

1 **An investigation identifying which key performance indicators influence the**
2 **chances of promotion to the elite leagues in professional European football**

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32 **An investigation identifying which key performance indicators influence the**
33 **chances of promotion to the elite leagues in professional European football**

34 **Abstract**

35 Technical performances of teams competing in the professional second divisions
36 of England, Germany and France were analysed over 5 seasons in order to
37 determine which factors influence the chances of promotion to the elite leagues. A
38 total of (n = 11,032) team-match observations were analysed via a series of
39 logistical regressions. The results revealed that teams with an overworked
40 defensive unit that were frequently asked to make blocks, clearances and
41 goalkeeper saves would have significantly reduced chances of promotion.
42 Conversely, set-plays and in particular taking advantage of penalty kick
43 opportunities significantly increased the odds of promotion by 37%. In addition,
44 scoring goals from corner kicks were also revealed to significantly enhance the
45 odds of promotion by 35%. With regards to open play, creating chances in the form
46 of assists and through balls were revealed to significantly increase the odds of
47 promotion by 28% and 14% respectively. These results, therefore, indicate that
48 lower league teams with ambitions of achieving promotion to the elite level should
49 adopt a strategy which consists of frequent penetrative passing that leads to chance
50 creation. Furthermore, teams hoping to achieve promotion should look to improve
51 their efficiency from penalty kicks and corner kick set-plays.

52 **Keywords:** soccer; match analysis; performance analysis; lower league football; Second
53 tier; technical performance; KPI's; relegation

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57 **Introduction**

58 In the last decade, much research on football has been focussed on the
59 identification of “key performance indicators”, hereafter referred to as KPI’s (Hughes et
60 al., 2012). KPI’s are defined as being those factors that are more closely aligned with
61 success for a specific team and individual (Wright et al., 2014). Although previous
62 studies have been able to identify KPI’s in several sports including football, these studies
63 have tended to analyse football at the elite club and international level overlooking the
64 lower leagues. The present ‘big data’ study will therefore focus exclusively on second
65 tier football leagues across Europe in order to identify which factors are of most
66 importance in lower league football and thus which KPI’s enhance a team’s odds of
67 promotion to the elite level.

68 There are two strands of research on the theme of KPI’s, and both are receiving
69 increasing levels of attention from sports scientists and performance analysts. The first
70 strand revolves around talent identification (TI) systems. TI systems are designed to
71 identify and develop young talented footballers, and they represent a means to remain
72 competitive whilst also combating the financial strains of inflating wages and transfer
73 fees (Sarmiento, Anguera, et al., 2018). However, in a similar manner to what “talent”
74 actually comprises of being subjective and contentious, traditional TI systems can also
75 be informed primarily by the subjective opinions of coaches and scouts rather than
76 scientific evidence (Larkin & Reeves, 2018). Thus, the second strand of research in this
77 field revolves around the use of a variety of statistical techniques intended towards the
78 identification of both physical and technical parameters that can influence the team and

79 player performances (Andrzejewski et al., 2013; Bush et al., 2015; Di Salvo et al., 2009;
80 Fernandez-Navarro et al., 2016; Jamil, 2020; Liu, Gomez, et al., 2015; Zhou et al., 2018).
81 With regards to the second strand of research, many of these studies have tended in the
82 main to focus on football at the elite level in the form of national and international
83 knockout football tournaments or the top tier of professional football in the country
84 adopted as the focus of the study. It has been widely accepted that football in the lower
85 leagues is of a lower standard and consists of players with less technical capabilities
86 (Bradley et al., 2013). They are giving credence to the notion that the KPI's that are of
87 most importance at the elite levels are not necessarily what is required to be successful
88 at the lower levels of football. In a comparative study on English football leagues,
89 Bradley et al. (2013) discovered several differences between football at the elite level
90 and the lower levels, chief of which was that lower league football players (English
91 Championship) covered more high intensity running distance in the Championship rather
92 than the Premier League. According to Bradley et al. (2013), the different styles of play
93 between these two leagues is the most likely cause of this trend they discovered. Similar
94 results on these physical aspects of performance were discovered by Di Salvo et al.
95 (2012), who claimed superior technical skills, increased efficiency and more competent
96 decision making by players in the elite leagues were potential causes for their findings.

97 Considering the variation in performance characteristics discovered in the
98 aforementioned previous research, it is quite surprising that performances in lower league
99 football have not been the subject of further scrutiny. Particularly technical aspects of
100 performances in the second tiers of football leagues, which appear to have been relatively
101 overlooked. This fact is made even more surprising given the financial incentives lower
102 league teams have to perform well. The recently published Deloitte Annual Review of
103 Football Finance (2019) revealed that in England alone, promotion to the top tier Premier

104 League can be worth £170+ million in the case of a single season stay, rising to £300+
105 million if the promoted club can survive in the elite league beyond one season. The
106 financial incentives of achieving promotion are also outlined by Goddard (2015), who
107 stated that newly promoted teams enjoyed on average, revenue increases of 16.8% in the
108 year they achieved promotion followed by a vast revenue increase of 192.2% in their first
109 season in the elite tier. Although the reward for promotion to the elite leagues is
110 extensive, the associated costs of relegation from the elite level have been revealed to be
111 almost equally as steep. In a study by Cerqua (2014), it was estimated that relegation
112 from the English Premier League would have resulted in losses of around €135 million
113 in the following season. In contrast, relegation from the French Ligue 1 would result in
114 lower, but still significant losses of about €32 million. Cerqua (2014) also stated that
115 relegated teams would, on average, require up to 6 seasons to recover from the negative
116 economic shock of relegation.

117 So far, there have been no big data studies with a large sample size identifying
118 which technical parameters are of most importance across the second tiers of several
119 European football leagues and which parameters specifically enhance the chances of
120 promotion to the elite leagues. Taking this into consideration, this study aims to utilise
121 predictive statistical models to assess match level technical performance data for 98
122 teams performing in the English Championship, French Ligue 2 and German Bundesliga
123 2 over a 5-season sample period (2013/14 – 2017/18), in order to identify the technical
124 KPI's most likely to aid the chances of promotion to the elite leagues in football.

125 **Methods**

126 *Data and Statistical Analyses*

127

128 In this study, 11,032 team match-observations were analysed. Previous research in
129 sports performance analysis has revealed that aggregated seasonal data can mask important
130 variation in the data (Leard & Doyle, 2011). Consequently, team match-observations were
131 analysed in this study as this would capture any match to match variations, which ultimately
132 contribute towards a better understanding of overall match performances in football (Liu et al.,
133 2016).

134
135 Technical performance data were utilised in this study and data were provided by Opta
136 Sports – a high degree of reliability was previously reported by Liu et al. (2013) and data sets
137 sourced by Opta are considered to be the gold standard (Sapp et al., 2018). A wide-range of
138 variables collected by Opta have been frequently utilised in many previous studies on football
139 (Ermidis et al., 2019; Jamil, 2019; Jamil & Kerruish, 2020; Lepschy et al., 2020; Liu, Yi, et al.,
140 2015; Mclean et al., 2019; Yi et al., 2019). Table 1 presents a list of operational purposes for
141 all independent variables utilised in this study; all definitions were obtained from either the
142 official Opta F24 appendices or the Opta website*¹. All matches analysed in this study were
143 played over a 5-season sample period ranging from the 2013/14 season to the 2017/18 season.
144 Originally, 42 technical variables were selected for this study but due to the detection of
145 multicollinearity (through VIF and tolerance statistics) some variables were dropped resulting
146 in a final total of 36 technical metrics². These 36 technical performance parameters were then
147 divided into 3 categories; defensive, set-pieces, and passing. A generalised linear model was
148 employed to identify the linear relationships between each technical parameter and the
149 probability of being promoted. A series of logistic regressions were run, independently, on
150 defensive, set-pieces, and passing metrics. Samples were deliberately left imbalanced for all
151 logistic regressions conducted in this study, as sample balancing has been revealed to have next

¹ *www.Optasports.com – Staff at Opta were contacted directly to clarify definitions for a select few variables

² In cases of multicollinearity, the variables with the greater effect sizes remained whilst the others were dropped

152 to no effect in the context of logistic regressions (Crone & Finlay, 2012). On the contrary,
153 Crone and Finlay (2012) argue that rather than over-sampling or under-sampling, the utilisation
154 of all available data results in superior predictive models. Promotion was the dependent
155 variable (classified as 1 = promotion and 0 = non-promotion) and the values of relevant KPI's
156 were the independent variables which were modelled to predict the logarithm of the odds of
157 being promoted (Peng et al., 2002). All statistical testing was conducted on StataSE 16.0
158 (StataCorp. 2019. *Stata Statistical Software: Release 16*. College Station, TX: StataCorp LP).
159 Significance was reported as $p \leq 0.05$. Ethical approval for this study was obtained by the ethics
160 committee of the local institution.

161 ****Please insert table 1 here****

162 **Results**

163 *Defensive Metrics*

164 Results revealed that recovering possession of a loose ball increased the odds of
165 promotion, albeit marginally by under 1% ($p = 0.001$). Conceding goals had a negative effect
166 on the odds of promotion. Expressly, every goal conceded reduced the odds of being promoted
167 by 27% ($p < 0.001$). Signs of teams being under pressure defensively, such as clearing the ball
168 ($p < 0.001$), blocking shots ($p < 0.001$), the goalkeeper making saves ($p < 0.001$) were all
169 revealed to have a negative impact upon the chances of promotion by 1%, 6% and 9%
170 respectively. Receiving a yellow card ($p = 0.018$) also reduced the odds of promotion by around
171 6%. The Hosmer-Lemeshow post estimation goodness-of-fit (gof) revealed a non-significant
172 p-value of 0.6310, as did the Pearson gof test, $p = 0.4691$. The AUC value (area under the ROC
173 curve) was revealed to be 0.6296.

174 *Set-Piece Metrics*

175 Results revealed that scoring penalty kicks increased the odds of promotion by 37% (p
176 < 0.001). Scoring direct free-kick goals and goals from corners also increased the odds of being

177 promoted by 38% ($p = 0.031$) and 35% ($p < 0.001$) respectively. Corners successfully taken
178 (directed to a team-mate) significantly increased the odds of promotion by 4% ($p = 0.003$).
179 Taking short corners were also revealed to significantly increase the odds of promotion by 17%
180 ($p < 0.001$). Conceding corners, on the other hand, were revealed to decrease the odds of
181 promotion by 7% ($p < 0.001$). The Hosmer-Lemeshow post estimation gof test revealed a non-
182 significant p-value of 0.5293, as did the Pearson gof test, $p = 0.3571$. The AUC value (area
183 under the ROC curve) was revealed to be 0.5994.

184 *Passing Metrics*

185 Results revealed creating goal-scoring opportunities in the form of assists and through
186 balls significantly increased the odds of promotion by 28% ($p < 0.001$) and 14% respectively
187 ($p = 0.001$). If a team were able to maintain possession of the ball their odds of promotion
188 would increase, but only marginally by 0.3% ($p < 0.001$). Other aspects of general build up
189 play such as, each successful flick-on and successful lay-off also increased the odds of
190 promotion by around 4% ($p = 0.004$) in the case of flick-ons and 0.5% in the case of lay-offs.
191 The Hosmer-Lemeshow post estimation gof test revealed a non-significant p-value of 0.6274,
192 as did the Pearson gof test, $p = 0.4002$. The AUC value (area under the ROC curve) was
193 revealed to be 0.6271.

194

195 ****Please insert tables, 2,3 and 4 here****

196 **Discussion**

197 The aim of the study was to investigate the technical performance levels of professional
198 football teams performing in second-tier leagues around Europe in order to identify factors that
199 impact their chances of promotion to the elite leagues. Evidence suggested that the teams in
200 second-tier leagues across Europe have significantly fewer chances of being promoted when
201 their defensive units and goalkeepers have high involvement. Set-pieces and in particular, the

202 successful execution of penalty kicks and corner kicks were revealed in this study to increase
203 the odds of promotion significantly. Attacking play pertaining to chance creation was also
204 revealed to improve the chances of promotion to the elite leagues substantially.

205 In this investigation, set pieces were discovered to be of great importance in the lower
206 leagues across Europe as 6/17 variables relating to set-pieces were revealed to have a
207 statistically significant impact upon the odds of being promoted. Previous research has shown
208 that roughly one-third of all goals in elite football is scored either directly or indirectly from a
209 set-play (Jamil, Littman, et al., 2020; Pulling, 2015). Furthermore, set plays can often lead to
210 match-winning situations (Bar-Eli & Azar, 2009; Sarmiento, Clemente, et al., 2018). In line
211 with much of this previous research, the results of this study emphasised the importance of set-
212 plays in lower league football. Specifically, this study revealed that scoring penalty kicks
213 significantly increased the odds of promotion by around 37%. As revealed by Fariña et al.
214 (2013) scoring penalty kicks can substantially enhance the chances of winning matches, since
215 matches only have 2.5 goals on average. The results of this investigation also revealed that
216 goals scored directly from free-kicks significantly increased the odds of promotion by 38%.
217 These results therefore indicate lower league footballers accept the opportunity to shoot
218 towards goal when granted, which is not too surprising a result as free-kicks awarded in the
219 vicinity of the penalty box often present a good shooting opportunity (Alcock, 2010). Corner
220 kicks were also revealed to be particularly important in lower league football as goals scored
221 directly from corner kicks led to a 35% increase in the odds of being promoted and even
222 successfully directing the corner kick to a team-mate increased the odds of promotion by 4%.
223 Directing a corner towards a team-mate and allowing them the opportunity to make the first
224 contact on the ball has been revealed to increase the number of attempts at goal (Pulling, 2015).
225 Taking short corners were also exposed to increase the odds of promotion significantly by 17%.
226 These results could be explained by the fact that short corners have proven to be a particularly

227 effective corner kick strategy as they ensure possession is retained and ultimately result in more
228 attempts at goal than either the in-swinging or out-swinging corner delivery methods (Kubayi
229 & Larkin, 2019). Conversely, conceding corner kicks were revealed to significantly decrease
230 the odds of promotion by around 7%.

231 With regards to open play, creating chances via successful passes in the form of assists
232 and through balls were revealed to increase the odds of promotion significantly. Much previous
233 research in the field of performance analysis have discovered that successful passes are key
234 contributors to positive outcomes in football (Hughes & Franks, 2005; Jamil, McErlain-Naylor,
235 et al., 2020; Mclean et al., 2018; Rein et al., 2017). In line with this previous research, the
236 results of this study suggest that successful passing is of great importance in lower league
237 football, particularly as successful passing in attacking areas of the pitch can aid the chances
238 of promotion.

239 This study has outlined which aspects of technical performance lower league teams
240 across Europe should focus their efforts on to enhance their chances of promotion and thus
241 compete at the highest level. This study, however, was limited in the main by an absence of
242 physical parameters which could also potentially reveal further aspects of play teams should
243 pay specific attention towards in order to aid their chances of promotion. Future research,
244 therefore, could expand on this strand of research focussing on lower league football and
245 incorporate physical performance data to inform the tactics, strategies further and playing
246 philosophies lower league football teams across Europe should adopt in order to enhance their
247 chances of promotion.

248 **Conclusion**

249 This study discovered that teams that rely on their goalkeepers to frequently make saves
250 and outfield players to regularly perform defensive actions such as, clearing the ball and
251 blocking opponent's shots are significantly less likely to achieve promotion. Set-plays are

252 revealed to be of vital importance in lower league football and in particular, corner kicks and
253 penalty kicks. Accurate corner kicks directed towards team-mates and leading to goal scoring
254 attempts were revealed in this study to significantly increase the prospects of promotion to the
255 elite leagues as did the efficient use of penalty kicks. With regards to open play, creating
256 chances were revealed to significantly increase the odds of promotion. These results, therefore,
257 suggest that adopting a penetrative style of play focussed on chance creation and efficiently
258 utilising set-piece opportunities are the best strategies to adopt for those teams in lower league
259 football hoping to achieve promotion.

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Table 1 – Operational Definitions for Independent Variables

(1) Goals Conceded	Any goal (deliberate or accidental) conceded
(2) Duels Won	Total 50/50 challenges (when the ball is in the air/ground) – Won
(3) Tackles Won	Tackle = dispossesses an opponent of the ball, Won = gained possession
(4) Total Clearances	Player under pressure hits ball clear of the defensive zone or/and out of play
(5) Blocks	Outfield player makes a block of an opposition action
(6) Interceptions	When a player intercepts any pass event between opposition players and prevents the ball reaching its target.
(7) Recoveries	When a player takes possession of a loose ball
(8) Total Fouls Conceded	Foul = An infringement resulting in a free kick, Conceded = Free kick is awarded to the opponent
(9) Yellow Cards	Player shown a yellow card
(10) Red Cards	Player shown a straight red card
(11) Saves Made	Goalkeeper event; saving a shot on goal
(12) GK successful distribution	GK successfully finding a team-mate from a throw/kick restart
(13) Team clean sheet	A player or team who does not concede a goal for the full match
(14) Penalty Goals	Goal scored was from a penalty kick
(15) Direct Free-Kick Goals	Goal scored from a direct free kick
(16) Direct Free-Kick on Target	Goal attempt from a direct free kick on target
(17) Direct free-Kick off Target	Goal attempt from a direct free kick off target
(18) Blocked Direct Free Kick	Goal attempt from a direct free kick blocked by an opponent
(19) Goals From Corners	Goals scored as a result of a corner kick
(20) Goals From Throws	Goals scored as a result of a throw-in
(21) Attempts From Corners On-target	Goal attempts as a result of a corner kick on target
(22) Attempts From Throws On-target	Goal attempts as a result of a throw-in on target
(23) Attempts From Set-Play On-target	Goal attempts as a result of a set-play on target
(24) Successful Crosses Corners	Corner kicks successfully directed to a team-mate
(25) Corners Taken Inc Short Corners	Total corner kicks taken
(26) Corners Conceded	Total corner kicks conceded to the opponent
(27) Successful Corners into Box	Corner kicks successfully directed to a team-mate (inside 18 yard box)
(28) Short Corners	Corner kicks taken short to a team-mate
(29) Throw-Ins to Own Player	Throw-ins to own player, possession retained

(30) Throw-Ins to Opposition Player	Throw-ins to own player, possession conceded
(31) Total Successful Passes (excluding crosses and corners)	Any intentional played ball from one player to another (successfully received by the intended recipient without a touch from an opposing player). Passes include open play passes, goal kicks and free kicks played as a pass.
(32) Assists	The final touch (pass, pass-cum-shot or any other touch) leading to the recipient of the ball scoring a goal. If the final touch is deflected by an opposition player, the initiator is only given a goal assist if the receiving player was likely to receive the ball without the deflection having taken place. Own goals, directly taken free kicks, direct corner goals and penalties do not get an assist awarded.
(33) Key Passes	The final pass or pass-cum-shot leading to the recipient of the ball having an attempt at goal without scoring.
(34) Successful Flick-Ons	(31) - a glancing pass with head or foot onto a team mate where the ball is helped on in the same general direction
(35) Successful Lay-Offs	(31) - A first time pass away from goal when there is pressure on the passer (typically played by a forward) with one touch when they have their back to goal
(36) Through Ball	A pass splitting the defence for a team-mate to run on to

Table 2. Logistic regression results for defensive metrics

Variables	Coef	Coef exp (Odds Ratio)	Z	p	95% Confidence Intervals	
Goals Conceded	-0.318	0.728	-7.22	0.000**	-.404246	-.2316206
Duels Won	0.002	1.002	0.58	0.562+	-.0037451	.0068909
Tackles Won	-0.004	0.996	-0.57	0.571+	-.0178953	.0098762
Total Clearances	-0.010	0.990	-3.69	0.000**	-.0155622	-.0047641
Blocks	-0.066	0.936	-4.04	0.000**	-.0976315	-.0337942
Interceptions	-0.006	0.994	-1.36	0.174+	-.015156	.0027367
Recoveries	0.009	1.009	3.24	0.001**	.0033836	.0137127
Total Fouls Conceded	-0.003	0.997	-0.39	0.695+	-.0175706	.0117117
Yellow Cards	-0.062	0.940	-2.37	0.018*	-.1136728	-.0107608
Red Cards	0.022	1.022	0.21	0.833+	-.1798738	.2233565
Saves Made	-0.095	0.910	-5.57	0.000**	-.1278654	-.0612754
GK successful distribution	-0.004	0.997	-0.45	0.651+	-.0186456	.0116533
Team clean sheet	0.037	1.038	0.41	0.685+	-.141826	.2157529

** = Significant at 99% CI, * = Significant at 95% CI

Table 3. Logistic regression results for set-piece metrics

Variables	Coef	Coef exp (Odds Ratio)	Z	p	95% Confidence Intervals	
Penalty Goals	0.317	1.373	3.74	0.000**	.1507241	.4829814
Direct Free-Kick Goals	0.319	1.376	2.16	0.031*	.0299057	.6087743
Direct Free-Kick on Target	0.118	1.125	1.71	0.087+	-.0171254	.2529936
Direct free-Kick off Target	0.000	1.000	0.00	0.998+	-.1134411	.1136744
Blocked Direct Free Kick	0.071	1.074	1.10	0.270+	-.0554551	.198203
Goals From Corners	0.303	1.354	3.57	0.000**	.1365527	.470047
Goals From Throws	-0.247	0.781	-0.82	0.413+	-.8395625	.3447789
Attempts From Corners On-target	-0.020	0.980	-0.39	0.696+	-.1199895	.0801013
Attempts From Throws On-target	0.034	1.035	0.25	0.806+	-.2384923	.3068744
Attempts From Set-Play On-target	0.038	1.039	0.78	0.438+	-.0583691	.1347828
Successful Crosses Corners	0.039	1.040	2.96	0.003**	.0132901	.0654094
Corners Taken Inc Short Corners	0.011	1.011	0.77	0.443+	-.0175586	.0401174
Corners Conceded	-0.074	0.929	-6.19	0.000**	-.0973346	-.0505069
Successful Corners into Box	-0.056	0.946	-1.70	0.088+	-.1204482	.0083886
Short Corners	0.158	1.172	5.13	0.000**	.0978211	.2189561
Throw-Ins to Own Player	0.005	1.005	0.95	0.342+	-.0049827	.0143521
Throw-Ins to Opposition Player	-0.003	0.997	-0.29	0.768+	-.019611	.0144856

** = Significant at 99% CI, * = Significant at 95% CI

Table 4. Logistic regression results for passing metrics

Variables	Coef	Coef exp (Odds Ratio)	Z	p	95% Confidence Intervals	
Total Successful Passes	0.003	1.003	9.28	0.000**	.0029955	.0039920
Assists	0.246	1.280	8.68	0.000**	.19062036	.3023245
Key Passes	0.014	1.014	1.73	0.084+	-.0020020	.0295588
Successful Flick-Ons	0.039	1.039	3.05	0.002**	.01390291	.0629747
Successful Lay-Offs	0.012	0.005	2.54	0.011*	.0029955	.0207825
Through Ball	0.126	1.135	3.12	0.002**	.0468835	.2053868

** = Significant at 99% CI, * = Significant at 95% CI