions. Conversely, a decline in offloads and an increase in defenders beaten were identified, which may indicate a shift in tactical approaches to the game. Additionally, the number of cards issued rose over a single season, aligning with broader trends observed following competition rule changes. These results highlight the need for coaches to adapt their training process to improve ball retention, defensive reliability and effective transitions into attack, which are becoming increasingly important in modern rugby. Future research should focus on the longitudinal analysis of performances of winning and losing teams.

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Conflict of Interest

The authors declare no conflict of interest.

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