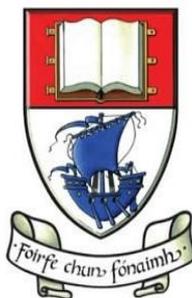


TIER-SPECIFIC ANALYSIS OF TECHNICAL PERFORMANCE  
IN THE ENGLISH PREMIER LEAGUE FROM 2011/12 TO 17/18

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for the BSc in Sports Coaching and Performance.  
Submitted April 24<sup>th</sup>, 2019.



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**Statement of Originality & Ownership of Work**

Department of Health, Sport and Exercise and Science  
BSc in Sports Coaching and Performance

Name: Robert Forde

I confirm that all the work submitted in this project is my own work, not copied from any other person's work (published or unpublished) and that it has not previously been submitted for assessment on any other course, in any other institution.

Signed: \_\_\_\_\_

A handwritten signature in black ink, appearing to read 'R Forde', written over a horizontal line.

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## Abstract

The primary aim of the present study was to identify the differences in technical performance of teams in the English Premier League with special reference to final league position. All data was gathered on seasons 2010/11 to 17/18 and teams were split into four tiers, A (1<sup>st</sup> - 4<sup>th</sup>), B (5<sup>th</sup> - 8<sup>th</sup>), C (9<sup>th</sup> - 14<sup>th</sup>) and D (15<sup>th</sup> - 20<sup>th</sup>). Results included significant differences between tiers in terms of goals conceded (A>B,C,D [ $p \leq 0.001$ ]; B>C,D [ $p \leq 0.001$ ]; C>D [ $p \leq 0.001$ ]), pass completion (A>B,C,D [ $p \leq 0.001$ ]; B>C,D [ $p \leq 0.001$ ]), chances created (A>B,C,D [ $p \leq 0.001$ ]; B>C,D [ $p \leq 0.001$ ]; C>D [ $p \leq 0.05$ ]), and goals scored (A>B,C,D [ $p \leq 0.001$ ]; B>C,D [ $p \leq 0.001$ ]; C>D [ $p \leq 0.001$ ]). A secondary aim was to assess whether there had been any evolution in technical performance and competitiveness. Results included a significant decline in tackle success across all tiers, A ( $76.0 \pm 1.5$  vs  $64.1 \pm 3.6$  [ $p \leq 0.001$ ]), B ( $74.5 \pm 2.6$  vs  $64.1 \pm 2.1$  [ $p \leq 0.001$ ]), C ( $73.7 \pm 1.8$  vs  $62.4 \pm 1.6$  [ $p \leq 0.001$ ]) and D ( $73.6 \pm 2.2$  vs  $62.6 \pm 2.5$  [ $p \leq 0.001$ ]); significant increase in the clean sheets attained by Tier D ( $6.2 \pm 2.2$  vs  $8.2 \pm 2.0$  [ $p \leq 0.05$ ]); significant increase in passes performed by Tier A ( $525.3 \pm 26.1$  vs  $586.1 \pm 70.5$  [ $p \leq 0.05$ ]); significant decrease in shots performed by Tiers C ( $13.4 \pm 1.5$  vs  $11.6 \pm 0.9$  [ $p \leq 0.05$ ]) and D ( $12.8 \pm 1.3$  vs  $10.2 \pm 0.8$  [ $p \leq 0.001$ ]); significant decline in points won by Tier C ( $46.9 \pm 1.8$  vs  $43.9 \pm 1.8$  [ $p \leq 0.001$ ]). Conclusions: The findings of the study predictably demonstrated the general dominance of Tier A teams across nearly all performance variables, who were followed by B, then C and D. Additionally, the superiority of the top teams seems to be increasing as the gap between Tiers B and C has significantly widened.

## 1. Introduction

The English Premier League (EPL) is the most watched soccer league in the world (Cox, 2018) and as a result, it attracts multi-billion pounds in broadcasting, sponsorship, and domestic and foreign investment deals (Wilson, Plumley & Ramchandani, 2013; Deloitte, 2016; Jones, 2017). Thus, the financial rewards for teams competing within the league can be greatly beneficial depending on the final position achieved (Premier League, 2017). Additionally, based on final position further financial rewards can be gained through qualification into Union of European Football Associations (UEFA) competitions, i.e. Champions League (1<sup>st</sup> – 4<sup>th</sup> place) and Europa League (5<sup>th</sup> place) (UEFA, 2012). Research has shown a strong correlation between the EPL teams' financial performance and league position achieved. Consequently, poor-performing or under-achieving teams may experience a negative impact on financial revenue. (Wilson, Plumley & Ramchandani, 2013). Moreover, relegated teams may suffer detrimentally regarding finances because of losing a place in the lucrative EPL (Noll, 2002; Barros & Leach, 2006; Plumley, Ramchandani and Wilson 2018).

Relatedly, research based on EPL clubs' revenue by Cerqua (2014) forecasted a potentially detrimental financial impact suffered by relegated teams due to an unsustainable wage-bill to revenue ratio and losses in broadcasting revenue (up to 20% of overall income), sponsorship deals (approximately £5 million) and matchday profits (up to 15% of overall income). The study concluded by projecting that it may take up to six years for the teams to fully recover financially, thus, it is imperative that relegation is avoided. A limitation of Cerqua's research was the predictive nature of its findings. With those financial implications in mind, there is a significant burden on teams to finish as high possible in the EPL. A large amount of that burden is placed on the coaches due to the results-driven culture of sport (Cushion & Jones, 2006; Cruickshank & Collins, 2012; Rhind, Scott & Fletcher, 2013). Accordingly, coaches are constantly seeking to understand what differentiates successful from unsuccessful teams in terms of on-field performances (Araya, & Larkin, 2013). Consequently, modern coaches are growing evermore reliant on Performance Analysis (PA) to establish the differences between successful and unsuccessful teams (Wright, Atkins & Jones, 2012; Nicholls, & Worsfold, 2016).

PA has been described as an objective method for observing a performance so that the critical events can be efficiently quantified (Hughes & Franks, 2008). The main goal of PA is to develop an understanding of a performance so informed decisions can be made by a coach seeking to optimise future performances, thus it is an integral part of the coaching process (O' Donoghue 2009). The desired understanding of performances, particularly successful ones, can be gained from the studying of the key performance indicators (KPIs) (Wright, Atkins, Jones, & Todd, 2013). KPIs have been defined as a variety, or mixture, of performance variables that aim to identify essential elements of an overall performance (Hughes & Bartlett, 2002). A useful tool for identifying KPIs of a final league position can be to analyse teams that are in direct competition (Swarc, 2004). KPI's may assist teams with initial opposition profiling (Carling, Reilly & Williams, 2008; Mitrotasios & Armatas, 2014) in preparation for countering strengths and exploiting weaknesses (Carling, Reilly & Williams, 2007; Edwards, 2008; O' Donoghue 2009), implementing training interventions (Yiannakos and Armatas, 2006), and setting team and individual goals (Rajeswari, 2016). One of the most common types of research used in PA is descriptive retrospective research which may incorporate longitudinal or cross-sectional analysis (O' Donoghue 2009). According to Castellano, Casamichana and Lago (2012) longitudinal analysis of successful performances can reveal new tactical trends and outline the evolution of playing styles. Also, Castellano and co noted that such analysis can determine the performance variables which are presently thought to be the most important in soccer.

Research conducted by Oberstone (2009), on the 2007/08 EPL season, studied the factors that differentiate top, middle and bottom teams. Oberstone found that, in comparison with the rest of the teams, the league winners scored the highest or one of the highest in shooting (e.g. goals per game, 2), passing (e.g. pass completion, 81%) and defensive performance (e.g. goals conceded per game, 0.6). Alternatively, the study also found that the team in last place recorded predominately the worst or one of the worst scores in shooting (e.g. goals per game, 0.5), passing (e.g. pass completion, 67%) and defensive performance (e.g. goals conceded per game, 2). Furthermore, subsequent comparative analysis of top (1<sup>st</sup> – 4<sup>th</sup>), middle (5<sup>th</sup> – 15<sup>th</sup>) and bottom (16<sup>th</sup> – 20<sup>th</sup>) teams revealed that there were numerous KPIs that differentiate the 3 groups including goals per game, goals conceded per game, total passes, pass completion, and total short passes. Additionally, recent research undertaken by Araya

and Larkin (2013) studied the performance indicators that differentiate between the top ten and bottom ten teams in the EPL during the 2012/13 season. Similar to Oberstone (2009), the researchers identified several KPIs that differentiate the groups including shots per game, pass completion, total short passes, and shots conceded per game. Nevertheless, there are two possible limitations to the both studies. Firstly, having many teams in the sample groups may not provide an accurate assessment of successful and unsuccessful teams and secondly, the studies analysed data from just one season which also had limited statistics on defensive variables. Defensive performance has been previously labelled as a key determinant of the final league position achieved by a team (Evangelos, Gioldasis, Ioannis & Georgia, 2018)

Longitudinal research steered by Barnes, Archer, Hogg, Bush and Bradley (2014) examined the technical performances of EPL teams from season 2006/07 to 2012/13. Barnes and co established that the passing demands of the EPL has substantially evolved within the time period as the number of total passes increased by 40% and passing accuracy increased from 76% to 84%. Accordingly, the number of times possession was lost per game decreased from 23 to 19. The study concluded by stating that coaches should be aware of that notion when implementing training programmes. Further investigation is required to see if these trends have continued to increase. Recently, in a follow up study Bradley, Archer, Hogg, Schuth, et al., (2016) analysed the same dataset used in the previous study (Barnes et al., 2014), but this time with special reference to the final league position of teams. Teams were split into four groups, Tier A (1<sup>st</sup> – 4<sup>th</sup>), Tier B (5<sup>th</sup> – 8<sup>th</sup>), Tier C (9<sup>th</sup> – 14<sup>th</sup>) and Tier D (15<sup>th</sup> – 20<sup>th</sup>). The study found that Tier A unsurprisingly performed the greatest number of technical events as well as technical efficiency by recording almost double the number of passes completed (40) than Tiers B (21), C (27), and D (21). However, Tier B demonstrated the best improvements in pass success rate (12%) in comparison with Tiers A (4%), C (5%), and D (11%). These findings suggest that the technical performance margins between Tiers A and B has significantly decreased. In an examination of points won by each tier, the study highlighted that at the top of the table Tier A accumulated on average 0.4 points less per season while B amassed 0.3 points more. At the bottom of the table Tier C accrued 0.3 points less per season while D won 0.2 points more. The study's discoveries suggest that while the gap between Tiers

A and B has narrowed, the margin between top (A & B) and middle to bottom teams (C & D) has widened.

In similar longitudinal research, Armatas et al. (2009) examined the attacking performance of the top teams (1<sup>st</sup> and 2<sup>nd</sup>) and bottom teams (penultimate and last) in the Greek First Division from season 1998/99 – 2007/08. Some of the study's findings lack exact numerical values as they were not clearly stated or presented in the results. Predictably, the research found that top teams took more shots and scored significantly greater amount of goals than bottom teams. Armatas and co also found that there was a significant reduction in the number of goals scored by top teams over the timeframe despite an increase in the number of attempted shots by all teams. This finding was attributed to a reduction in the margin between strong and weak teams. Moreover, the study also revealed that 1<sup>st</sup> placed teams generally created more goal-scoring opportunities (428) than the rest of the teams (2<sup>nd</sup>, 407, penultimate, 287, last, 242). It was suggested those results may be due to greater technical and tactical efficiency and competency of the winners. Two possible weakness of the study included the lack of analysis on defensive variables and the exclusion of teams placed 3<sup>rd</sup> – 18<sup>th</sup>.

### 1.1 Summary and rationale

In summary, previous publications have emphasised the significant financial rewards teams can gain by achieving the highest possible position in the EPL (Jones, 2017), but also the financial losses acquired when relegated (Cerqua, 2014). These financial implications make the EPL a results-driven business which can put significant pressure on coaches (Cruickshank & Collins, 2012). Accordingly, coaches have become heavily reliant on PA to establish KPIs to assist with improving team performances and final league position. League position research to date has revealed the superiority of the top EPL teams in technical performance citing numerous KPIs that differentiate top, middle, and bottom teams (Oberstone, 2009; Araya & Larkin, 2013). Additionally, longitudinal analysis on the points won by teams in the EPL has suggested that the league has become less competitive with the gap between top teams and middle to bottom teams widening (Bradley et al., 2016). To the current author's knowledge, there has been no research of a similar nature conducted on the subsequent seasons of EPL.

Therefore, the author will look to conduct a longitudinal study which retrospectively analyses the technical performance of teams in the EPL over the duration of eight seasons (2010/11 – 2017/18). The proposed research will observe the technical performance with special reference to tier position achieved by teams as previous research focused solely on top and bottom teams (Oberstone, 2009; Armatas et al., 2009; Araya & Larkin, 2013). Teams will be grouped into four tiers (A, B, C & D) depending on final league position similar to the research of Bradley et al. (2016). The aims will be to: (i) further investigate the differences in technical performance between tier positions, particularly in regard to defensive variables due to previous literature being scant; and, (ii) examine whether the EPL continues to evolve in terms of technical performance and competitiveness. Statistical analysis will be conducted to gain insight into the points won by teams and their technical performance in four category variables;

- goal-scoring
- shooting
- possession
- defending

## 1.2 Research questions

1. What are the differences in technical performance between tier positions in the EPL?
2. Has the technical performance of EPL teams evolved following the 2012/13 season?
3. Has the competitiveness of the EPL evolved following the 2012/13 season?

## **Chapter 2. Methodology**

### **2.1 Conceptual Framework**

A longitudinal descriptive study which will retrospectively observe and analyse quantitative data on performance variables of teams competing in the EPL over eight seasons. According to Gratton and Jones (2010) a quantitative designed study involves the collection of measurable numerical values followed by statistical analysis.

### **2.2 Sample**

The participants of the study will be the teams of the EPL. The EPL competition involves 20 teams playing 38 matches each over the duration of a season, totalling 3040 matches over eight seasons (2010/11 – 17/18). The 38 matches are separated by 19 home and 19 away matches with every team playing each other twice. The teams will be divided into four tiers depending on final league position; 1<sup>st</sup> - 4<sup>th</sup> (Tier A), 5<sup>th</sup> - 8<sup>th</sup> (Tier B), 9<sup>th</sup> – 14<sup>th</sup> (Tier C), and 15<sup>th</sup> – 20<sup>th</sup> (Tier D).

### **2.3 Data Source**

All data gathered to analyse the performance variables of EPL teams will be manually retrieved from publicly accessible online statistical databases (Premier League, n.d.; Who Scored, n.d.). Both databases source data from OPTA Sports, a well-established organisation prominent in providing reliable performance analysis and data collection (Liu, Hopkins, Gomez, & Molinuevo, 2013). OPTA Sports methodically capture football matches with the use of advanced camera technology. Thereafter, football matches are analysed by using sophisticated software programmes which produce in-depth data.

### **2.4 Statistical Analysis**

All performance data will be obtained on every team during the eight seasons and will be entered into Microsoft Excel. Descriptive statistical methods will be used to determine the mean and standard deviation (SD) of each variable. The data will be then transferred to IBM SPSS 25.0 for statistical analysis. A Shapiro-Wilk test will be carried out to check the normality of all data. In terms of analysing the difference between tiers, a one-way analysis of variance ANOVA test with sphericity assumed will be conducted to inspect the difference (p-value, 0.05). Subsequently, a Fisher's LSD post-hoc test will be conducted to establish the level of significance a difference has. In regard to examining for any technical evolution, the data will be split into two

groups, 10 – 12 (seasons 2010/11 & 11/12) and 16 – 18 (seasons 2016/17 & 17/18). Thereafter, a Mann-Whitney test will be carried out to check for any significant alterations in technical performance and competitiveness over the concerning time period (p-value, 0.05).

## 2.5 Variables

The variables of interest in the proposed study make up four separate categories; Defending, Possession, Shooting, and Goal-scoring. Each of these categories will be subdivided into corresponding performance variables, all of which are defined by OPTA Sports (Appendix A).

## 2.6 Ethical considerations

The research does not involve the direct participation of any individuals. The data is displayed publicly online and consent is not required for usage. OPTA Sports have been referenced as the original source of the data.

## Chapter 3. Results

### 3.1 Technical Performance Difference Between Tiers

#### 3.1.1 Defensive variables

Teams in Tier A conceded significantly less goals per game ( $1.0 \pm 0.2$ ) compared to teams in Tiers B ( $1.2 \pm 0.2$ ), C ( $1.5 \pm 0.2$ ) and D ( $1.7 \pm 0.2$ ) ( $p \leq 0.001$ ) (Table 1). Also, Tier B conceded significantly less than Tiers C and D ( $p \leq 0.001$ ), whereas, Tier C conceded significantly less than Tier D ( $p \leq 0.001$ ). Similar results were found with shots conceded per game as Tier A recorded significantly fewer ( $11.1 \pm 2.6$ ) than Tiers B ( $12.7 \pm 2.3$ ;  $p \leq 0.05$ ), C ( $14.0 \pm 1.5$ ;  $p \leq 0.001$ ) and D ( $14.7 \pm 2.2$ ;  $p \leq 0.001$ ) respectively. Additionally, Tier B conceded significantly less shots than Tiers C ( $p \leq 0.05$ ) and D ( $p \leq 0.001$ ). However, there was no significant difference found between Tiers C and D. In terms of saves per game, there was no significant difference found between Tiers A and B. Although, goalkeepers of Tiers A and B teams had to make significantly fewer saves ( $2.5 \pm 0.4$  and  $2.7 \pm 0.5$ ) than those of Tiers C ( $3.1 \pm 0.5$ ) and D ( $3.4 \pm 0.6$ ) ( $p \leq 0.001$ ). Additionally, goalkeepers of Tier C performed significantly fewer saves than those of D ( $p \leq 0.05$ ). In regard to clearances per game, there was no significant difference between Tiers A and B. However, Tier A ( $25.9 \pm 4.5$ ) did conduct significantly less clearances than C ( $30.2 \pm 5.5$ ) and D ( $31.2 \pm 5.0$ ) ( $p \leq 0.001$ ). Additionally, Tier B performed significantly less clearances ( $28.3 \pm 5.6$ ) than D ( $p \leq 0.05$ ). Following the analysis of tackle success there were no significant difference found between any of the Tiers (A,  $69.5 \pm 5.9\%$ ; B,  $70.1 \pm 4.9\%$ ; C,  $68.2 \pm 4.9\%$ ; D,  $68.1 \pm 5.2\%$ ). Similarly, there was no significant difference found between Tiers relating to interceptions per game (A,  $14.5 \pm 3.5$ ; B,  $14.8 \pm 2.5$ ; C,  $14.9 \pm 2.8$ ; D,  $15.1 \pm 2.6$ ).

#### 3.1.2 Possession variables

Teams in Tier A were significantly better at ball possession ( $56.0 \pm 3.3\%$ ) in comparison with B ( $52.3 \pm 3.3$ ), C ( $47.7 \pm 3.7$ ), and D ( $46.7 \pm 2.4$ ) ( $p \leq 0.001$ ) (Table 1). Tier B were significantly better than C and D, but there was no significant difference between C and D. In terms of passing, Tier A teams performed significantly more passes per game ( $540.9 \pm 58.5$ ) when compared with B ( $472.4 \pm 61.6$ ), C ( $398.8 \pm 65.4$ ) and (D  $382.9 \pm 36.8$ ) ( $p \leq 0.001$ ). Tier B teams executed significantly greater number of passes than C and D ( $p \leq 0.001$ ). There was no significant difference in

passes per game between Tiers C and D. Similar results were observed following the analysis of short passes per game as Tier A performed significantly more ( $482.7 \pm 62.2$ ) in comparison with B ( $408.4 \pm 65.1$ ), C ( $333.4 \pm 67.1$ ), and D ( $315.0 \pm 37.5$ ) ( $p \leq 0.001$ ). Additionally, Tier B executed significantly greater number of short passes than C and D. Again, there was no significant difference in short passes between Tiers C and D. The analysis of pass completion found that Tier A recorded a significantly higher percentage of success ( $83.5 \pm 2.9\%$ ) than B ( $80.3 \pm 3.8\%$ ), C ( $75.5 \pm 4.9\%$ ) and ( $75.0 \pm 4.0\%$ ) respectively ( $p \leq 0.001$ ). Also, Tier B recorded a significantly greater percentage of pass completion than C and D ( $p \leq 0.001$ ), but there was no significant difference found between C and D.

The evaluation of chances created per game found that Tier A fashioned significantly more ( $14.1 \pm 1.4$ ) than B ( $12.0 \pm 1.9$ ), C ( $9.8 \pm 1.2$ ) and D ( $9.1 \pm 1.2$ ) ( $p \leq 0.001$ ) respectively. Also, Tier B crafted significantly more chances than C and D ( $p \leq 0.001$ ). Additionally, Tier C created a significantly greater number of chances per game than D ( $p \leq 0.05$ ). On the subject of chance conversion, the analysis established that Tier A had a significantly lower success rate ( $7.0 \pm 0.8\%$ ) compared to B ( $8.2 \pm 1.1\%$ ), C ( $8.2 \pm 1.0\%$ ) and D ( $9.2 \pm 1.4$ ) ( $p \leq 0.001$ ). In addition, Tiers B and C recorded significantly lower percentages than D ( $p \leq 0.05$ ;  $p \leq 0.001$ ). Concerning the study of losses of possession per game, it was found that no significant difference was present between Tiers A and B. However, it was noted that Tier A had significantly more events ( $24.4 \pm 2.4$ ) than C ( $23.4 \pm 2.1$ ) and D ( $22.9 \pm 2.0$ ) ( $p \leq 0.05$ ). Similarly, Tier B also had a greater number of incidences ( $24.7 \pm 2.0$ ) in comparison with C ( $p \leq 0.05$ ) and D ( $p \leq 0.001$ ).

### 3.1.3 Shooting variables

Tier A produced significantly more shots per game ( $16.4 \pm 1.6$ ) than B ( $14.7 \pm 2.2$ ), C ( $12.3 \pm 1.4$ ) and D ( $11.6 \pm 1.4$ ) ( $p \leq 0.001$ ) respectively (Table 1). Tier B also manufactured significantly more shots per game than C and D ( $p \leq 0.001$ ). Moreover, Tier C had significantly greater number of shots per game than D ( $p \leq 0.05$ ). In regard to shot accuracy, the study found that Tier A recorded a significantly higher percentage ( $35.8 \pm 2.2\%$ ) when compared with B ( $33.5 \pm 2.1\%$ ), C ( $31.6 \pm 2.4\%$ ) and D ( $31.4 \pm$

2.0%) ( $p \leq 0.001$ ). Also, Tier B recorded a significantly higher success rate than C and D ( $p \leq 0.001$ ). There was no significant difference found between C and D.

### 3.1.4 Goal-scoring variables

Tier A had a significantly higher number of goals per game ( $2.0 \pm 0.3$ ) compared to B ( $1.5 \pm 0.2$ ), C ( $1.2 \pm 0.2$ ) and D ( $1.0 \pm 0.2$ ) ( $p \leq 0.001$ ) (Table 1). Tier B also produced a significantly higher amount of goals per game than C and D ( $p \leq 0.001$ ). Furthermore, Tier C scored a significantly larger number than D ( $p \leq 0.001$ ). The observation of goals from set plays discovered that Tier A scored ( $19.5 \pm 5.5$ ) significantly more than B ( $14.2 \pm 3.7$ ), C ( $15.0 \pm 4.1$ ) and D ( $8.3 \pm 3.4$ ) ( $p \leq 0.001$ ) respectively. There were no other significant differences found between Tiers related goals from set plays.

**Table 1:** Technical performance across each tier from season 2010/11 to 2017/18.  
Data displayed as means (SD). pg = per game.

Performance Variables	Tier A	Tier B	Tier C	Tier D	Post Hoc
<i>Defending</i>					
Goals conceded pg	1.0 (0.2)	1.2 (0.2)	1.5 (0.2)	1.7 (0.2)	A<B <sup>+</sup> ,C <sup>+</sup> ,D <sup>+</sup> ; B<C <sup>+</sup> ,D <sup>+</sup> ; C<D <sup>+</sup>
Shots conceded pg	11.1 (2.6)	12.7 (2.3)	14.0 (1.5)	14.7 (2.2)	A<B*,C <sup>+</sup> ,D <sup>+</sup> ; B<C*,D*
Saves pg	2.5 (0.4)	2.7 (0.5)	3.1 (0.5)	3.4 (0.6)	A<C <sup>+</sup> ,D <sup>+</sup> ; B<C <sup>+</sup> ,D <sup>+</sup> ; C<D*
Tackle success (%)	69.5 (5.9)	70.1 (4.9)	68.2 (4.9)	68.1 (5.2)	
Interceptions pg	14.5 (3.5)	14.8 (2.5)	14.9 (2.8)	15.1 (2.6)	
Clearances pg	25.9 (4.5)	28.3 (5.6)	30.2 (5.5)	31.2 (5.0)	A<C <sup>+</sup> ,D <sup>+</sup> ; B<D*
<i>Possession</i>					
Ball possession (%)	56.0 (3.3)	52.4 (3.3)	47.7 (3.7)	46.7 (2.4)	A>B <sup>+</sup> ,C <sup>+</sup> ,D <sup>+</sup> ; B>C <sup>+</sup> ,D <sup>+</sup>
Passes pg	540.9 (58.5)	472.4 (61.6)	398.8 (65.4)	382.9 (36.8)	A>B <sup>+</sup> ,C <sup>+</sup> ,D <sup>+</sup> ; B>C <sup>+</sup> ,D <sup>+</sup>
Short passes pg	482.7 (62.2)	408.4 (65.1)	333.4 (67.1)	315.0 (37.5)	A>B <sup>+</sup> ,C <sup>+</sup> ,D <sup>+</sup> ; B>C <sup>+</sup> ,D <sup>+</sup>
Pass completion (%)	83.5 (2.9)	80.3 (3.8)	75.5 (4.9)	75.0 (4.0)	A>B <sup>+</sup> ,C <sup>+</sup> ,D <sup>+</sup> ; B>C <sup>+</sup> ,D <sup>+</sup>
Chances created pg	14.1 (1.4)	12.0 (1.9)	9.8 (1.2)	9.1 (1.2)	A>B <sup>+</sup> ,C <sup>+</sup> ,D <sup>+</sup> ; B>C <sup>+</sup> ,D <sup>+</sup> ; C>D*
Chance conversion (%)	7.0 (0.8)	8.2 (1.1)	8.2 (1.0)	9.2 (1.4)	A<B <sup>+</sup> ,C <sup>+</sup> ,D <sup>+</sup> ; B<D*, C<D <sup>+</sup>
Losses of possession pg	24.4 (2.4)	24.7 (2.0)	23.4 (2.1)	22.9 (2.0)	A>C*,D*; B>C*, D <sup>+</sup>
<i>Shooting</i>					
Shots pg	16.4 (1.6)	14.7 (2.2)	12.3 (1.4)	11.6 (1.4)	A>B <sup>+</sup> ,C <sup>+</sup> ,D <sup>+</sup> ; B>C <sup>+</sup> ,D <sup>+</sup> ; C>D*
Shot accuracy (%)	35.8 (2.2)	33.5 (2.1)	31.6 (2.4)	31.4 (2.0)	A>B <sup>+</sup> ,C <sup>+</sup> ,D <sup>+</sup> ; B>C <sup>+</sup> ,D <sup>+</sup>
<i>Goal scoring</i>					
Goals pg	2.0 (0.3)	1.5 (0.2)	1.2 (0.2)	1.0 (0.2)	A>B <sup>+</sup> ,C <sup>+</sup> ,D <sup>+</sup> ; B>C <sup>+</sup> ,D <sup>+</sup> ; C>D <sup>+</sup>
Goals from set plays	19.5 (5.5)	14.2 (3.7)	15.0 (4.1)	8.3 (3.4)	A>B <sup>+</sup> ,C <sup>+</sup> ,D <sup>+</sup>

\* =  $p \leq 0.05$ , <sup>+</sup> =  $p \leq 0.001$

## 3.2 Evolution of Technical Performance

### 3.2.1 Defensive variables

Following the analysis of differences between seasons 10 – 12 and 16 – 18, there was no significant alteration evident in the number of clean sheets achieved by teams in Tiers A ( $15.6 \pm 2.5$  vs  $16.5 \pm 2.1$ ), B ( $11.8 \pm 2.5$  vs  $13.5 \pm 2.2$ ), and C ( $8.7 \pm 3.8$  vs  $8.8 \pm 1.6$ ) (Table 2). However, Tier D teams did experience a significant increase in clean sheets achieved ( $6.2 \pm 2.2$  vs  $8.8 \pm 1.6$ ;  $p \leq 0.05$ ). In terms of shots conceded per game, there was no significant change experienced by all Tiers (A,  $11.8 \pm 1.3$  vs  $8.5 \pm 1.6$ ; B,  $13.1 \pm 1.3$  vs  $11.8 \pm 1.9$ ; C  $15.1 \pm 1.0$  vs  $13.5 \pm 1.2$ ; D  $16.5 \pm 1.7$  vs  $14.7 \pm 1.9$ ). Additionally, no significant change occurred to number of goals conceded per game by all Tiers (A,  $1.0 \pm 0.2$  vs  $0.9 \pm 0.2$ ; B,  $1.2 \pm 0.1$  vs  $1.2 \pm 0.2$ ; C,  $1.5 \pm 0.2$  vs  $1.6 \pm 0.2$ ; D,  $1.8 \pm 0.2$  vs  $1.6 \pm 0.2$ ). Moreover, the study also discovered that each Tier experienced no significant alteration to clearances per game between the observed time periods (A,  $26.3 \pm 4.4$  vs  $21.8 \pm 3.2$ ; B,  $29.4 \pm 6.8$  vs  $26.3 \pm 4.8$ ; C,  $32.5 \pm 7.2$  vs  $26.9 \pm 1.5$ ; D,  $34.1 \pm 4.7$  vs  $28.2 \pm 2.3$ ). Conversely, the tackle success of teams across all Tiers significantly dropped during the studied timeframe (A,  $76.0 \pm 1.5\%$  vs  $64.1 \pm 3.6\%$ ; B,  $74.5 \pm 2.6\%$  vs  $64.1 \pm 2.1\%$ ; C,  $73.7 \pm 1.8\%$  vs  $62.4 \pm 1.6\%$ ; D,  $73.6 \pm 2.2\%$  vs  $62.6 \pm 2.5\%$ ;  $p \leq 0.001$ ). The analysis of interceptions per game revealed no significant change over time in Tiers A ( $16.6 \pm 1.5$  vs  $10.9 \pm 2.0$ ), B ( $15.7 \pm 1.9$  vs  $12.7 \pm 1.7$ ), and C ( $15.7 \pm 2.7$  vs  $13.0 \pm 1.4$ ). However, there was a significant decrease evident in interceptions per game in Tier D ( $16.5 \pm 2.7$  vs  $13.0 \pm 1.4$ ;  $p \leq 0.05$ ). The study of saves per game established a significant decrease experienced by Tier A ( $2.6 \pm 0.3$  vs  $2.0 \pm 0.5$ ;  $p \leq 0.05$ ), while B, C and D experienced no significant change respectively ( $2.7 \pm 0.4$  vs  $2.6 \pm 0.5$ ,  $3.2 \pm 0.4$  vs  $3.0 \pm 0.3$ ,  $3.6 \pm 0.6$  vs  $3.4 \pm 0.6$ ).

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**Table 2:** Defensive performance of each tier in 10 – 12 (2010/11 – 2011/12) and 16 - 18 (2016/17 – 2017/18). Data displayed as means (SD). pg = per game. ps = per season.

<b>Defensive Variables</b>	<b>10 - 12</b>	<b>16 - 18</b>
<i>Clean sheets ps</i>		
Tier A	15.6 (2.5)	16.5 (2.1)
Tier B	11.8 (2.5)	13.5 (2.2)
Tier C	8.7 (3.8)	8.8 (1.6)
Tier D	6.2 (2.2)	8.3 (2.0)*
<i>Shots conceded pg</i>		
Tier A	11.8 (1.3)	8.5 (1.6)
Tier B	13.1 (1.3)	11.8 (1.9)
Tier C	15.1 (1.0)	13.5 (1.2)
Tier D	16.5 (1.7)	14.7 (1.9)
<i>Goals conceded pg</i>		
Tier A	1.0 (0.2)	0.9 (0.2)
Tier B	1.2 (0.1)	1.2 (0.2)
Tier C	1.5 (0.2)	1.6 (0.2)
Tier D	1.8 (0.2)	1.6 (0.2)
<i>Tackle success ps (%)</i>		
Tier A	76.0 (1.5)	64.1 (3.6)†
Tier B	74.5 (2.6)	64.1 (2.1)†
Tier C	73.7 (1.8)	62.4 (1.6)†
Tier D	73.6 (2.2)	62.6 (2.5)†
<i>Interceptions pg</i>		
Tier A	16.6 (1.5)	10.9 (2.0)
Tier B	15.7 (1.9)	12.7 (1.7)
Tier C	15.7 (2.0)	13.0 (1.8)
Tier D	16.5 (2.7)	13.0 (1.4)*
<i>Clearances pg</i>		
Tier A	26.3 (4.4)	21.8 (3.2)
Tier B	29.4 (6.8)	26.3 (4.8)
Tier C	32.5 (7.2)	26.9 (1.5)
Tier D	34.1 (4.7)	28.2 (2.3)
<i>Saves pg</i>		
Tier A	2.6 (0.3)	2.0 (0.5)*
Tier B	2.7 (0.4)	2.6 (0.5)
Tier C	3.2 (0.4)	3.0 (0.3)
Tier D	3.6 (0.6)	3.4 (0.6)

\* =  $p \leq 0.05$ , † =  $p \leq 0.001$

### 3.2.2 Possession variables

The examination of ball possession held by teams in each Tier between seasons 10 – 12 and 16 – 18 revealed that there was no significant change experienced (A,  $55.8 \pm 1.7$  vs  $58.5 \pm 4.0$ ; B,  $51.1 \pm 2.4$  vs  $52.6 \pm 4.7$ ; C,  $47.9 \pm 3.6$  vs  $46.5 \pm 2.6$ , D,  $47.5 \pm 2.3$  vs  $45.9 \pm 2.6$ ) (Table 3). Similarly, there was no significant difference evident between both periods in relation to pass completion (A,  $83.4 \pm 1.6\%$  vs  $84.3 \pm 2.2\%$ ; B,  $78.1 \pm 3.2\%$  vs  $80.0 \pm 5.2\%$ ; C,  $74.0 \pm 6.0\%$  vs  $74.9 \pm 3.1\%$ ; D,  $72.8 \pm 3.9\%$  vs  $74.7 \pm 3.3\%$ ). In terms of passes per game, the analysis discovered a significant increase experienced by Tier A ( $525.3 \pm 26.1$  vs  $586.1 \pm 70.5$ ;  $p \leq 0.05$ ). However, there were no significant changes observed in Tiers B ( $441.9 \pm 44.5$  vs  $495.9 \pm 90.9$ ), C ( $390.0 \pm 73.1$  vs  $385.1 \pm 36.1$ ), and D ( $376.0 \pm 34.2$  vs  $383.9 \pm 41.2$ ). Comparably, a similar significant alteration was evident following the testing of short passes per game as Tier A experienced a growth in occurrences ( $468.1 \pm 30.0$  vs  $525.2 \pm 77.0$ ;  $p \leq 0.05$ ), yet there were no significant changes to Tiers B ( $377.3 \pm 45.7$  vs  $431.1 \pm 100.5$ ), C ( $324.7 \pm 74.4$  vs  $317.7 \pm 38.6$ ), and D ( $307.9 \pm 32.6$  vs  $313.4 \pm 43.1$ ).

In regard to chances created per game, the examination revealed a significant decrease experienced by Tier C ( $10.7 \pm 1.4$  vs  $9.2 \pm 0.6$ ;  $p \leq 0.05$ ), but no significant differences in Tiers A ( $14.8 \pm 1.7$  vs  $14.0 \pm 1.3$ ), B ( $12.3 \pm 1.5$  vs  $11.4 \pm 2.4$ ), and D ( $10.0 \pm 1.0$  vs  $7.9 \pm 0.9$ ). Following the analysis of chance conversion, it was established that there were no significant differences across all Tiers between 10 – 11 and 16 – 18 (A,  $7.6 \pm 0.9\%$  vs  $6.4 \pm 0.5\%$ ; B,  $8.7 \pm 1.2\%$  vs  $7.9 \pm 1.4\%$ ; C,  $8.5 \pm 0.9\%$  vs  $7.5 \pm 0.9\%$ ; D,  $8.8 \pm 1.2\%$  vs  $8.9 \pm 1.0\%$ ). Additionally, there were no significant alterations to losses of possession per game observed (A,  $26.0 \pm 1.5$  vs  $25.5 \pm 1.0$ ; B,  $25.8 \pm 2.2$  vs  $24.3 \pm 1.6$ ; C,  $23.9 \pm 2.0$  vs  $24.6 \pm 2.3$ ; D,  $22.9 \pm 2.8$  vs  $23.1 \pm 1.8$ ).

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**Table 3:** Possession performance of each tier in 10 – 12 (2010/11 – 2011/12) and 16 - 18 (2016/17 – 2017/18). Data displayed as means (SD). pg = per game. ps = per season.

Possession Variables	10 - 12	16 - 18
<i>Ball possession ps (%)</i>		
Tier A	55.8 (1.7)	58.5 (4.0)
Tier B	51.1 (2.4)	52.6 (4.7)
Tier C	47.9 (3.6)	46.5 (2.6)
Tier D	47.5 (2.3)	45.9 (2.6)
<i>Pass completion ps (%)</i>		
Tier A	83.4 (1.6)	84.3 (2.2)
Tier B	78.1 (3.2)	80.0 (5.2)
Tier C	74.0 (6.0)	74.9 (3.1)
Tier D	72.8 (3.9)	74.7 (3.3)
<i>Passes pg</i>		
Tier A	525.3 (26.1)	586.1 (70.5)*
Tier B	441.9 (44.5)	495.9 (90.9)
Tier C	390.0 (73.1)	385.1 (36.1)
Tier D	376.0 (34.2)	383.9 (41.2)
<i>Short passes pg</i>		
Tier A	468.1 (30.0)	525.2 (77.0)*
Tier B	377.3 (45.7)	431.1 (100.5)
Tier C	324.7 (74.4)	317.7 (38.6)
Tier D	307.9 (32.6)	313.4 (43.1)
<i>Chances created pg</i>		
Tier A	14.8 (1.7)	14.0 (1.3)
Tier B	12.3 (1.5)	11.4 (2.4)
Tier C	10.7 (1.4)	9.2 (0.6)*
Tier D	10.0 (1.0)	7.9 (0.9)
<i>Chance conversion ps (%)</i>		
Tier A	7.6 (0.9)	6.4 (0.5)
Tier B	8.7 (1.2)	7.9 (1.4)
Tier C	8.5 (0.9)	7.5 (0.9)
Tier D	8.8 (1.2)	8.9 (1.0)
<i>Losses of possession pg</i>		
Tier A	26.0 (1.5)	25.4 (1.0)
Tier B	25.8 (2.2)	24.3 (1.6)
Tier C	23.9 (2.0)	24.6 (2.3)
Tier D	22.9 (2.8)	23.1 (1.8)

\* =  $p \leq 0.05$

### 3.2.3 Shooting variables

The study of shots per game performed between 10 – 12 and 16 – 18 revealed significant decreases experienced by Tiers C ( $13.4 \pm 1.5$  vs  $11.6 \pm 0.9$ ;  $p \leq 0.05$ ) and D ( $12.8 \pm 1.3$  vs  $10.2 \pm 0.8$ ;  $p \leq 0.001$ ) while there no significant changes to A ( $17.4 \pm 1.7$  vs  $16.3 \pm 1.4$ ) and B ( $15.5 \pm 1.8$  vs  $13.6 \pm 2.6$ ) (Table 4). The analysis of shot accuracy showed there were no significant differences across all Tiers between both periods (A,  $34.7 \pm 2.1\%$  vs  $36.3 \pm 2.0\%$ ; B,  $31.8 \pm 1.8\%$  vs  $35.6 \pm 2.3\%$ ; C,  $30.9 \pm 2.6\%$  vs  $32.6 \pm 2.4\%$ ; D,  $30.9 \pm 1.5\%$  vs  $31.6 \pm 2.1\%$ ).

**Table 4:** Shooting performance of each tier in 10 – 12 (2010/11 – 2011/12) and 16 - 18 (2016/17 – 2017/18). Data displayed as means (SD). pg = per game. ps = per season

Shooting Variables	10 - 12	16 - 18
<i>Shots pg</i>		
Tier A	17.4 (1.7)	16.3 (1.4)
Tier B	15.5 (1.8)	13.6 (2.6)
Tier C	13.4 (1.5)	11.6 (0.9)*
Tier D	12.8 (1.3)	10.2 (0.8)†
<i>Shooting accuracy ps (%)</i>		
Tier A	34.7 (2.1)	36.3 (2.0)
Tier B	31.8 (1.8)	35.6 (2.3)
Tier C	30.9 (2.6)	32.6 (2.4)
Tier D	30.9 (1.5)	31.6 (2.1)

\* =  $p \leq 0.05$ , † =  $p \leq 0.001$

### 3.2.4 Goal-scoring variables

The observation of teams' goals per game between season 10 – 12 and 16 – 18 revealed a significant increase experienced by Tier B ( $1.4 \pm 0.2$  vs  $1.5 \pm 0.4$ ;  $p \leq 0.05$ ) while there were no significant alterations demonstrated by A ( $2.0 \pm 0.3$  vs  $2.2 \pm 0.3$ ), C ( $1.3 \pm 0.1$  vs  $1.2 \pm 0.1$ ), and D ( $1.1 \pm 0.1$  vs  $0.9 \pm 0.2$ ) respectively (Table 5). The analysis of goals from set plays revealed no significant change across all Tiers between both periods (A,  $18.8 \pm 6.6$  vs  $18.1 \pm 3.8$ ; B,  $16.4 \pm 2.8$  vs  $12.9 \pm 3.7$ ; C,  $16.1 \pm 4.4$  vs  $15.9 \pm 3.4$ ; D,  $16.4 \pm 5.1$  vs  $12.9 \pm 4.2$ ).

**Table 5:** Goal-scoring performance of each tier in 10 – 12 (2010/11 – 2011/12) and 16 - 18 (2016/17 – 2017/18). Data displayed as means (SD). pg = per game. ps = per season

<b>Goal-scoring Variables</b>	<b>10 - 12</b>	<b>16 - 18</b>
<i>Goals pg</i>		
Tier A	2.0 (0.3)	2.2 (0.3)
Tier B	1.4 (0.2)	1.5 (0.4)*
Tier C	1.3 (0.1)	1.2 (0.1)
Tier D	1.1 (0.1)	0.9 (0.2)
<i>Goals from set plays ps</i>		
Tier A	18.8 (6.6)	18.1 (3.8)
Tier B	16.4 (2.8)	12.9 (3.7)
Tier C	16.1 (4.4)	15.9 (3.4)
Tier D	16.4 (5.1)	12.9 (4.2)

\* =  $p \leq 0.05$

### 3.2.5 Competitiveness variable

Between 10 – 12 and 16 - 18 there has been no significant alteration to the points won by Tiers A ( $75.9 \pm 8.9$  vs  $83.3 \pm 9.1$ ), B ( $57.5 \pm 5.8$  vs  $60.9 \pm 10.4$ ), and C ( $37.2 \pm 5.3$  vs  $34.8 \pm 5.3$ ) (Table 6). In contrast, there has a significant reduction in the points won by Tier C ( $46.9 \pm 1.8$  vs  $43.9 \pm 1.8$ ;  $p \leq 0.001$ ).

**Table 6:** Points won by each tier in 10 – 12 (2010/11 – 2011/12) and 16 - 18 (2016/17 – 2017/18). Data displayed as means (SD). ps = per season

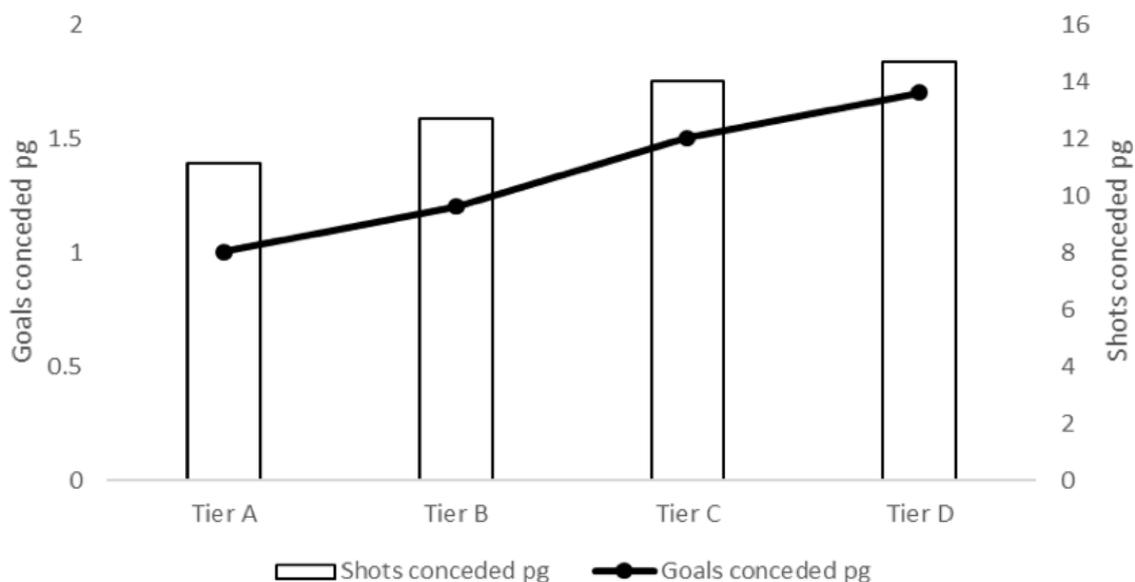
<b>Competitiveness Variable</b>	<b>10 - 12</b>	<b>16 - 18</b>
<i>Points won ps</i>		
Tier A	75.9 (8.9)	83.3 (9.1)
Tier B	57.5 (5.8)	60.9 (10.4)
Tier C	46.9 (1.8)	43.9 (1.8)‡
Tier D	37.2 (5.3)	34.8 (5.3)

‡ =  $p \leq 0.001$

## Chapter 4. Discussion

### 4.1 Technical Performance Difference Between Tiers

The primary aim of the present study was to further investigate the difference between tiers in the EPL in terms of technical performance (goal-scoring, shooting, possession and defending) of which adds to the previous research of Bradley et al. (2016). Unsurprisingly, it was that for the most part the teams of Tier A recorded the highest levels of technical performance followed by B then C. Predictably, Tier D generally performed the poorest across all performance variables. Specifically, the defensive analysis established that there were significant differences across all tiers in terms of goals and shots conceded per game. Tier A were the most superior in the restriction of goals and shots conceded per game (1.0 and 11.1) followed by B (1.2 and 12.7), then C (1.5 and 14.0) and lastly, D (1.7 and 14.7). The findings on goals conceded are similar to those found in previous literature (Oberstone, 2009; Araya and Larkin, 2013; Evangelos et al., 2018). A parallel upward trend in goals and shots conceded from Tier A to D suggests that a causal relationship may exist between both variables and final league position (Figure 1), a view shared by Evangelos, Eleftherios, Aris, Ioannis, Aristotelis and Antonios (2013), although further research is required to investigate the level of interaction. Consequently, shots conceded per game in combination with goals conceded per game may be used by coaches as a reliable KPI for evaluating and monitoring a team's defensive efficiency, as also recommended by Oberstone (2009) and Araya and Larkin (2013).

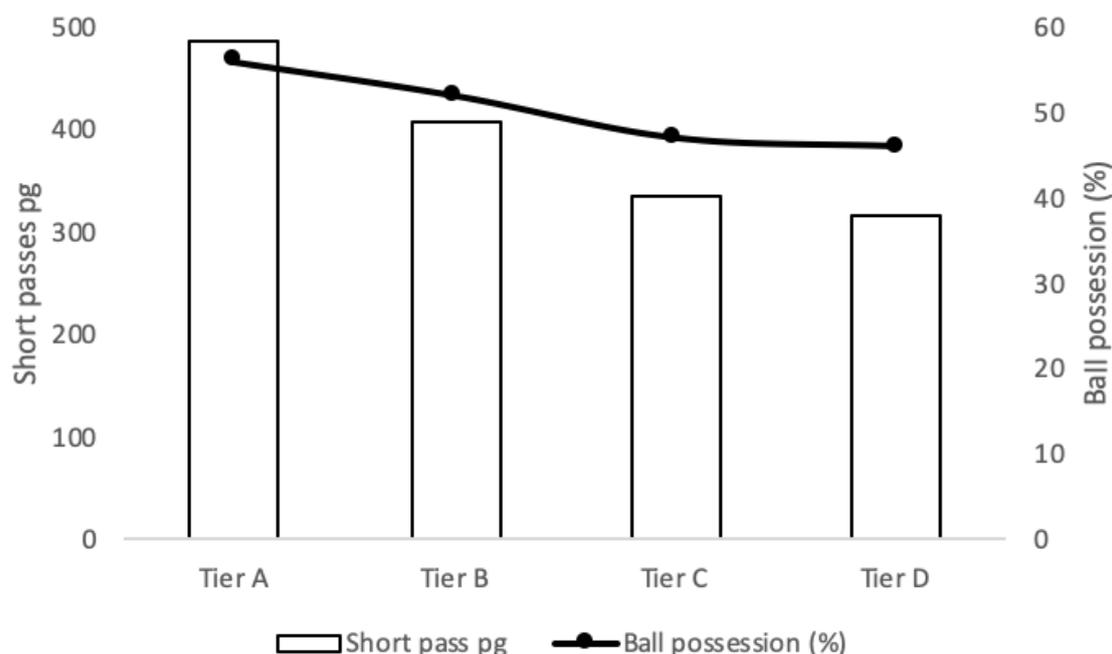


**Figure 1:** The average number of goals and shots conceded per game (pg) by each tier from season 2010/11 to 17/18.

Further defensive analysis revealed more significant differences between tiers in relation to saves per game. In detail, goalkeepers of Tier A and B teams performed significantly less saves per game (2.5 and 2.7) compared to the goalkeepers of C (3.1) and D (3.4) teams. Additionally, Tiers A and B were required to perform significantly less clearances per game (25.9 and 38.3) compared with C (30.2) and D (31.2). Taken the results of saves and clearances into consideration, it may be fair to suggest that top teams (Tiers A & B) experience fewer highly-pressurized attacking situations from the opposition compared with middle to bottom teams (Tiers C & D), however further research is required to confirm that notion. In contrast to the previous findings, there were no significant differences recorded across all tiers in regard to tackle success and interceptions per game.

From the perspective of possession variables, the analysis revealed Tier A were significantly more superior at retaining possession (56.0%) in comparison with B (52.4%), C (47.7%) and D (46.7%). There were significant differences amongst almost all tiers, however there was no significant difference between C and D. However, it is of universal thought that ball possession alone is not a measure of success (Lago-Peñas & Dellal, 2010; Wright, Atkins, Polman, Jones & Sargeson, 2011; Collet, 2013; Göral, 2015; Pratas, Volossovitch & Carita, 2018). A similar level and pattern of disparity were evident in terms of total passes and short passes per game as Tier A performed the most (540.9 and 487.2), followed by B (472.4 and 408.4), then C (398.8 and 333.4) and finally, D (382.9 and 315.0). In detail, approximately 89% of Tier A teams' total passes were short passes while B, C and D's short passes made up 86%, 83%, and 82% respectively. Previous research has linked high passing frequencies with successful outcomes (Evangelos et al., 2013; Evangelos, Aristotelis, Ioannis, Stergios & Foteini, 2014; Miswan, Aznan, Ismail, Jamaludin & Kassim, 2018) and a higher ratio of short rather than long passes being particularly important for maintaining possession (Kapidžić, Mejremić, Bilalić & Bečirović, 2010; Adams, Morgans, Sacramento, Morgan & Williams, 2013; Bush, Barnes, Archer, Hogg & Bradley, 2015). That concept seems to demonstrate its worth when short passes are studied alongside ball possession (Figure 2).

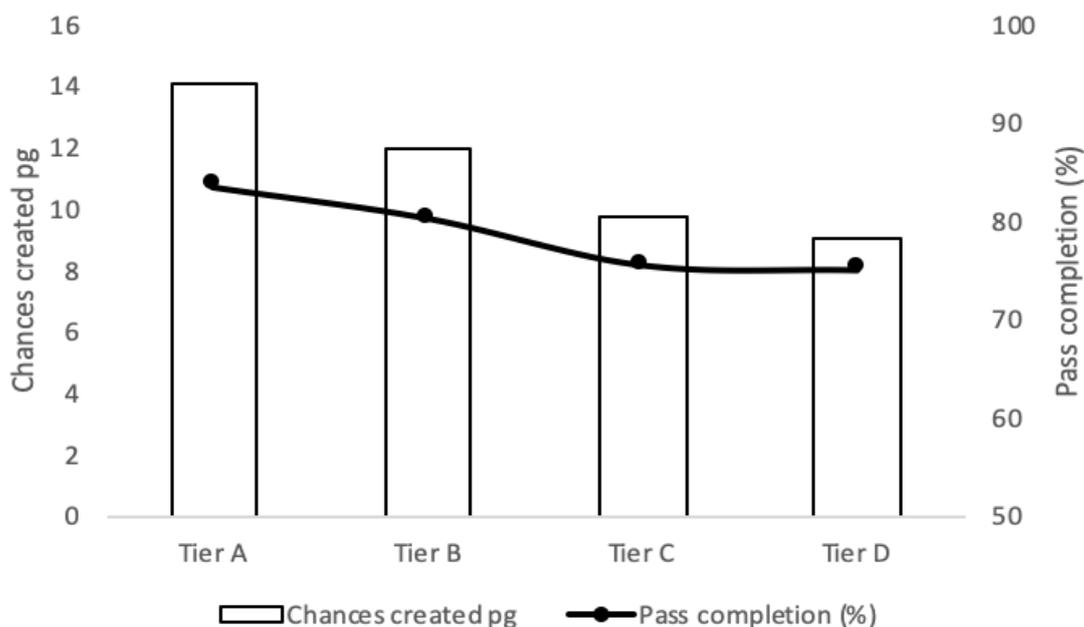
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**Figure 2:** The average number of short passes per game (pg) and ball possession (%) by each tier from season 2010/11 to 17/18.

Pass completion displayed an identical pattern of disparity as seen in passes per game and ball possession. Tier A teams were significantly more accurate with their pass completion (83.5%) compared to B (80.3%), C (75.5%) and D (75.0%). Recent research has suggested that a high frequency of passing alongside accurate passing is an effective method of creating goal-scoring opportunities (Araya & Larkin, 2013) while also limiting the opposition in creating of goal-scoring opportunities (Pratas, Volossovitch & Carita, 2018). The findings relating to chances created per game would seem to put some truth to that suggestion as there were significant differences across all tiers in favour of the top teams over the middle and bottom teams (Figure 3). Tier A created 14.1 opportunities per game while B, C and D fashioned 12.0, 9.8 and 9.1 respectively, these findings are consistent with those of Armatas and colleagues (2009). Previous literature has noted high pass completion for being a good indicator in measuring attacking performance, but it alone is not a precondition for success (Evangelos et al., 2013). Thus, coaches can perhaps use pass completion in combination with short passes and chances created per game as KPI's for evaluating attacking progressions, as also recommended by Oberstone (2009) and Araya and Larkin (2013).

TIER-SPECIFIC ANALYSIS OF TECHNICAL PERFORMANCE  
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**Figure 3:** The average number of chances created per game (pg) and pass completion (%) by each tier from season 2010/11 to 17/18.

Interestingly, the findings on chance conversion were dissimilar to the previous findings on possession as Tier A teams converted significantly less of their goal scoring opportunities (7.0%) in comparison with B (8.2%), C (8.2%), and D (9.2%). There were significant differences amongst all tiers with the exception of between B and C. Similarly, Tier A teams also performed the poorest in terms of losses of possession per game (24.4) compared with B (24.7), C (23.4), and D (22.9). Tiers A and B lost possession on significantly more occasions than C and D. There were no other significant differences recorded between tiers. A possible explanation for these findings may be that top teams are willing to take greater risks in the objective of scoring goals as they generally create plenty of opportunities to score, whereby middle and bottom teams might have to be more scrupulous with their limited opportunities.

The examination of shooting variables revealed significant differences across all tiers in regard to shots per game. Tier A teams performed significantly more shots (16.4) compared with B (14.7), C (12.3), and D (11.6). Additionally, the top teams also demonstrated superiority in shot accuracy as Tier A were significantly more accurate with their shooting (35.8%) in comparison to B (33.5%), C (31.6%), and D (31.4). There were significant differences across all tiers except between C and D. Both these findings were consistent with previous research (Armatas et al., 2009; Araya & Larkin,

2013). Therefore, shots per game and shot accuracy may also be used by coaches as a method of measuring and evaluating attacking outcomes.

The analysis of goal-scoring variables predictably showed that the top teams score significantly more goals than the middle and bottom teams. Tier A scored 2.0 goals per game where as B, C and D scored 1.5, 1.2 and 1.0 respectively. Significant differences were seen amongst all tiers. Additionally, Tier A demonstrated further superiority in terms of goals from set plays by scoring 19.5 per season while B, C and D scored 14.2, 15.0 and 8.3 respectively. Tier A scored significantly more from set plays compared with B, C and D.

#### 4.2 Evolution of Technical Performance

The secondary aim of the present study was to examine whether the EPL has continued to evolve in terms of technical performance and competitiveness following the findings of Barnes et al. (2014) and Bradley et al. (2016). The examination of defensive performance revealed that from the season 2010/11 to 17/18 each tier has increased their clean sheet count with Tier D in particular keeping significantly more clean sheets per season (8.3) than previously (6.2). Additionally, the number of shots conceded per game has fallen across all tiers, of which is in contrast to the findings of Barnes and co (2014) where it remained unchanged. However, there were no significant alterations recorded in the present study. Accordingly, the number of saves per game performed by all tiers have also fallen during the studied timeframe with A being the only tier to experience a significant decline (2.6 to 2.0). The number of goals conceded per game has remained largely unchanged. The interceptions performed per game have fallen across all tiers with a significant decrease recorded in Tier D (16.5 to 13.0). Additionally, clearances performed per game has also reduced across all tiers similar to Barnes et al. (2014), but no significant changes were observed. Interestingly, the tackle success of all tiers has significantly dropped with Tier A experiencing the largest drop from 76.0% to 64.1%. The present study's findings suggest that the defensive structure (e.g. limiting the space available close to goal) of EPL teams, particularly teams at the bottom, has improved as teams are performing less shots and less saves. However, individual defending of players (e.g. 1v1 situations) has generally weakened as players are failing more often in their tackling attempts. A possible explanation for the decline in tackling success could be the recently documented increase in explosive sprints being performed by players

(Bradley et al., 2016), which may be making it more difficult for defending players to time and execute a successful tackle.

The observation of possession variables over time revealed no significant alterations to ball possession. There were also no significant alterations to pass completion and losses of possession, of which is in contrast to the findings of Barnes et al. (2014). However, there were significant alterations evident in relation to overall passes and short passes per game. Tier A experienced a significant increase in both overall passes (525.3 vs 586.1) and short passes (468.1 vs 525.2) performed per game over the eight seasons. Tier B also experienced an increase in both variables (441.9 vs 495.9 and 377.3 vs 431.1) but there were no significant changes recorded. These increases seen in Tiers A and B were similar to the findings of Barnes et al. (2014) and Bradley et al. (2016), however there were no similarities present in regard to Tiers C and D as they were mainly unaltered over the eight seasons. Earlier the present study established that there were significant differences between the top and the middle to bottom teams in terms of passing. With the further increases in passes in mind, it could be suggested that the gap between the top and middle to bottom has widened in terms of passing ability. The examination of chances created per game revealed slight decreases in Tiers A and B, while larger decreases were seen in C and D with C being significantly altered (10.7 vs 9.2). There were also reductions seen in the chances converted but none were of any significance.

The analysis of the shooting performances of each tier over the eight seasons revealed slight improvements in shot accuracy across the board, albeit none of any significance. However, the number of shots performed per game has fallen across all tiers with C and D experiencing significant decreases (13.4 vs 11.6 and 12.8 vs 10.2). These results are in contrast with findings of Armatas et al. (2009). The present study's findings could be attributed to the improved defensive structure of teams as alluded to earlier. The analysis of goal-scoring has shown small drop-offs in the goals scored per game by Tiers C and D, however no significant changes were recorded. In contrast, Tiers A and B experienced increases in goals scored per game with the alteration seen in B being significant (1.4 vs 1.5). Goals scored from set plays has declined across all tiers but no significant changes were recorded.

Finally, the evaluation of the competitiveness present within the EPL revealed that the points won by Tier A and B teams has increased while those won by C and D has decreased. The only significant change recorded was seen in Tier C (46.9. vs 43.9). These results were consistent with the findings of Bradley et al. (2016) whereby the margin between B and C also widened. The widening gap may be linked to the increase in goals scored by top teams and the decrease experienced by middle to bottom teams. As a result, it may be suggested that the level of competitiveness between the top and middle to bottom teams has fallen even further following the 2011/12 season. This widening gap will have implications for teams with aspirations of entering into UEFA competitions for the large financial gains.

#### 4.3 Conclusion

In conclusion, the difference between tiers in EPL can be attributed to teams generally outperforming teams in the tiers below with greater technical ability (ball possession, passing, creating shooting opportunities, shooting and saving shots) and more rigid defensive structure (e.g. limiting the number of opposition shots). In a broader sense, the most significant differences were evident between the top and middle to bottom teams. Specifically, top teams can maintain possession for long periods of time with the use of a high frequency of accurate passing over short distances. Maintaining possession in this manner allow top teams to restrict their opponents' shooting opportunities, so concede less goals, while also optimising the creation of shooting opportunities for themselves, thus score more goals. The level of competitiveness between Tiers A and B remains strong, but the same cannot be said for competitiveness between B and C as the points accrued by C has fallen closer to that of D. Unfortunately for middle to bottom teams the gap continues to widen between them and the top teams.

#### 4.4 Practical implications

Whether teams are looking to improve their final league position for reaping the financial gains of qualifying for UEFA competitions or for avoiding relegation and maintaining a status in the lucrative EPL, they could perhaps use KPI's for identifying the specific areas upon which improvement is needed. KPI monitoring can be applied as such: shots and goals conceded per game for assessing defensive efficiency; pass completion, short passes per game and chances created per game as a method of measuring the effectiveness of attacking progressions; and shots per game and shot

accuracy as a means of evaluating attacking outcomes. These KPI's can also be used to profile the strengths and weaknesses of opposition teams prior to competition.

#### 4.5 Limitations

A possible limitation to the present study may be the method applied to analyse the evolution of technical performance and competitiveness. The use of data across every season instead of the first two and final two seasons may provide more accurate findings.

## Appendices

### *Appendix A: The proposed study's category variables and performance variables with OPTA definitions.*

CATEGORY VARIABLES	PERFORMANCE VARIABLES	DEFINITIONS
<b>Goals scoring</b>	Average goals scored per game	The total number of goals scored divided by the total number of matches.
	Goals scored during set plays	A goal scored from a dead ball situation (corner kick, free kick, throw-in, or penalty kick).
<b>Shooting</b>	Average shots attempted per game	The total number of shots attempted divided by the total number of games
	Shot accuracy (%)	The total number of shots on target divided by the total number of shots attempted by a team.
<b>Possession</b>	Ball possession (%)	The total possession percentage is calculated by adding the total minutes in possession of both teams, then dividing the total minutes in possession of each team by total possession minutes.
	Loss of Possession	The total number of times possession was lost. Unsuccessful receptions + dispossessions.
	Total passes	The total number of passes attempted by a team.
	Pass completion (%)	A completed pass is a pass which directly reaches a team mate without a touch from an opponent. The percentage is calculated by dividing the number of completed passes by the total number of passes. Excludes crosses and goalkeeper throw outs.

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	Short pass	An attempted pass in which the ball travels less than 25m.
	Assist	The final pass or pass-cum-shot that reaches a team mate who then shoots and scores.
	Key pass	The final pass or pass-cum-shot that reaches a team mate who then shoots but doesn't score.
	Chance creation	Assists + key passes.
	Chance conversion	The percentage is calculated by dividing total chances created by total goals scored.
<b>Defending</b>	Average goals conceded per game	The total number of goals conceded divided by the total number of games.
	Clean sheet	A team that does not concede a goal during a full match.
	Average shots conceded per game	The total number of shots conceded divided by the total number of games.
	Average saves per game	The total number of saves a goalkeeper makes divided by the total number of games.
	Tackles	A tackle where a player connects with the ball in a ground challenge that successfully takes the ball away from the player in possession.
	Interception	When a defending player prevents an opponent's pass from reaching an opposition teammate.
	Clearance	An action by a defending player that temporarily removes the opposition's attacking threat on goal and that effectively alleviates pressure.

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