



OPEN ACCESS

EDITED BY

Dr. Samsurijal Hasan, MM
Universitas Pahlawan, Indonesia.

Assoc. Prof. Dr. Herli Pardilla
Universitas Muhammadiyah Sumatera Utara,
Indonesia.

*CORRESPONDENCE
Cristian Murillo García
cristian.murillo@cecar.edu.co

RECEIVED: September 09, 2025

ACCEPTED: January 20, 2026.

PUBLISHED: January 27, 2026.

COPYRIGHT © 2026 (Author)

Cristian Murillo García



This work is licensed under a Creative
Commons Attribution-ShareAlike 4.0
International License.

Association Between Expected Goals (xG) and Goal Scoring Across Club and National Team Competitions in Elite Football

Cristian Murillo García^{1*}¹Corporación Universitaria del Caribe - CECAR, Colombia.

ABSTRACT

Background & objective: The purpose of this study was to analyze the association between xG and goals scored in soccer matches.

Materials & Methods: This study was quantitative, correlational, and longitudinal. 333 league matches were analyzed. The dataset was obtained from Sofascore, a website that offers statistics and results from various sporting events. The hypothesis was put forward that there is a positive correlation between xG and goals scored. The sample consisted of 333 official matches from international competitions, including the 2013/24 Champions League, the 2024 Copa Libertadores, Euro 2024, and the 2024 Copa América. These tournaments were selected due to their significant international relevance.

Results: The results of this research confirm the validity of using xG as an indicator for analyzing a team's offensive performance, although its predictive capacity tends to vary depending on the context or competition. In clubs, players have more continuity because they train together, which makes it easier to establish a playing pattern, so this may be a reason for higher xG compared to national team tournaments.

Conclusions: The results obtained in this study confirm the relationship between xG and goals scored in football matches, thus establishing it as a valid indicator for measuring offensive performance in football. It was found that in club tournaments, the amount of association, in the Copa Libertadores ($r = 0.537$) having the best association between the variables, in the Champions League the association was lower ($r = 0.403$). Meanwhile, in national team tournaments, the values for the Copa América and Euro were ($r = 0.475$) and ($r = 0.479$), respectively, where some similarity can be observed in the association of variables, which is attributed to the poor group cohesion and poor tactical fit of the national teams compared to the clubs.

Keywords

expected goals (xg); football performance analysis; offensive performance indicators; goal scoring efficiency; match analytics; elite football competitions.

CITATION APA STYLE 7:

Murillo García, C. (2026). Association Between Expected Goals (xG) and Goal Scoring Across Club and National Team Competitions in Elite Football. *INSPIREE: Indonesian Sport Innovation Review*, 7(01), 09-14. <https://doi.org/10.53905/inspire.v7i01.161>

INTRODUCTION

Global and Theoretical Context

Elite football performance analysis increasingly uses quantitative indicators to distinguish performance quality from the uncertainty of match outcomes. As football is a low-scoring sport, a few decisive events can substantially affect results, making goals alone insufficient to evaluate offensive performance comprehensively. Expected goals (xG) addresses this limitation by estimating the probability that a shot will result in a goal, providing an additional measure of scoring-opportunity quality beyond conventional score-based indicators (Brechtot & Flepp, 2020; Mead et al., 2023).

The theoretical rationale for xG is grounded in probabilistic modelling and the distinction between process performance and realized outcomes. Each shot represents an opportunity with a probability of success determined by characteristics such as shooting distance, angle, shot type, and the surrounding match situation. Aggregating these probabilities across a match produces a team-level estimate of the goals expected from its shooting opportunities. When this estimate is sufficiently well calibrated,

higher aggregate xG should generally correspond to more goals over an appropriate set of observations. Nevertheless, the expected value is not a deterministic forecast of the final score: teams may score fewer or more goals than their xG because individual finishing outcomes, goalkeeping performance, defensive actions, and other match-specific circumstances introduce additional uncertainty (Anzer & Bauer, 2021; Mead et al., 2023).

This distinction is important for performance evaluation. Brechtot and Flepp (2020) demonstrated the value of incorporating expected goals into the assessment of European club football because observed results can be affected by randomness and may not accurately represent underlying team performance. Similarly, Mead et al. (2023) showed that xG models can provide useful information for evaluating football performance and predicting subsequent team outcomes. These findings support the use of xG as an analytical indicator, while also indicating that its usefulness depends on the model specification, the information available, and the outcome being evaluated. In particular, an association between aggregate xG and goals scored does not, by itself, establish that a

particular xG model is calibrated or that it predicts future results accurately.

Critical Review of Existing Evidence

Previous research has examined xG from complementary methodological perspectives. Anzer and Bauer (2021) developed a goal-scoring probability model using synchronized positional and event data, highlighting the importance of contextual information in estimating shot outcomes. Their approach demonstrates that scoring probabilities depend not only on shot location but also on the surrounding game situation. However, evaluating the performance of a shot-level probability model differs from examining the association between match-level xG totals and actual goals scored; these represent distinct analytical questions and should not be treated as equivalent. Mead et al. (2023) extended this line of research by examining improvements in xG modelling and comparing its predictive value with that of more conventional football statistics. Their findings support the practical value of xG while highlighting the importance of model features and predictive evaluation. In contrast, Brechot and Flepp (2020) focused on the consequences of randomness for performance assessment in European club football, emphasizing that observed match outcomes may not adequately reflect a team's underlying performance. Together, these studies establish a strong methodological rationale for evaluating expected and realized goals, but they do not automatically establish that the relationship is identical across different competitive environments. Research on contextual determinants of football performance provides an additional explanation for potential variation. Fernández-Navarro et al. (2019) examined how contextual variables influence playing styles, while Gómez et al. (2018) investigated playing styles in relation to team quality and match location in professional football. Although these studies do not directly establish differences in xG–goal correlations between club and national-team competitions, they indicate that tactical behaviour and match context should be considered when interpreting offensive performance indicators. Research on positional variables and shooting outcomes likewise demonstrates the relevance of shot-related characteristics to goal-scoring effectiveness (Schulze et al., 2018).

An important limitation of the existing evidence is therefore the distinction between validating xG models at the shot level, evaluating their predictive performance over time, and examining the association between match-level xG and actual goals. These approaches use different units of analysis, outcome definitions, and statistical procedures. Findings from one approach cannot be transferred uncritically to another. Furthermore, results derived predominantly from domestic league settings may not fully represent international tournaments, where competition formats,

opponent quality, squad continuity, and tactical preparation can differ. Club teams generally benefit from more continuous training and established tactical relationships, whereas national teams operate within more restricted preparation periods. These differences provide plausible contextual explanations for variation in attacking performance, but they should not be interpreted as proven mechanisms without direct measurement and appropriate statistical testing.

Research Gap, Novelty, and International Contribution

Although previous studies have established the analytical relevance of expected goals (xG) in football performance evaluation, evidence remains limited regarding the consistency of the association between match-level xG and actual goals across elite club and national-team competitions within a common comparative framework. In particular, the relationship across the UEFA Champions League, Copa Libertadores, UEFA European Championship (Euro), and Copa América has not been sufficiently established in the literature reviewed for this study. This gap concerns the consistency of the association across competitive contexts rather than the general usefulness of xG as a performance indicator.

This study addresses the gap by analyzing 333 official matches from the four competitions using xG and goals-scored data obtained from SofaScore. Its novelty lies in comparing the xG–goal association across European and South American club and national-team tournaments using a common match-level analytical approach. The study contributes international comparative evidence on the consistency and magnitude of these associations, without claiming to develop a new xG model or establish causal mechanisms. The findings provide a basis for further research using larger datasets, standardized and validated xG models, and formal statistical tests to determine whether differences between competitions are statistically meaningful.

Objectives and Hypotheses

This study aimed to examine the association between expected goals (xG) and actual goals scored in 333 matches across four elite football competitions: the UEFA Champions League, Copa Libertadores, Euro, and Copa América, and to describe variations in this association across competitions.

H1: Match-level xG is positively associated with actual goals scored across all matches.

H2: Match-level xG is positively associated with actual goals scored within each of the four competitions.

Differences in correlation magnitudes across competitions were considered exploratory and were not interpreted as statistically significant without formal testing.

MATERIALS METHODS

Setting and Participants

This study examined 333 official football matches from four international competitions: the UEFA Champions League, Copa Libertadores, UEFA European Championship (Euro), and Copa América. Match-level data were obtained from SofaScore, an online platform providing football match statistics and results. The sample comprised 125 matches from the UEFA Champions League, 125 from the Copa Libertadores, 51 from the Euro, and 32 from the Copa América. The competitions were selected because of their international significance and their representation of two competitive environments: club football and national-team football. The UEFA Champions League and Copa Libertadores represented club competitions, whereas the Euro and Copa América

represented national-team competitions. This classification provided the basis for examining the association between expected goals (xG) and actual goals scored across different competitive settings. The unit of analysis was the individual match. For each match, xG and actual goals were recorded as the combined totals for both competing teams. Thus, each observation represented one match and contained two principal variables: total match xG and total goals scored. The final analytical sample consisted of 333 match-level observations across the four competitions.

Study Design and Reporting Guideline

A quantitative, observational correlational design was used to examine the association between expected goals (xG) and actual goals scored using secondary match-level data from SofaScore.

Pearson's correlation analyses were conducted across all 333 matches and separately within the four competitions. Although the original manuscript described the study as longitudinal, no repeated measurements or temporal follow-up were reported; therefore, the design is more accurately characterized as a cross-sectional analysis of match-level records. The manuscript followed the STROBE recommendations for reporting observational studies, including study design, participant selection, variable definitions, statistical methods, and limitations.

Sample Size and Rigor Justification

The final sample consisted of 333 official matches distributed across the four selected competitions: 125 UEFA Champions League matches, 125 Copa Libertadores matches, 51 Euro matches, and 32 Copa América matches. These figures correspond to the sample sizes reported in the original study. The inclusion of four competitions provided an opportunity to examine the xG–goal association across club and national-team football rather than restricting the analysis to a single tournament. The sample was, however, unbalanced across competitions, with fewer observations available for the Euro and Copa América than for the two club competitions. Consequently, competition-specific correlation estimates may differ in precision. The sample size was treated as the number of match records available for the reported analysis. No claim of a priori statistical power or a prespecified minimum detectable effect is made in the absence of a documented power calculation. The interpretation of the findings therefore takes into account the different sample sizes across competitions. To support analytical transparency, the study distinguished the overall sample from the four competition-specific subsets and used the same principal variables and correlation approach throughout. The findings were interpreted within the scope of the available match records. The extent to which the results generalize to other competitions, seasons, or levels of football should be considered in light of the competitions represented in the dataset.

Measures and Instruments

Expected goals (xG)

Expected goals (xG) was the principal explanatory variable and represented the combined xG totals of both teams in each match.

RESULTS

The final dataset comprised 333 match-level observations from four competitions. The sample included 125 Copa Libertadores matches, 125 UEFA Champions League matches, 32 Copa América matches, and 51 Euro matches. The analyses examined total expected goals (xG) and total goals scored by both teams in each match.

Descriptive statistics by competition

Table 1 presents the reported means and standard deviations for xG and actual goals in each competition. The UEFA Champions League had the highest mean xG ($M = 3.00$, $SD = 1.04$) and mean goals ($M = 2.99$, $SD = 1.70$). The Copa Libertadores had a mean xG of 2.30 ($SD = 0.95$) and a mean of 2.40 goals ($SD = 1.43$). In the Copa América, mean xG was 2.41 ($SD = 0.84$), compared with 2.18 goals ($SD = 1.55$). In the Euro, mean xG was 2.61 ($SD = 0.91$), while mean goals were 2.29 ($SD = 1.36$). These descriptive values do not, by themselves, establish statistically significant differences between xG and goals or between competitions.

Table 1. Descriptive Statistics of Expected Goals (xG) and Goals Scored Across Competitions

Competition	n	xG M	xG SD	Goals M	Goals SD
-------------	---	------	-------	---------	----------

The values were obtained from SofaScore, which estimates the probability of a shot resulting in a goal. The underlying xG model was not independently validated in this study.

Actual goals scored

Actual goals scored was the outcome variable, defined as the combined number of goals scored by both teams in each match. The data were obtained from SofaScore match records, using the same match-level aggregation approach across all four competitions.

Data source and data preparation

SofaScore provided the secondary match statistics and results. According to the original study, match records were exported into a structured dataset and cleaned before analysis. The dataset was then organized for descriptive statistics and Pearson correlation analyses. Any data exclusions or missing-record procedures should be reported only when supported by the original research records.

Statistical or Analytical Procedures

Statistical analyses were performed using SPSS. Descriptive statistics (means, standard deviations, and sample sizes) were calculated for expected goals (xG) and actual goals scored, while Pearson's correlation was used to examine their linear association across 333 matches overall and within each of the four competitions. Tests were two-tailed, with significance set at $p < .05$. Differences between competition-specific correlations were interpreted descriptively, as no formal comparison was reported. All findings were treated as observational associations rather than causal evidence or independent validation of the xG model.

Ethical Approval and Informed Consent

This study analyzed secondary match-level football statistics obtained from SofaScore without direct participant recruitment or intervention. The original manuscript does not document formal ethics approval or exemption; therefore, no such determination is claimed. Individual informed consent was not obtained as part of the reported data collection. Any applicable ethics or consent requirements should be addressed in accordance with the responsible institution's determination and SofaScore's data-use terms.

Copa Libertadores	125	2.30	0.95	2.40	1.43
UEFA Champions League	125	3.00	1.04	2.99	1.70
Copa América	32	2.41	0.84	2.18	1.55
Euro	51	2.61	0.91	2.29	1.36

Note. Values are reproduced from the descriptive statistics reported in the source article. M = mean; SD = standard deviation.

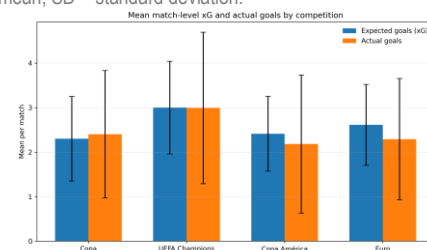


Figure 1. Mean match-level expected goals and actual goals by competition. Error bars represent ± 1 standard deviation.

Association between xG and actual goals

Across all 333 matches, xG was positively associated with actual goals scored, $r = .488$, $p < .001$ (Table 2). This indicates a

moderate positive linear association in the combined sample. The finding supports the hypothesis that matches with higher aggregate xG tended to have higher aggregate goal totals. The correlation should be interpreted as an association, not as evidence of causation or, by itself, as validation of the predictive accuracy of the underlying xG model.

Table 2. Overall Correlation Between Expected Goals (xG) and Goals Scored Across All Competitions

Sample	n	Pearson's r	p	Interpretation
All competitions	333	.488	< .001	Moderate positive association

Note. The overall coefficient and significance value are reported in the original article.

Competition-specific correlations

Positive correlations were reported in each competition (Table 3). The strongest coefficient was observed in the Copa Libertadores ($r = .537$, $p < .001$), followed by the Copa América ($r = .475$, $p = .006$), the Euro ($r = .479$, $p < .001$), and the UEFA Champions League ($r = .403$, $p < .001$). Thus, all four competition-specific estimates were positive and statistically significant at the .05 level. The numerical differences between coefficients are descriptive; the original analysis did not report a formal test of whether the correlations differed significantly from one another.

Table 3. Competition-Specific Correlations Between Expected Goals (xG) and Goals Scored

Competition	n	Pearson's r	p	Descriptive ranking
Copa Libertadores	125	0.537	< .001	1 (by r)
UEFA Champions League	125	0.403	< .001	4 (by r)

Copa América	32	0.475	.006	3 (by r)
Euro	51	0.479	< .001	2 (by r)

Note. Correlation coefficients and p values are reproduced from the original article. Ranking is descriptive and does not indicate statistically significant differences.

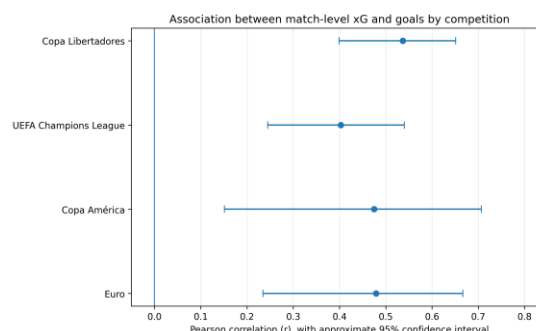


Figure 2. Competition-specific Pearson correlations between total match xG and actual goals. Error bars show approximate 95% confidence intervals calculated using Fisher's z transformation from the reported r and n values.

Summary of findings

The results show a positive association between match-level xG and actual goals in the combined sample and within each of the four competitions. The magnitude of the observed correlations varied from .403 to .537. The Copa Libertadores had the largest reported coefficient, whereas the UEFA Champions League had the smallest. Because no formal between-competition comparison was reported, these differences should not be interpreted as statistically confirmed differences. The results establish association within the observed dataset but do not establish why the coefficients vary or demonstrate that club and national-team competitions differ significantly.

DISCUSSION

Principal Findings

This study examined the association between expected goals (xG) and actual goals scored across 333 matches from four elite football competitions. A significant positive correlation was found overall ($r = .488$, $p < .001$) and within each competition ($r = .403$ – $.537$), supporting H1 and H2. These findings indicate that higher match-level xG is associated with higher goal totals, although expected and actual goals are not interchangeable because scoring outcomes remain subject to match-specific variation.

The strongest correlation was observed in the Copa Libertadores and the weakest in the UEFA Champions League; however, these differences were descriptive and were not formally tested. The findings provide comparative evidence supporting xG as an indicator of scoring output across the selected competitions, but they do not establish causality or independently validate the xG model. Further research should use standardized, validated xG measures and formal statistical comparisons to assess differences between competitions.

Comparison with International Evidence

The positive relationship observed in this study is consistent with research emphasizing the analytical value of expected goals in football performance evaluation. Brechot and Flepp (2020) examined the role of randomness in European club football and demonstrated why conventional match outcomes may not fully represent underlying team performance. Their work provides a rationale for considering opportunity-based indicators alongside realized goals. The present findings extend this general rationale by documenting positive associations in both club and national-team tournament settings. Similarly, Mead et al. (2023)

investigated improvements in xG modelling and demonstrated the value of model-based performance indicators in football analytics. Their work highlights the importance of evaluating the information provided by xG rather than relying exclusively on observed results. The present study complements this perspective by examining the association between aggregate match xG and goals across four competitions. Nevertheless, the analytical objectives differ: the current correlations describe the relationship between two match-level variables, whereas model evaluation requires additional evidence concerning predictive performance, calibration, or discrimination. Consequently, the present results should not be interpreted as an independent validation of the SofaScore xG model. Anzer and Bauer (2021) developed a goal-scoring probability model using synchronized positional and event data. Their approach emphasizes the relevance of contextual information for estimating the probability that a shot will result in a goal. This is important when interpreting the current findings because match-level xG aggregates estimates derived from individual scoring opportunities. The relationship between the aggregate estimate and realized goals may depend on the quality and consistency of the underlying shot-level probabilities. However, the present study did not have sufficient methodological information to establish whether the xG model applied by SofaScore was identical across all four competitions.

Research on contextual variables and playing styles provides another relevant perspective. Fernández-Navarro et al. (2019) examined contextual influences on playing styles, while Gómez et al. (2018) investigated playing styles in relation to team quality and match location in professional football. Although these studies did

not directly test the differences in xG–goal correlations reported here, they support the broader proposition that football performance should be interpreted within its competitive context. Tactical organization, opposition characteristics, and match circumstances may influence how teams create scoring opportunities and how those opportunities translate into goals.

The findings also raise questions about potential differences between club and national-team football. Club teams generally have more continuous training environments, whereas national teams have more limited preparation periods, potentially affecting tactical coordination and attacking patterns. However, training continuity, team cohesion, tactical familiarity, and preparation time were not directly measured in this study; therefore, these factors remain possible explanations rather than established mechanisms.

The findings do not show that club competitions consistently have stronger xG–goal associations than national-team competitions: Copa Libertadores had the highest correlation, while the UEFA Champions League had the lowest, and Euro and Copa América showed similar values. These differences may reflect competition characteristics, measurement, sample size, or random variation rather than competition type alone. This study contributes a comparative analysis using a common match-level framework; future research should use standardized measurements and formal statistical tests to determine whether differences between competitions are meaningful.

Theoretical, Methodological, and Practical Implications

Theoretically, the findings support the probabilistic interpretation of expected goals (xG), indicating that higher aggregate xG is positively associated with actual goals without determining the final scoring outcome. The moderate correlations across the four competitions highlight the distinction between the quality of scoring opportunities and realized goals. Therefore, differences between xG and actual goals should be interpreted cautiously and examined using repeated observations and validated measurement procedures.

Methodologically, this study provides a comparative assessment of the xG–goal association across four elite club and national-team competitions. The positive correlations observed overall and within each competition offer descriptive evidence of consistent associations. However, the absence of formal comparisons between correlation coefficients and independent validation of the xG model limits conclusions about differences across competitions and measurement consistency.

Practically, coaches and analysts can use xG alongside actual goals to evaluate offensive performance and identify potential

areas for further investigation, such as finishing and shot selection. Nevertheless, xG should not be treated as a stand-alone measure of team quality because other factors, including defensive performance, opponent strength, and tactical context, were not examined. The findings therefore support incorporating xG into multidimensional performance analysis while emphasizing transparent data sources and cautious interpretation.

Strengths and Limitations

This study has several strengths, including the analysis of 333 official matches across four prominent international football competitions, covering both club and national-team contexts. The use of match-level data and overall and competition-specific Pearson correlations provided a comparative assessment of the association between expected goals (xG) and actual goals scored across the selected competitions. However, the observational cross-sectional design does not establish causality. Unequal sample sizes, reliance on secondary SofaScore data without independent xG model validation, and aggregation of both teams' statistics limit the precision and interpretation of the findings. In addition, contextual factors were not controlled, match-selection and missing-data procedures were not fully documented, and differences between competition-specific correlations were not formally tested. Consequently, the findings may not generalize to other competitions or football levels. Future research should use larger and more diverse samples, standardized and validated xG measures, transparent data procedures, and appropriate statistical models incorporating relevant match-context variables.

Future Research

Future research should examine larger and more balanced samples across competitions, countries, seasons, and levels of football, including men's and women's competitions. Standardizing xG measurement by documenting data providers, model specifications, and aggregation procedures is also essential. Comparisons between providers, supported by model calibration and out-of-sample validation, could clarify the reliability and predictive performance of xG across different competitive contexts.

Further studies should use multilevel and longitudinal analyses to investigate contextual factors, such as opponent strength, match location, tactical style, and goalkeeper performance, and formally test differences between competitions. Research should also examine how coaches and analysts apply xG in performance evaluation and tactical decision-making. Independent replication, transparent data documentation, and preregistered analytical plans would strengthen the evidence and clarify the practical value of xG in international football analysis.

CONCLUSION

This study found a statistically significant positive correlation between expected goals (xG) and goals scored across 333 matches from the UEFA Champions League, Copa Libertadores, Copa América, and UEFA European Championship, both overall and within each competition. These findings indicate that match-level xG is a useful statistical indicator for analyzing goal-scoring patterns across elite club and national-team football. The study contributes comparative evidence to international football

analytics; however, its observational design, reliance on secondary SofaScore data, unequal competition sample sizes, and aggregation of both teams' statistics limit generalizability. The findings should not be interpreted as evidence of causation or as formal proof of differences between competitions, highlighting the need for future research using standardized, independently validated xG models and broader competition samples.

DECLARATIONS

Ethical Approval

This study analyzed secondary, match-level statistical data obtained from SofaScore. No direct involvement of human participants or collection of personally identifiable information was undertaken by the researchers. Formal ethics approval or

exemption was not documented in the study records. The need for ethical review should therefore be determined in accordance with the relevant institutional policies.

Consent for Publication

Consent for publication was not applicable because the manuscript

does not report identifiable individual participant information.

Author Contributions (CRediT)

The author's contributions should be specified according to the work actually performed. The following roles may be used where applicable: Conceptualization, Methodology, Data Curation, Formal Analysis, Investigation, Writing – Original Draft, Writing – Review & Editing, and Visualization. All listed contributions must be verified and approved by the author before submission.

Funding

The funding status was not specified in the available study information. The author should confirm whether the research received financial support before selecting the appropriate funding statement.

Conflict of Interest

The author should disclose any financial or non-financial relationships that could reasonably be perceived to influence the research. A declaration of no competing interests should be included only after the author confirms that no such interests exist.

Data Availability

The data analyzed in this study were obtained from publicly accessible match statistics provided by SofaScore. The availability

of the extracted dataset and any supplementary materials is subject to the source platform's terms of use and the author's data-retention arrangements. Further information about data access may be requested from the corresponding author, where applicable.

Acknowledgements

The author acknowledges SofaScore as the source of the secondary match-level statistics used in this study. No additional acknowledgements are included because no other contributors or supporting organizations were identified in the available study information.

Generative AI Disclosure

The author should disclose any use of generative artificial intelligence tools in preparing the manuscript, in accordance with the target journal's policy. If generative AI tools were used for language editing or manuscript drafting, the author should specify the tool and its role, verify the accuracy of the resulting text, and accept full responsibility for the final manuscript. If no such tools were used, this subsection should state that no generative AI tools were used in preparing the manuscript.

REFERENCES

- Antipov, E., & Pokryshevskaya, E. (2020). Interpretable machine learning for demand modeling with high-dimensional data using gradient boosting machines and shapley values. *J. Rev. Pricing Manage*, 19(7), 355-364. <https://doi.org/10.1057/s41272-020-00236-4>
- Anzer, G., & Bauer, P. (2021a). A Goal Scoring Probability Model for Shots Based on Synchronized Positional and Event Data in Football (Soccer). *Front. Sports Act. Living*, 3(62), 75-82. <https://doi.org/10.3389/fspor.2021.624475>
- Anzer, G., & Bauer, P. (2021b). A goal scoring probability model for shots based on synchronized positional and event data in football (soccer). *Frontiers in sports and active living*, 3(21), 624-475. <https://doi.org/10.3389/fspor.2021.624475>
- Bradlow, E., Gangwar, M., Kopalle, P., & Voleti, S. (2017). The role of big data and predictive analytics in retailing. *Journal of Retailing*, 5(93), 79-95. <https://doi.org/10.1016/j.jretai.2016.12.004>
- Brechet, M., & Flepp, L. (2020a). Dealing with randomness in match outcomes: How to rethink performance evaluation in European club football using expected goals. *J. Sport. Econ*, 4(21), 335-362. <https://doi.org/10.1177/1527002519897962>
- Brechet, M., & Flepp, R. (2020b). Dealing With Randomness in Match Outcomes: How to Rethink Performance Evaluation in European Club Football Using Expected Goals. *Journal of Sports Economics*, 21(4), 335-362. <https://doi.org/10.1177/1527002519897962>
- Cavus, M., & Biecek, P. (2022). Explainable expected goal models for performance analysis in football analytics. *Data Science and Advanced Analytics*, 4(9), 1-9. <https://doi.org/10.1109/DSAA54385.2022.10032440>
- Davis, J., & Robberechts, P. (2020). How data availability affects the ability to learn good xG models. *International Workshop of Machine Learning and Data Mining for Sports Analytics (Ghent)*, 13(24), 17-27. https://doi.org/10.1007/978-3-030-64912-8_2
- Fairchild, A., Pelechrinis, K., & Kokkodis, M. (2018). Spatial analysis of shots in MLS: A model for expected goals and fractal dimensionality. *Journal of Sports Analytics*, 4(3), 165-174. <https://doi.org/10.3233/JSA-170207>
- Fernández-Navarro, J., Fradua, L., Zubillaga, A., Ford, P., & McRobert, A. (2019). Influence of contextual variables on styles of play in soccer. *International Journal of Performance Analysis in Sport*, 19(6), 747-759. <https://doi.org/10.1080/24748668.2019.1684773>
- Gómez, A., Mitrotasios, M., Armatas, V., & Lago-Peñas, C. (2018). Analysis of playing styles according to team quality and match location in Greek professional soccer. *International Journal of Performance Analysis in Sport*, 18(3), 986-997. <https://doi.org/10.1080/24748668.2018.1539382>
- Hoernig, M., & Link, D. (2017). Individual ball possession in socce. *PLoS ONE*, 12(7), 1-15. <https://doi.org/10.1371/journal.pone.0179953>
- Khrapach, V., & Siryi, O. (2024). Statistical Metric Expected Goals in Football and Its Impact on Scoring Performance: A review article. *Health Technologies*, 2(3), 47-54. <https://doi.org/10.58962/HT.2024.2.3.47-54>
- Mead, J., O'Hare, A., & McMenemy, P. (2023a). Expected goals in football: Improving model performance and demonstrating value. *PLoS ONE*, 18(5), 20-28. <https://doi.org/10.1371/journal.pone.0282295>
- Mead, J., O'Hare, A., & McMenemy, P. (2023b). Expected goals in football: Improving model performance and demonstrating value. *PLoS ONE*, 18(4), 45-55. <https://doi.org/10.1371/journal.pone.0282295>
- Sabin, R. (2021). Estimating player value in American football using plus-minus models. *Journal of quantitative analysis in sports*, 4(17), 313-364. <https://doi.org/doi.org/10.1515/jqas-2020-0033>
- Schulze, E., Mendes, B., Mauricio, N., Furtado, B., Cesário, N., Carriço, S., & Meyer, T. (2017). Effects of positional variables on shooting outcome in elite football. *Science and Medicine in Football*, 2(2), 93-100. <https://doi.org/10.1080/24733938.2017.1383628>
- Zeng, Z., & Pan, B. (2021). A Machine Learning Model to Predict Player's Positions based on Performance. *icSPORTS*, 1(17), 36-42. <https://www.scitepress.org/PublishedPapers/2021/106533/106533.pdf>
- Zi, M., & Gao, D. (2023). A study of football goal trajectories of trained players through a kinetic model. *Journal of engineering-joe*, 12(2), 4-6.