ORIGINAL ARTICLE

# Benchmarking tactical efficiency in international football: Identifying gaps and strategic improvements

**Heechul Hwang** . *Korea Institute of Materials Science. Changwon-daero, Seongsan-gu, Changwon-si, Gyeongsangnam-do, Republic of Korea.*

## ABSTRACT

This study evaluates the tactical efficiency of the South Korean national football team using a modified output-oriented BCC Data Envelopment Analysis (DEA) model, by benchmarking its performance against reference teams grouped by continental classifications. Among the four reference groups, America and Europe group produced feasible solutions. South Korean national football team consistently underperformed in converting tactical inputs into goals. In several cases indicating that the team would need to double its goal output—given its current resource level—to match benchmark efficiency. This research contributes methodologically by reinterpreting Ø as a goal-scaling factor and slack variables as diagnostics for tactical inefficiencies. As such, DEA proves valuable not only for internal efficiency evaluation but also for strategic benchmarking in high-performance football contexts. This study offers a DEA-based framework to evaluate tactical efficiency by comparing teams' resource usage and outcomes across formations and tournament stages. It benchmarks the target team against efficient team combinations to identify tactical gaps and input shortfalls. The findings provide strategic guidance by quantifying areas for improvement and suggesting optimal resource.

**Keywords**: Performance analysis, Football, Efficiency, DEA, Optimal, Benchmark.

**Cite this article as:**
Hwang, H. (2025). Benchmarking tactical efficiency in international football: Identifying gaps and strategic improvements. *Journal of Human Sport and Exercise, 20*(4), 1255-1264. https://doi.org/10.55860/1kcw3d09

**Corresponding author.** *Korea Institute of Materials Science. Changwon-daero, Seongsan-gu, Changwon-si, Gyeongsangnam-do, Republic of Korea.*
E-mail: sumvete@gmail.com
Submitted for publication May 23, 2025.
Accepted for publication August 06, 2025.
Published August 23, 2025.
Journal of Human Sport and Exercise. ISSN 1988-5202.

**doi:** https://doi.org/10.55860/1kcw3d09

## INTRODUCTION

The FIFA World Cup is the most prominent and widely viewed international sporting event, drawing participation from 32 national teams across eight groups. Following the group stage—where the top two teams from each group advance—the tournament adopts a single-elimination format, culminating in a final match that determines the world champion. Given the high level of competition and global representation, the World Cup offers a unique lens through which to analyse tactical diversity, strategic preferences, and the developmental trajectories of national football programs across continents.

FIFA World Cup performance analysis encompasses both individual and collective dimensions, and extensive research has explored the key factors associated with success in matches. Studies focusing on offensive metrics typically emphasize variables such as shot frequency, shot accuracy, and passing effectiveness, whereas defensive performance is commonly assessed through measures like tackles and clearances. However, the exclusive use of indicators such as shot count, possession percentage, and number of passes presents inherent limitations in capturing the full complexity of team performance.

At the 2018 FIFA World Cup in Russia, Germany was eliminated in the group stage after a 2–0 defeat to South Korea, despite recording 16 more shots and completing 476 more passes. Similarly, at the 2022 FIFA World Cup in Qatar, Japan secured a 2–1 victory over Spain and topped their group, even though they registered eight fewer shots and 846 fewer passes. Additionally, one of the most unexpected results of the 2022 tournament occurred when Saudi Arabia defeated eventual champions Argentina 2–1 in the group stage.

These surprising outcomes highlight that traditional match statistics alone may not fully reflect tactical effectiveness. To address this gap, the present study moves beyond match-level data and proposes a structured benchmarking framework based on regional team classifications. By clustering reference teams the study interprets λ-weighted combinations not just as efficiency references, but as practically meaningful tactical archetypes.

Furthermore, the inclusion of slack variables enables a more granular analysis of tactical resource utilization, identifying specific areas where input variables—such as shots, effective shots, or passes—fall short of benchmark standards. This allows for a diagnostic perspective on how much tactical adjustment is required to reach desired performance levels.

By reframing the output-oriented BCC DEA model as a means of evaluating "*tactical implementation efficiency*," this research shifts the focus from static efficiency rankings to actionable insight. In doing so, the study contributes a novel analytical framework that links benchmarking efficiency with tactical feasibility and strategic planning. This approach underscores the importance of region-specific benchmarking in formulating adaptable and competitive tactical strategies. Using a modified output-oriented BCC Data Envelopment Analysis (DEA) framework, this research aims to identify areas of tactical inefficiency and potential improvement, with the goal of informing future strategic planning and training optimization.

The remainder of this paper is structured as follows. Section 2 reviews the relevant literature and Section 3 describes the methodology and variable selection for the efficiency analysis. Section 4 presents the empirical findings, including descriptive statistics and benchmarking outcomes. Finally, Section 5 discusses the implications of the results and offers concluding remarks along with directions for future research.

 

This paper conducted an analysis targeting the Korea National Football team that advanced to the FIFA WORLD CUP, and the current status of various previous studies is as follows. Numerous variables influence outcomes and rankings in football matches. While a substantial body of research has examined these factors within the context of league competitions, relatively fewer studies have focused on tournament settings.

Many researchers have studied shooting indicators. A range of empirical studies has highlighted key performance indicators related to successful outcomes in international football tournaments. Liu (2015), examining data from the 2014 FIFA World Cup, found that both the number of shots and shots on target were positively associated with the probability of winning. Similarly, Danilo (2019) reported that winning teams in the 2018 World Cup exhibited higher passing accuracy, along with increased shot attempts and shots on target. Complementing this, Lago-Ballesteros and Lago-Peñas (2010) noted that leading teams generally achieved more goals, as well as a greater number of total and accurate shots. Building on these findings, Lago-Peñas, Lago-Ballesteros, and Rey (2011) identified shot volume—particularly shots on target—as a distinguishing factor between winning and losing teams.

Several scholars have investigated the role of passing in determining match outcomes. Collet (2013) emphasized the importance of pass efficiency, particularly those passes that directly contribute to goal-scoring opportunities, as a critical factor in team success. Harrop and Nevill (2014) argued that a reduced number of total passes, especially those executed in the attacking half, were positively associated with winning matches. More recently, Rossi et al. (2019) asserted that the effectiveness of passing plays a more decisive role in match performance than simple ball possession.

Efficiency-related metrics have been the focus of several key studies in football performance analysis. Broich et al. (2014) highlighted the critical role of goal efficiency in determining team success within Germany's top-tier league. In the context of Korean professional football, Hwang (2022) demonstrated that overall match efficiency had a positive influence on a team's seasonal performance. Expanding this line of inquiry, Hwang (2024) identified both passing and shooting efficiency as significant contributors to improved performance outcomes in Italy's Serie A. Furthermore, Hwang (2025) reported that efficiency metrics played a decisive role in differentiating winning and losing teams in the quarterfinal and semifinal stages of UEFA EURO 2024.

Previous studies have primarily focused on comparative analyses of efficiency metrics to evaluate relative team rankings within leagues or to distinguish winners from losers in tournament matches. However, such research has been limited to descriptive assessments without further exploration of strategic implications.

This study distinguishes itself from previous research in several key aspects.

First, rather than merely calculating efficiency scores, it focuses on the South Korean national team as the primary subject of analysis and incorporates an evaluation of input resources to identify suitable benchmark teams.

Second, by deriving these benchmark teams, the study proposes a quantitative methodology that not only assesses efficiency but also provides strategic recommendations for improving the tactical structure and overall strategy of the Korea team.

Third, the research further extends its scope by grouping teams based on region (e.g., Europe, America) thereby enabling a structured benchmarking analysis across multiple dimensions.

## METHODOLOGY

### *Data*

This study is based on an analysis of the 32 group stage matches played by the 32 national teams that qualified for the FIFA World Cup. All match data is presented in Table 1.

Table 1. Match data.

| Nations | Number of shots | Number of effective shots | Number of success passes | Goal |
|---|---|---|---|---|
| Argentina | 43 | 20 | 1754 | 5 |
| Australia | 21 | 7 | 802 | 3 |
| Belgium | 35 | 9 | 1530 | 1 |
| Brazil | 57 | 21 | 1462 | 3 |
| Cameroon | 28 | 16 | 895 | 4 |
| Canada | 35 | 5 | 1205 | 2 |
| Costa Rica | 12 | 7 | 770 | 3 |
| Croatia | 29 | 16 | 1394 | 4 |
| Denmark | 34 | 10 | 1505 | 1 |
| Ecuador | 30 | 11 | 1076 | 4 |
| England | 39 | 17 | 1713 | 9 |
| France | 54 | 17 | 1601 | 6 |
| Germany | 69 | 24 | 1595 | 6 |
| Ghana | 26 | 10 | 913 | 5 |
| Iran | 33 | 10 | 700 | 4 |
| Japan | 31 | 10 | 848 | 4 |
| Mexico | 41 | 16 | 1011 | 2 |
| Morocco | 24 | 8 | 842 | 4 |
| Netherlands | 25 | 8 | 1491 | 5 |
| Poland | 19 | 5 | 701 | 2 |
| Portugal | 39 | 14 | 1555 | 6 |
| Qatar | 20 | 6 | 1051 | 1 |
| Saudi Arabia | 29 | 9 | 803 | 3 |
| Senegal | 42 | 12 | 920 | 5 |
| Serbia | 32 | 9 | 1098 | 5 |
| South Korea | 42 | 13 | 1062 | 4 |
| Spain | 36 | 16 | 2489 | 9 |
| Switzerland | 27 | 10 | 1155 | 4 |
| Tunisia | 32 | 8 | 901 | 1 |
| United States | 28 | 7 | 1244 | 2 |
| Uruguay | 33 | 11 | 1078 | 2 |
| Wales | 24 | 7 | 955 | 1 |

Effective game strategies that maintain offensive momentum through passes into the goal opportunity can contribute to winning. From an efficiency perspective, a team that executes few passes while making numerous attacks may demonstrate high game efficiency. The shot and pass success rate data for the 2022 FIFA World cup teams are presented in Table 2.

Although football analytics increasingly relies on numerical performance indicators, these raw statistics frequently fall short in explaining how tactical efforts translate into actual match results. For instance, during the 2022 FIFA World Cup group stage, teams averaged 33.4 shots, 11.5 shots on target, and 1,191 successful passes per match, resulting in an average of 3.75 goals. However, the overall shot success rate

 

stood at only 34%, while the goal success rate was just 32%.

These figures highlight a significant efficiency gap between offensive effort and scoring outcomes, reinforcing the need for analytical approaches that assess not only the volume but also the transformation efficiency of tactical actions.

Table 2. Shot / pass success rate.

| Shot success rate (Number of shots on target / shots) | Goal success rate (Goals/Number of shots on target) |
|---|---|
| 34% | 32% |

Table 3. Group stage matches data.

| Division | Average | Standard Deviation | Minimum value | Maximum value |
|---|---|---|---|---|
| Shooting | 33.4 | 11.5 | 12 | 69 |
| Effective shot | 11.5 | 4.86 | 5 | 24 |
| Number of success passes | 1191 | 395 | 700 | 2489 |
| Goal | 3.75 | 2.08 | 1 | 9 |

***Methods***

Data Envelopment Analysis (DEA) is a non-parametric method used to assess efficiency by comparing the inputs and outputs of decision-making units (DMUs). It evaluates the performance of each DMU relative to a peer group, identifying whether it operates efficiently or inefficiently. By employing linear programming, DEA measures the relative efficiency of each unit based on its distance from the efficiency frontier. This approach has been widely applied in prior research to analyse the performance efficiency of football teams. (Espitia-Escuer & García-Cebrian, 2004; Espitia-Escuer & García-Cebrián, 2010; García-Sánchez, 2007; Haas et al., 2004; Haas, 2003;Hwang, 2022; Hwang, 2024: Hwang, 2025; Rossi et al., 2019; Tenga et al., 2010).

Efficiency in DEA is measured on a scale ranging from 0 to 1, facilitating relative comparisons among decision-making units (DMUs). A score closer to 1 signifies higher efficiency, whereas lower-scoring DMUs can pinpoint inefficiencies in their input usage or output production. Conventional BCC models primarily focus on relative efficiency assessments among internal DMUs and do not readily allow for quantitative interpretation of the benchmark units.

$$\max \emptyset + \varepsilon \left( \sum s^{-}{}_{i} + \sum s^{+}{}_{r} \right)$$

$$s.t$$

$$\sum_{i=1}^{n} \lambda_j x_{ij} = x_{io} + s_i^-$$

$$\sum_{i=1}^{n} \lambda_j y_{rj} = \emptyset \cdot y_{io} + s_r^+$$

$$\sum_{i=1}^{n} \lambda_j = 1$$

$$\lambda_j \geq 0, \quad s_i^-, s_r^+ \geq 0, \quad \emptyset \geq 0$$

Table 4. Symbol Definitions for the Output-Oriented BCC DEA Model.

| Symbol | Description |
|---|---|
| Φ | Output-oriented efficiency score |
| ε | A very small positive value used to penalize slack in the objective function |
| j | DMU(National Team) |
| $\lambda_j$ | Weight assigned to DMU j (used in convex combinations) |
| $X_{i,j}$ | Value of input variable i for DMU j |
| i | Input value (shots, shots on target, success pass) |
| r | Output value (goal) |
| $X_{i,o}$ | Value of input variable evaluated $DMU_0$ |
| $Y_{r,j}$ | Value of output variable i for DMU j |
| $Y_{i,o}$ | Value of output variable evaluated $DMU_0$ |
| $S_i^-$ | Input slack for variable (shots, effective shots, passes) |
| $S_r^+$ | Input slack for variable (goal) |
| n | Total number of DMUs |

This study adopts a modified output-oriented BCC DEA model based on the envelopment form but redefines the benchmarking framework by introducing externally defined target input-output values.

Unlike the conventional DEA which evaluates internal DMUs against the efficient frontier, this model assesses how closely a specific team (South Korea) can approach a predefined strategic performance target by forming a λ-weighted combination of efficient peer teams. While preserving the mathematical structure of the traditional BCC envelopment model, the proposed approach reinterprets Ø not merely as a radial expansion factor, but rather as a strategic amplification coefficient for achieving target outcomes. Furthermore, slack variables are recontextualized to represent the shortfalls in tactical resources required to meet performance goals. This enhanced perspective enables the model to function as a tactical benchmarking tool for decision support in fields such as sports analytics.

Table 4. presents the definitions of all variables and parameters used in the output-oriented BCC DEA model. The inputs (shots, shots on target and passes) are indexed by i, while the output (goals scored) is denoted by r. Slack variables represent the shortfall in achieving efficient performance under the benchmark configuration. This study adopts the number of total shots, shots on target, and successful passes as input variables, based on prior research identifying these factors as key contributors to match outcomes. The primary aim is to develop a benchmarking model that enables the evaluation of tactical efficiency and the derivation of strategic implications for improvement. To achieve this, 32 national teams were grouped according to continental classifications.

## RESULTS

In this study, teams were categorized by continent into four groups: Asia, Africa, Europe, and the Americas. The Asia group consisted of Australia, Iran, Japan, Qatar, and Saudi Arabia. The Africa group included Cameroon, Ghana, Morocco, Senegal, and Tunisia. The Europe group comprised Belgium, Croatia, Denmark, England, France, Germany, Netherlands, Poland, Portugal, Serbia, Spain, Sweden, and Wales. The America group, considering sample size, incorporated both South and North/Central American teams, including Argentina, Brazil, Canada, Costa Rica, Ecuador, Mexico, United States, and Uruguay.

Among the multiple reference groups constructed for benchmarking, 2 Group were selected for in-depth analysis: one group based on Europe and another is America.

 

Asia and Africa group had resulted in an infeasible solution under the given input-output targets. While the DEA model for the Europe and America group converged to a feasible optimal solution ($\emptyset = 1.2$ $\emptyset = 2.1$) the model.

In the case of the infeasible reference group, the target unit's output target (e.g., 6 goals) could not be reproduced by any convex combination of the Asia and Africa as none of their λ-weighted projections reached the target output level. For instance, the λ combination of all reference units yielded a maximum goal output of 4.8, falling short of the target team's actual goal (6), while requiring more input (pass counts exceeding 1000). This suggests that the South Korea team performance lies outside the production possibility set defined by the benchmark units, thereby resulting in infeasibility. Two specific benchmark configurations—America and Europe—yielded Ø values of 1.2 and 2.1, respectively, highlighting notable variation in required output expansion to reach efficient frontiers.

The analysis results are shown in Table 6. The America group presented a comparatively moderate resource demand, with an efficiency coefficient (φ) of 1.25, indicating that only a 25% increase in goal output would be sufficient for the team to reach the benchmark efficiency level. The efficiency score was 0.80, which is higher than that of the European group, and the λ-combination included multiple reference teams such as Argentina, offering a more realistic strategic alternative. The slack values indicated a shortfall of approximately 7 effective shots and 692 successful passes, suggesting a relatively lower input burden compared to the European benchmark. In contrast, the Europe group presented significantly higher resource demands, with Ø = 2.1, suggesting that while the tactical model is theoretically more productive.

In Europe Group (Ø = 2.1, efficiency score = 0.47), the DEA model projected that the target team would need to increase its goal-scoring output by about 110% to match the benchmark efficiency level. Slack analysis revealed shortfalls of approximately 4 effective shots and 1,264 successful passes compared to the benchmark, implying that a substantially higher level of tactical input would be required to achieve comparable performance. In contrast, America (Ø = 1.25, efficiency score = 0.8) presented a considerably more attainable benchmark. Here, the required expansion in goal output was 25% increase, with comparatively lower input slack: 7 effective shots and 692 passes. Compared to the America group, European teams exhibited significantly higher levels of successful passes and effective shots but required a greater increase in output (φ = 2.1) to reach the efficiency frontier. This suggests that while the European tactical model is theoretically productive, its practical feasibility may be limited for the target team.

Therefore, from a strategic feasibility perspective, the America-based benchmark appears to be more compatible and actionable for the South Korea team. It further reinforces the need for strategic adjustments in shot efficiency and pass success to align more closely with high-performing benchmark teams. These findings underscore the utility of DEA not only as a diagnostic tool for internal performance efficiency but also as a strategic instrument for external benchmarking. By treating Ø as a performance scaling coefficient and slack variables as indicators of tactical inefficiency, the model enables a nuanced understanding of where and how improvements can be realistically pursued.

Table 5. Group 4 results.

| Group | Status | Φ |
|---|---|---|
| Asia | Infeasible | - |
| Africa | Infeasible | - |
| America | Feasible | 1.25 |
| Europe | Feasible | 2.11 |

Table 6. Group 2 results.

| | **Group1(America)** | **Group2(EUROPE)** |
|---|---|---|
| Φ | 1.25 (0.80) | 2.11 (0.47) |
| Shots(slack) | - | - |
| Effective shots(slack) | 7 | 4.45 |
| Pass(slack) | 692 | 1,264 |
| Goal | 5 | 8.45 |
| Benchmark Team | Argentina ($\lambda_j$ = 1.0) | Spain ($\lambda_j$ = 0.8)<br>Germany ($\lambda_j$ = 0.2) |

## CONCLUSIONS

This study investigates the efficiency of a South Korea national football team by comparing its performance against multiple reference groups using a modified output-oriented BCC Data Envelopment Analysis (DEA) framework. Through this approach, the study evaluates how tactical resources—namely total shots, effective shots on target, and success pass—translate into scoring output when benchmarked against internationally recognized team configurations. Among the four groups, Asia and Africa group resulted in an infeasible solution under the given input-output targets.

The infeasibility observed in two of the reference group configurations highlights a fundamental limitation in tactical alignment between the target team and the selected benchmark units. Specifically, the target inputs and outputs could not be expressed as a convex combination of the reference DMUs, which implies that either the performance target was unrealistic within the data envelope or the reference set lacked sufficient structural diversity. In such cases, infeasibility meaningful outcome that signals limited strategic compatibility.

The analysis reveals that across most reference groups, the team consistently underperformed in its transformation of tactical inputs into goals. Notably, several configurations required a Ø coefficient greater than 2.0, implying that, under ideal benchmark conditions, the team could potentially double its scoring output with more effective deployment of similar or modestly improved resources. This gap underscores both a tactical inefficiency and an opportunity for targeted performance enhancement.

Among the evaluated groups, the configuration derived from Argentina National team produced the most efficient projection (Ø = 1.25, efficiency score = 0.80), indicating minimal performance adjustment needed. This suggests that adopting strategies closer to that configuration may yield realistic and actionable improvements within the team's current resource capacity. In contrast, configurations referencing teams from Europe—despite indicating higher theoretical goal productivity—demanded significantly greater input levels, potentially reducing practical feasibility.

From a methodological perspective, the study extends the utility of DEA beyond conventional internal efficiency analysis. By using DEA as a strategic benchmarking instrument, the Ø coefficient is reinterpreted as a goal-scaling factor, and slack variables provide granular diagnostic insights into resource deficiencies across key tactical areas. This innovative application supports evidence-based coaching and tactical planning in high-performance sports contexts.

Furthermore, the findings open avenues for broader application. Future studies can explore additional input dimensions, such as assists, defensive interceptions, and off-the-ball movements, to capture holistic team dynamics. Comparative analysis across tournaments—including the World Cup, Copa America, or AFC

 

Asian Cup—could also enrich our understanding of continental tactical typologies. Ultimately, refining DEA models to accommodate complex match dynamics can foster deeper insights into strategic efficiency and performance optimization in elite football.

This study contributes to the field by offering a structured framework to quantitatively evaluate the resource configurations and tactical outcomes of teams advancing through each stage of international tournaments. By benchmarking against tactically efficient team combinations across various formations and regional groupings, the model enables a precise diagnosis of the target team's tactical deficiencies and input shortfalls. Consequently, it provides actionable insights for strategic improvement by identifying optimal tactical compositions and resource adjustments required to enhance performance.

## SUPPORTING AGENCIES

No funding agencies were reported by the authors.

## DISCLOSURE STATEMENT

No potential conflict of interest was reported by the authors.

## REFERENCES

Alves, Danilo L., et al. "What variables can differentiate winning and losing teams in the group and final stages of the 2018 FIFA World Cup?." International Journal of Performance Analysis in Sport 19.2 (2019): 248-257. https://doi.org/10.1080/24748668.2019.1593096

Broich, H., Mester, J., Seifriz, F., & Yue, Z. (2014). Statistical analysis for the First Bundesliga in the current soccer season. Prog App Math, 7(2), 1-8.

Collet, C. (2013). The possession game? A comparative analysis of ball retention and team success in European and international football, 2007-2010. J Sports Sci, 31(2), 123-136. https://doi.org/10.1080/02640414.2012.727455

Cooper, W. W., Seiford, L. M., & Tone, K. (2007). Data envelopment analysis: A comprehensive text with models, applications, references and DEA-solver software (Vol. 2). Springer. https://doi.org/10.1007/978-0-387-45283-8

Espitia-Escuer, M., & Garcia-CebriÁn, L. I. (2004). Measuring the efficiency of Spanish first-division soccer teams. J Sports Econ, 5(4), 329-346. https://doi.org/10.1177/1527002503258047

Espitia-Escuer, M., & García-CebriÁn, L. I. (2010). Measurement of the efficiency of football teams in the Champions League. Manag Decis Econ, 31(6), 373-386. https://doi.org/10.1002/mde.1491

Haas, D. J. (2003). Productive efficiency of English football teams-A data envelopment analysis approach. Manag Decis Econ, 24(5), 403-410. https://doi.org/10.1002/mde.1105

Haas, D., Kocher, M. G., & Sutter, M. (2004). Measuring efficiency of German football teams by data envelopment analysis. Cent Eu J Oper, 12(3), 251-268.

Harrop, K., & Nevill, A. (2014). Performance indicators that predict success in an English professional League One soccer team. Int J Perform Anal Spor, 14(3), 907-920. https://doi.org/10.1080/24748668.2014.11868767

Hwang, H. C. (2022). Analysis of the effect of game efficiency of Korean professional soccer club on season performance. Korean Society for Sport Management, 27(6), 55-67. https://doi.org/10.31308/KSSM.27.6.55

Hwang, H. C. (2024). Effect of pass and shoot efficiency: Analysis of Italian first league ranking. Journal of Human Sport and Exercise 19 (1), 139-147. https://doi.org/10.14198/jhse.2024.191.12

Hwang, H. (2025). A study on the efficiency difference between winning and losing teams in the quarterfinals and semifinals of the EURO 2024. Scientific Journal of Sport and Performance, 4(1), 111-118. https://doi.org/10.55860/XMUY8220

Lago-Ballesteros, J., & Lago-Peñas, C. (2010). Performance in team sports: Identifying the keys to success in soccer. J Hum Kinet, 25(1), 85-91. https://doi.org/10.2478/v10078-010-0035-0

Lago-Peñas, C., Lago-Ballesteros, J., & Rey, E. (2011). Differences in performance indicators between winning and losing teams in the UEFA Champions League. J Hum Kinet, 27(1), 135-146. https://doi.org/10.2478/v10078-011-0011-3

Liu, Hongyou, et al. "Match statistics related to winning in the group stage of 2014 Brazil FIFA World Cup." Journal of sports sciences 33.12 (2015): 1205-1213. https://doi.org/10.1080/02640414.2015.1022578

Oberstone, J. (2009). Differentiating the top English premier league football clubs from the rest of the pack: Identifying the keys to success. J Quant Anal Sports, 5(3), 10. https://doi.org/10.2202/1559-0410.1183

Rossi, G., Goossens, D., Di Tanna, G. L., & Addesa, F. (2019). Football team performance efficiency and effectiveness in a corruptive context: The Calciopoli case. Eur Sport Manag Quart, 19(5), 583-604. https://doi.org/10.1080/16184742.2018.1553056

Tenga, A., Ronglan, L.T., and Bahr, R. (2010). Measuring the effectiveness of offensive match-play in professional soccer. Eur J Sport Sci, 10(4), 269-277. https://doi.org/10.1080/17461390903515170



 