Applications & implications of data-driven analytics in the football player valuation

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Abstract. This paper aims to explore the diverse applications and implications of data-driven analytics in valuing football players. The objective is to extract key themes from published papers concerning the use of data-driven analytics in football player valuation, providing insights into current practices, applications and future implications for player valuation in the context of data-driven analytics. The systematic literature review was employed to investigate the impact of data-driven analytics on football player valuation in the transfer market. This study identified key themes in football analytics, including market value estimation, data analytics and machine learning, AI's role in sports business, strategic analysis in football management, and challenges and future directions in football analytics. The findings contribute to advancing knowledge in football analytics, offering insights for researchers, practitioners, and stakeholders interested in optimizing player valuation processes and decision-making in the football industry.

1 Introduction

The valuation of football players in the transfer market is a critical aspect that significantly impacts clubs' financial health and competitive success. Despite the immense financial stakes involved in player transfers, the traditional approach to player valuation in football has been predominantly subjective, relying heavily on the intuition of coaches and board members [1]. This subjective evaluation process has often led to inefficiencies, with clubs overspending on players whose actual performance may not align with their transfer fees [2]. The lack of a systematic and data-driven approach to player valuation has underscored the need for a more objective and evidence-based methodology to assess players' worth accurately. Transfers provide a significant source of income for teams. Each club has its own distinct transfer plan to generate money and allocate funds towards acquiring players for enhanced performance [3]. Moreover, the transfer market has demonstrated a significant lack of efficiency in determining prices [2]. The analytical methodologies used in football are still quite uncomplicated. It is crucial for all stakeholders in the football industry, particularly clubs and player agents, to address and reduce this gap. This is because the sport involves significant financial transactions and intense competition for large amounts of money. Clubs and FIFA are recognizing the existence of this gap and are transitioning from basic analytical tools to

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more advanced prediction methodologies in order to accurately assess player worth for financial fair play objectives [3]. Despite the potential financial gains associated with effective player valuation, many clubs continue to overlook the transformative power of data analytics in this domain [4]. This systematic literature review is centered on exploring the implications of data-driven analytics on football player valuation in the transfer market. This study aims to shed light on how leveraging data analytics can revolutionize player valuation methodologies, optimize transfer negotiations, and ultimately improve clubs' decision-making processes in player acquisitions.

1.1 Problem Statement

The goal of this study is to optimize the current player valuation procedures in professional football by looking into the power of data-driven analytics. The identification of the applications to correct evaluation of player performance and price in the transfer market with the help of data-driven analytics is central to this investigation. To address these issues, we sought to leverage the potential of advanced analytics and machine learning approaches. Despite the growing popularity of data-driven analytics in football, there is a gap of research that properly evaluates the potential of data-driven analytics and its applications in player evaluation and transfer price estimates. The Study presented a systematic review of research investigating the determinants of football players' valuation over the past 30 years. This study was an attempt to sum up a heterogeneous field of research in football economics, however [5]. This study aims to address this gap by illustrating how data-driven analytics may circumvent the constraints of traditional valuation methods, resulting in objective and accurate player appraisals through reviewing the relevant existing literatures and extracting the key themes out of them.

1.2 Limitations in current player valuation practices

The traditional approach has faced criticism for its shortcomings in accurately assessing the value of football players. Here is an elaboration on the challenges associated with traditional market value estimations in football:

i. Subjective Assessments: Traditional methods of player valuation in football have heavily depended on subjective judgments influenced by factors like reputation, recent performance, and personal biases [6].

ii. Limited Data Sources: Clubs and analysts had limited access to detailed performance metrics, injury histories, and other crucial data points necessary for a more accurate assessment of a player's value.

iii. Outdated Valuation Methods: Traditional valuation methods in football have often lagged behind in terms of innovation and sophistication, failing to fully leverage the power of data analytics, predictive modeling, and advanced statistical analysis [7].

iv. *Inaccuracies and Inefficiencies:* The combination of subjective assessments and limited data may result to clubs ending up overpaying for players who did not meet expectations or undervaluing talents that could have been significant assets to the team [7].

2 Research Questions

The research question for this systematic literature review was developed utilizing the SPIDER model, which is derived from the PICO framework:

- Sample (S): Football club representatives, data analysts, researchers and experts involved in player valuation.

- Phenomenon of Interest (PI): The applications and implications of data-driven analytics in assessing football player value.
- Design (D): Qualitative research exploring perceptions, experiences, and challenges related to data-driven analytics in player valuation.
- Evaluation (E): Assessing the applications of data-driven analytics in the realm of football player valuation and its implications.
- Research type (R): Systematic literature review focusing on understanding the implications and applications of data-driven analytics on football player valuation in the transfer market based on the research papers found.

The research question formulated through the SPIDER model for this SLR is as follows:
RQ: What are the applications and implications of data-driven analytics on football player valuation based on the overall related literatures?
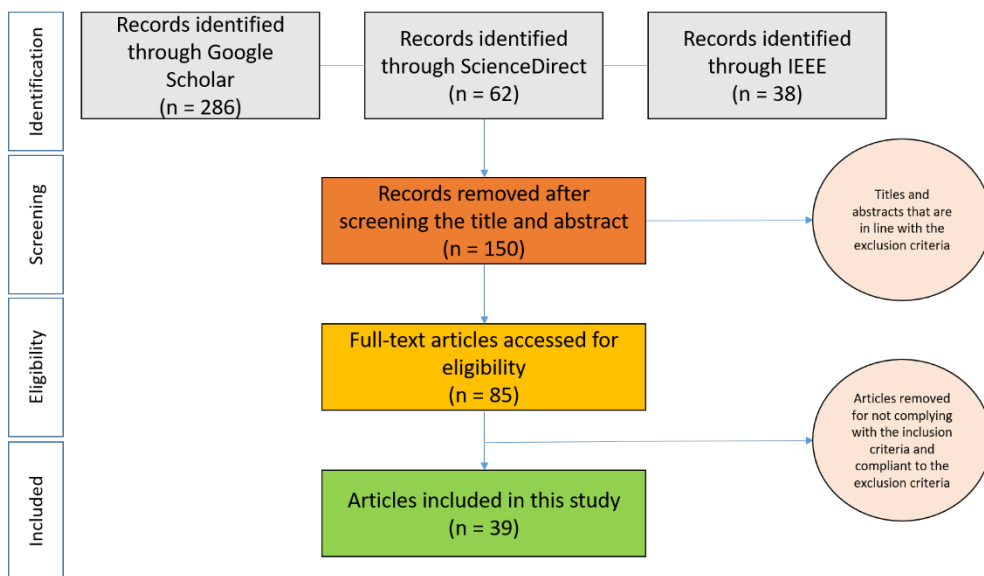
3 Methodology

Fig. 1. Diagram illustrating the process of identification, screening and inclusion of articles

This systematic literature review follows a rigorous and structured approach to examine the implications of data-driven analytics on football player valuation in the transfer market. The process begins with the formulation of a clear research question: "What are the applications and implications of data-driven analytics on football player valuation in the transfer market?" This question serves as the guiding principle throughout the review process. The search strategy involves accessing Google Scholar to identify relevant articles published that pertain to the topic of the valuation of football players and their performance using data and statistics. Manual searching technique was followed as the advanced search feature of Google scholar remains to be underdeveloped [8]. Search terms such as "football player valuation analytics analysis AND predictive "football transfer"" were used Google Scholar to ensure comprehensive coverage of the literature. And for ScienceDirect, the search terms of "football player valuation analytics analysis predictive transfer" were used. To search in the IEEE journal, the search terms of "("Full Text Only":analysis, analytics, value, valuation) AND ("Full Text Only":football) AND ("Full Text Only":player)" were used. Inclusion

criteria comprised peer-reviewed articles, conference papers, and grey literature that offer insights into the intersection of data analytics and football player valuation. Exclusion criteria involve studies unrelated to football or those lacking a focus on data-driven approaches. The screening process involves initial title and abstract screening, followed by full-text assessment against predefined inclusion and exclusion criteria. A total of 39 relevant articles were identified through the search process, providing a robust foundation for the subsequent thematic analysis.

Table 1. Selection criteria justification

Inclusion	Exclusion
Peer-Reviewed Articles: Peer-reviewed articles are prioritized due to their rigorous evaluation process by experts in the field, which enhances the reliability and validity of the findings. By including peer-reviewed articles, we aim to incorporate scholarly research that meets established academic standards and contributes to the existing body of knowledge on the topic.	Studies unrelated to football or those lacking a focus on data-driven approaches are excluded to maintain the relevance and specificity of the literature reviewed. Given the focus of this review on the implications of data analytics in football player valuation, only studies that directly address this intersection are considered for inclusion.
Conference Papers: Conference papers are included to capture recent developments and insights presented at academic conferences and symposiums. These papers often provide timely and innovative perspectives on emerging trends	
Grey Literature: Grey literature, including reports, working papers, and industry publications, is considered valuable for offering diverse perspectives and practical insights that may not be captured in traditional academic journals.	
English language: Literatures that have been published only in English have been included.	

3.1 Thematic Analysis Process

Thematic analysis is a qualitative technique employed to recognize and explain recurring patterns or themes in a given dataset. Qualitative data analysis is the methodical process of arranging and examining qualitative data in order to reveal underlying meanings and insights [9]. For this systematic literature review, we will use thematic analysis to combine the findings from the chosen papers and identify main themes about the impact of data-driven analytics on the valuation of football players in the transfer market. The systematic literature review entailed the process of categorizing and examining a wide range of scholarly publications within the chosen fields of study. The following table outlines the step-by-step process involved in conducting thematic analysis for this review.

Table 2. Thematic analysis process

Steps	Description
1. Familiarizing with the data	Thoroughly reading and familiarizing with the content of the selected articles.
2. Initial coding	Systematically coding the data by identifying meaningful units of information.
3. Generating initial themes	Review the coded data to identify initial themes or patterns emerging.
4. Defining and naming themes	Defining and naming each themes to reflect its content and significance.
5. Mapping and interpretation	Mapping out the relationships between themes and interpreting the results.
6. Reporting the analysis	Documenting the results in the "Findings" section of the paper

4 Findings and Discussions

4.1 RQ What are the applications and implications of data-driven analytics on football player valuation based on the overall related literatures?

A thematic analysis of literature on football analytics indicates numerous major themes that shape the landscape of player assessment and decision-making in the industry. The following themes capture the essential concepts drawn from the codes retrieved from articles about football player valuation, data analytics applications, strategic management insights, difficulties in the football industry.

Table 3. Key themes found in the literatures

Key Themes	Literatures
Market value estimation in football	[10], [11], [12], [13], [14], [7], [15], [1], [5], [16], [6], [17], [18], [19], [20], [21], [22], [23], [24], [25], [26], [4], [27], [28], [29], [30]
Data analytics and machine learning in Football	[3], [31], [12], [13], [32], [15], [17], [19], [33], [21], [34], [22], [23], [24], [35], [25], [26], [36], [4], [27], [37], [29], [30], [38]
Roles of AI and data analytics in the business side of football	[39], [40], [16], [41], [36], [27], [30], [38]
Strategic analysis in football management	[3], [31], [39], [12], [1], [6], [18], [19], [20], [33], [41], [25], [36], [4], [27], [42], [37]
Challenges and future directions in football analytics	[28], [40], [13], [32], [14], [7], [5], [42], [25]

4.1.1 Market Value Estimation in Football:

    a) Factors influencing market values such as player performance, characteristics, popularity, and reputation:
- Player performance metrics, including goals scored, assists provided, defensive contributions, and overall playing style, play a crucial role in determining their market value.
- Player characteristics such as age, position, physical attributes, technical skills, and potential for improvement are also significant factors considered by clubs and analysts when estimating market values.
- Popularity, marketability of players and reputation, including their social media following, commercial endorsements, and global fan base, can significantly impact their market values.

    b) Importance of accurate market value estimation in player transfers and negotiations:
- Accurate estimation of player market values is essential for football clubs to make sound financial decisions during player transfers and negotiations.
- Overestimating or underestimating a player's market value can lead to financial losses for clubs, as they may end up paying inflated transfer fees or undervaluing their assets during sales.

4.1.2 Data Analytics in Football:

a) Use of advanced algorithms and Artificial Neural Networks for predictive modeling:

- Advanced Algorithms: Random Forests, Gradient Boosting are algorithms use in machine learning technique that uses several decision trees to create player value models that are both accurate and reliable as well as integrates numerous weak models to produce a powerful prediction model.
- Artificial Neural Networks: Deep learning algorithms inspired by the human brain's neural networks, capable of processing complex football data to generate precise player valuations and performance predictions.

b) Enhancing player valuation accuracy through sophisticated data analysis techniques:

- Statistical modeling, predictive analytics, and optimization algorithms help clubs identify undervalued players, assess market trends, and optimize recruitment strategies.

4.1.3 Role of AI and Machine Learning in Sports Business:

a) Impact of AI on sports business research and decision-making:

- AI-powered tools provide insights into fan behavior, market trends, and revenue opportunities, helping sports businesses make data-driven decisions to enhance fan engagement, optimize marketing strategies, and maximize revenue generation.
- AI also plays a crucial role in automating routine tasks, streamlining operations, and improving operational efficiency within sports organizations, leading to cost savings and better resource allocation.

b) Leveraging machine learning for predicting player transfer values and enhancing recruitment strategies:

- Machine learning algorithms analyze historical player performance data, transfer market trends, and player attributes to predict player transfer values with greater accuracy, identify undervalued players, negotiate favorable transfer deals, and optimize recruitment strategies to build competitive teams. It also helps clubs mitigate risks associated with player transfers by evaluating potential injuries, performance fluctuations, and long-term value propositions, enabling informed decision-making and maximizing return on investment

4.1.4 Strategic Analysis in Football Management:

a) Examination of team performance, tactical choices, and financial strategies in European football leagues:

- Analysts assess team performance based on key performance indicators (KPIs) such as goals scored, possession statistics, defensive solidity, and shot conversion rates, to identify strengths and weaknesses and inform tactical adjustments.

- Financial strategies, such as transfer market investments, wage expenditure, and revenue generation initiatives, are scrutinized to assess their alignment with club objectives and long-term sustainability.

b) Correlation between team success, spending, tactical diversity, and leadership within teams:

- Tactical diversity, manifested through different playing styles, formations, and game plans, is analyzed to understand its impact on team performance and adaptability to different opponents and match situations.
- Leadership qualities, both on and off the field, such as managerial expertise, captaincy, and organizational culture, are evaluated to determine their influence on team cohesion, motivation, and performance.

4.1.5 Challenges and Future Directions in Football Analytics:

a) Addressing limitations in traditional market value estimations through data-driven approaches:

- Traditional market value estimations in football often rely on subjective assessments, limited data sources, and outdated valuation methods, leading to inaccuracies and inefficiencies in player valuation.
- By analyzing comprehensive player performance data, transfer market trends, injury histories, and social media metrics, data-driven approaches can provide more accurate and transparent assessments of player market values.

b) Future research directions focusing on model refinement, data augmentation, and improved predictive accuracy:

- Future research in football analytics should focus on refining existing models, enhancing data quality, and improving predictive accuracy to address evolving challenges and opportunities in the football industry.

5 Conclusion

The systematic literature review conducted in this study has shed light on the transformative potential of data-driven analytics in football player valuation. By diligently analyzing existing research and empirical evidence, it is clear that leveraging the power of data analytics has the potential to transform traditional player valuation systems. Through the integration of advanced analytical techniques such as machine learning algorithms, econometric models, and big data analytics, clubs can gain deeper insights into player performance, market trends, and potential transfer outcomes. This improved understanding allows clubs to optimize their transfer talks by finding undervalued players, negotiating favourable transfer fees, and maximizing the return on their investment. Furthermore, data-driven player valuation systems have the ability to improve club decision-making by offering actionable insights and predictive analytics to help with strategic planning and budget allocation. However, one of the main limitations to this study was subjectivity in literature selection and the qualitative

nature of analysis which introduce potential inconsistencies. Additionally, the study may not fully account for differences across leagues and markets, and resistance to adopting new practices could limit the practical applications demonstrated in this study. Furthermore, the implementation of data-driven player valuation methodologies marks a big step forward in the evolution of football management practices, paving the way for a more efficient, transparent, and data-driven approach to player valuation and transfer negotiations.

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