

Blockchain y la industria del deporte: una revisión sistemática de la literatura sobre Fan Tokens y sus implicaciones

Blockchain and sports industry: a systematic literature review of Fan Tokens and their implications

Vitor Ayres Principe, Giulio César P. S. M. da Silva, Rodrigo Gomes de Souza Vale, Rodolfo de Alkmim Moreira Nunes
Universidade do Estado do Rio de Janeiro (Brasil)

Abstract. Background: Fan tokens emerge as a significant innovation that enables a new form of interaction between clubs and their followers and introduces an alternative economic model for sports entities. Purpose: The review discusses the technical characteristics of fan tokens and their role in enhancing fan participation in minor club decisions, reinforcing the sense of belonging and community. Methods: The research encompassed a systematic literature review, following the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines and Evidence-Based Systematic Mapping in Software Engineering (EBSE). Thus, it presented a quantitative and qualitative analysis of the applications of fan tokens in the sports industry. Results: Despite engagement and monetization opportunities, the results highlight significant challenges, such as price volatility and appropriate regulation to ensure safe and effective adoption. The discussion also includes the ethical and social implications of using fan tokens, emphasizing the need for strategies that prioritize inclusion and fairness for fan engagement. Conclusion: Finally, the study proposes future research directions that consider continuous technological development and changes in fan expectations, aiming to optimize the use of fan tokens to benefit the stakeholders involved.

Keywords: Sport Management; Blockchain; Fan Engagement; Fan Tokens; Digital Assets; Tokens

Resumen. Antecedentes: Los tokens de fans surgen como una innovación significativa que permite una nueva forma de interacción entre los clubes y sus seguidores e introduce un modelo económico alternativo para las entidades deportivas. Propósito: La revisión discute las características técnicas de los tokens de fans y su papel en mejorar la participación de los aficionados en decisiones menores del club, reforzando el sentido de pertenencia y comunidad. Métodos: La investigación abarcó una revisión sistemática de la literatura, siguiendo las pautas de los Elementos de Informe Preferidos para Revisiones Sistemáticas y Meta-Análisis (PRISMA), y presentó un análisis cuantitativo y cualitativo de las aplicaciones de los tokens de fans en la industria deportiva. Resultados: Los resultados destacan que existen desafíos significativos como la volatilidad de los precios y la necesidad de una regulación adecuada para garantizar una adopción segura y efectiva a pesar de las oportunidades de participación y monetización. La discusión también incluye las implicaciones éticas y sociales del uso de tokens de fans, enfatizando la necesidad de estrategias que prioricen la inclusión y la equidad para la participación de los aficionados. Conclusión: Finalmente, el estudio propone futuras direcciones de investigación que consideren el desarrollo tecnológico continuo y los cambios en las expectativas de los aficionados, con el objetivo de optimizar el uso de los tokens de fans para beneficiar a las partes interesadas involucradas.

Palabras clave: Gestión Deportiva; Blockchain; Compromiso de los Aficionados; Tokens de Aficionados; Activos Digitales; Tokens.

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Vitor Ayres Principe
vitorprin@gmail.com

Introduction

The intersection of technology and sports, innovation, demographic shifts among fans, and the evolution of global sports sectors have catalyzed notable transformations in how sports entities interact with their fan base (Frevel, Beiderbeck, & Schmidt, 2022). In the past, fan engagement was directly linked to maximizing game attendance, viewership of sports broadcasts, and team merchandise sales (Funk & James, 2001). However, the emergence of digital platforms has ushered in a new era of community building. Fans now actively participate, share opinions, and influence club decisions (Filo, Lock, & Karg, 2015).

At the center of this revolution are fan tokens, which utilize blockchain technology to provide a secure and transparent digital collectible to engage fans in an innovative and meaningful way. These tokens strengthen the connection between sports entities and their supporters and open new avenues for monetization and community engagement, reshaping the commercial landscape in sports (Manoli, Dixon, & Antonopoulos, 2024). The tokens represent a new class of

digital assets that offer fans an active voice in the operations of sports entities. These tokens let fans vote on minor decisions like training locations, halftime music selections, or merchandise designs. They can participate in exclusive events, creating a sense of inclusion and belonging (Ante, Saggiu, Schellinger, & Wazinski, 2024). This new form of engagement is crucial for strengthening the bonds between clubs and their fans, transforming them from mere spectators into active participants in the culture of the sports entity and more involved in its management (Zarifis & Cheng, 2022).

Blockchain technology forms the foundation upon which fan tokens are built, bringing robustness, security, and transparency. Blockchain enables decentralized transactions and records each transaction on a distributed ledger, ensuring data security, transparency, and fairness in fan token operations. This technology is crucial for mitigating fraud and ensuring user trust, allowing fans to engage knowing that their contributions are secure and verifiable (Al-Saqaf & Seidler, 2017; Ata et al., 2023). While fan tokens offer many opportunities for innovation in fan engagement, they also present various challenges. Price volatility, driven by market speculation, can

deter less adventurous fans and put the investment of the more enthusiastic ones at risk. Furthermore, the absence of precise regulation for crypto-assets can create an environment of uncertainty for sports entities and fans, hindering the full realization of the potential offered by fan tokens (Assaf, Demir, & Ersan, 2024). Appropriate regulation is, therefore, crucial for the future use of fan tokens in sports. Hence, developing a regulatory framework that protects consumers without stifling innovation is essential. This regulation should address the economic aspects of fan tokens and their social and ethical implications, ensuring that fan engagement is fair and inclusive (Foglia, Maci, & Pacelli, 2024).

Therefore, defining a transparent approach to using fan tokens in sports is essential. The primary objective of this systematic review is to comprehensively explore the role of fan tokens in the sports industry, particularly how these blockchain-based assets are reshaping fan engagement, governance, and revenue generation for sports organizations. Specifically, this study aims to (1) analyze the adoption and utilization patterns of fan tokens by sports entities, (2) evaluate the economic and regulatory challenges associated with these digital assets, and (3) investigate the ethical and social implications of integrating fan tokens into the broader sports ecosystem. By addressing these aspects, this research seeks to provide a clearer understanding of the potential and limitations of fan tokens as tools for innovation in sports management.

This study strictly adhered to the standard guidelines for systematic reviews, following the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines (Page et al., 2021) and the Evidence-Based Systematic Mapping in Software Engineering (EBSE) (Kitchenham et al., 2007; Petersen, Vakkalanka, & Kuzniarz, 2015). The key contributions of this article are threefold, each designed to support and complement the study's objectives: (a) identifying and curating a set of primary studies related to fan tokens in the sports industry, providing a foundational database for future research; (b) conducting a comprehensive synthesis, both quantitative (bibliometric analysis) and qualitative (thematic analysis), to reflect the current state of the art in fan token research; and (c) offering practical insights based on systematic review findings, which can guide future applications and address the specific challenges highlighted in the study objectives. The remainder of this article is organized as follows: Section 2 provides an in-depth exploration of fan tokens and reviews relevant literature; Section 3 details the study methodology; Section 4 presents and discusses the results, focusing on fan token applications in the sports field and providing key insights; Section 5 addresses the study's limitations and offers recommendations for future research; and Section 6 concludes the article.

Theoretical background

Fan Engagement

Fan engagement in the context of sports currently transcends mere attendance at games or the consumption of licensed products. It encompasses a range of strategies and practices to strengthen the emotional and psychological connection between fans and their favorite clubs or athletes. Based on passion and loyalty, this connection is seen as a fundamental pillar of sports marketing (Huettermann, Uhrich, & Koenigstorfer, 2022). Additionally, brand equity significantly enhances this connection, directly influencing fan satisfaction and loyalty (Miranda, Filho, Silva, & Pedroso, 2024). It has demonstrated that the success of a team and the emotional bond fans have with their club can significantly impact their overall satisfaction, which fosters deeper engagement.

In recent years, the intersection of digital innovation in sports has led to an evolution in consumer behavior, redefining the fan engagement process and transforming sports management (Pandita & Vapiwala, 2023). One of the facilitators of this digital revolution is blockchain technology. This decentralized and secure digital ledger system has manifested itself in various application areas in the sports industry (Berkani, Moumen, Benharzallah, Yahiaoui, & Bounceur, 2024; Glebova & Mihal'ová, 2023; Stegmann, Matyas, & Ströbel, 2023), prompting clubs to rethink their engagement approaches. Currently, it is not just about providing a fan experience during the sporting event but creating an ecosystem of interaction that engages the fan at all times and through all available channels (Huth & Kurscheidt, 2022).

Academic literature examines fan engagement as a multi-dimensional phenomenon encompassing various forms of interaction between the fan and the club, including participation, identification, and contribution activities (Byon & Phua, 2021). Through these interactions, clubs seek to expand their fan base and promote a sense of community and belonging.

Fan engagement strategies vary significantly from sport to sport and club to club, reflecting differences in their histories, cultures, and commercial objectives. These strategies can range from simple initiatives, such as fan meetings and autograph sessions, to more sophisticated efforts, such as loyalty programs, exclusive social media content, and immersive augmented or virtual reality experiences (Cranmer, Han, Van Gisbergen, & Jung, 2021; Pilatti, Pereira, Cantorani, Lara, & Renaux, 2024).

A fundamental aspect of fan engagement is personalizing the fan experience. In the digital era, clubs have access to unprecedented data about their fans, enabling the creation of highly customized offers and content. This personalization enhances the fan experience and increases the effectiveness of marketing campaigns and brand loyalty (Xu, Li, Scott, & Wang, 2023).

Another critical point in fan engagement is constructing a compelling narrative around the club and its players. Stories

that resonate emotionally with fans can significantly strengthen their identification with the club and encourage active participation in the fan community. Social media's ability to rapidly spread content enables the construction and spread of viral narratives (Scholz, 2020).

Furthermore, fan engagement is broader than the online environment. Clubs are increasingly recognizing the importance of engaging fans in activities outside of the digital realm, such as community events, social responsibility initiatives, and fan involvement programs in club decisions. These activities help strengthen fans' emotional connection with the club and promote a sense of pride and belonging (Huettermann et al., 2022).

Fan engagement also directly impacts clubs' financial results. An engaged and loyal fan base is likelier to consume licensed products, purchase tickets, subscribe, and participate in loyalty programs. Additionally, high levels of engagement can attract sponsors and commercial partners, increasing the club's revenue (Dima, 2015).

In the digital era, social media has emerged as one of the most effective channels for fan engagement. It allows clubs to communicate directly with their fans, share exclusive content, and promote two-way interaction (Huth & Kurscheidt, 2022). In addition to social media, clubs are exploring a variety of digital technologies to enhance fan engagement. Customized mobile applications provide fans access to news, statistics, exclusive video content, and interactive features such as club-related games and quizzes (Byon & Phua, 2021), significantly enhancing sports institutions' marketing and publication efforts (Fathoni, Adi, Mu'arifin, Yunus, & Cholifah, 2024).

Gamification is another growing trend in fan engagement, utilizing game design elements to encourage fan participation in online activities. Contests, challenges, and reward systems can significantly increase engagement by motivating fans to interact with club content creatively and enjoyably (Cranmer et al., 2021). Moreover, the use of digital platforms also plays a crucial role in direct revenue generation through the sale of online products and services, further enhancing the economic sustainability of sports clubs (Fathoni et al., 2024). Virtual experiences represent a significant advancement, allowing fans to experience the game innovatively. From viewing matches in virtual reality to participating in virtual events in the metaverse, these technologies are opening up new horizons for interaction between clubs and fans (Scholz, 2020).

Personalization is a crucial aspect of fan engagement, with clubs using fan data to provide more relevant and personalized experiences. Advanced analytics and artificial intelligence allow segmentation of the fan base and delivery of content tailored to their individual preferences, increasing the effectiveness of marketing campaigns and overall engagement (Xu et al., 2023).

Fan tokens and cryptocurrencies are emerging as a new

form of engagement, allowing fans to participate in club decisions, access exclusive content, and earn rewards. This innovative approach transforms how fans interact with clubs, offering a new dimension of engagement and participation (Dima, 2015).

Fan Token Overview

Fan tokens have emerged as a disruptive innovation in the sports ecosystem, blending fan passion with emerging opportunities using blockchain technology (Demir, Ersan, & Popesko, 2022; Glebova & Mihal'ová, 2023). These digital assets, operating at the intersection of sports and finance, enable a new form of interaction between clubs and their fan base, offering a demonstration of financial support and active participation in the club's life (Ante, Schellinger, & Demir, 2024).

Academic literature and the cryptocurrency industry generally recognize fan tokens as fungible utility tokens developed on blockchain platforms, making each token of a specific type identical and interchangeable (Ante, Wazinski, & Saggu, 2023; Demir et al., 2022). These tokens empower holders with voting rights on certain organizational matters, access to exclusive rewards, and interactive experiences with the issuing organization, enhancing fan engagement and participation (Ante et al., 2024a).

However, the domain of fan tokens is dynamically evolving, leading to an unconventional perspective where fan tokens overlap with non-fungible tokens (NFTs) (Zarifis & Cheng, 2022). This approach leverages the unique ownership characteristics of NFTs to foster community engagement and brand promotion, diverging from traditional fungible advantages (Martha, Warnars, Prabowo, Meyliana, & Hidayanto, 2023). This approach opens up various pathways for monetization and enhances fan interaction (Glebova & Mihal'ová, 2023).

These tokens function as a bridge between fan passion and technological innovation, consolidating a new paradigm of engagement and interaction within the sports and entertainment ecosystem (Ante et al., 2024b; Demir et al., 2022; Glebova & Mihal'ová, 2023; Scharnowski, Scharnowski, & Zimmermann, 2023). The tokens represent the fan's loyalty and engagement with the club, allowing them to participate in decisions through voting, access exclusive merchandise, and even experience unique moments, such as meeting players or visiting the club's facilities exclusively (Glebova & Mihal'ová, 2023). This new form of digital engagement represents a significant evolution in how fans interact with their favorite teams, making them active participants in the sports community (Ante et al., 2024a).

In addition to participation and engagement, researchers highlight fan tokens as an effective way to generate additional income for clubs, expand their marketing strategies, and strengthen relationships with sponsors. This new revenue

stream is essential in dealing with financial challenges and gives sports clubs more flexibility in their operations (Foglia et al., 2024; Zarifis & Cheng, 2022).

Through blockchain technology, fan tokens ensure transparency and security in transactions, providing fans with a reliable means of investment and participation (Scharnowski et al., 2023). This technology facilitates the secure acquisition and exchange of tokens and records all interactions on an immutable blockchain, offering an additional layer of trust and authenticity to fan activities.

It is important to note that, in addition to opportunities, there are risks and challenges associated with adopting fan tokens, such as market volatility and the need for proper regulation to protect both consumers and the integrity of sports. These challenges require a cautious approach and a robust regulatory framework to ensure that the benefits of fan tokens are maximized without harming fans or sports overall (Zarifis & Cheng, 2022).

Elite football clubs worldwide have rapidly adopted fan tokens, recognizing the opportunity to strengthen ties with their global fan base while opening a new source of revenue. The Socios.com platform has been at the forefront of this innovation, collaborating with some of the biggest clubs in the world to launch their fan tokens (Demir et al., 2022; Vidal-Tomás, 2023).

However, this adoption has criticism and challenges. Some argue that this innovation may lead to excessive commercialization of the fan experience, putting access to specific exclusive experiences and participation behind a paywall. This concern raises essential questions about the inclusion and democratization of fan engagement (Scharnowski et al., 2023).

However, fan tokens also present a new dimension to sports marketing, allowing clubs to engage their fans innovatively and collect valuable data about preferences and behaviors. This insight can, in turn, inform more effective marketing strategies and product development tailored to meet fans' needs and desires (Ante et al., 2023; Glebova & Mihal'ová, 2023). This transformation benefits clubs with increased revenue and enhances the fan experience, making it more interactive and satisfying (Manoli et al., 2024).

Therefore, the issuance of fan tokens is typically associated with an Initial Coin Offering (ICO), where tokens are sold to fans and investors, akin to the launch of a new cryptocurrency. This process generates immediate revenue for the club and establishes a base of token holders with a vested interest in the club's success (Demir et al., 2022; Glebova & Mihal'ová, 2023). These tokens also represent an opportunity for globalization for clubs, enabling them to reach fans in international markets more effectively (Scharnowski et al., 2023).

This technology within the sports ecosystem offers innovative ways to enhance the fan experience, increase transpar-

ency in operations, and create revenue streams for stakeholders (Glebova & Mihal'ová, 2023). It provides safer and more efficient transactions, simplifies ticket and merchandise sales processes, and adds transparency in contract management, promoting fair and equitable treatment (Zarifis & Cheng, 2022).

The creation and widespread dissemination of fan tokens offer a new level of fan engagement, allowing them to own unique digital assets linked to their favorite teams and players (Zarifis & Cheng, 2022). Additionally, it helps reshape monetization opportunities for sports brands, communities, organizations, teams, and leagues, as they can sell these assets to fans at a premium. Blockchain-based voting systems can create a more democratized and inclusive sports industry and greater fan involvement in decision-making processes (Ante et al., 2024a).

The challenges and limitations must be carefully considered to unlock these technologies' full potential in the sports industry. These include regulatory issues, security concerns, and potential resistance from traditional sports organizations and stakeholders, who may view blockchain technologies as threatening their existing business models (Foglia et al., 2024; Wilson, Karg, & Ghaderi, 2022). Although there are significant challenges, this technology offers exciting opportunities to transform the sports industry in various ways, leading to greater efficiency, transparency, and fan engagement.

Materials and methods

A systematic literature review (SLR) was conducted to achieve the study's objectives, enabling mapping and assessing the current state of knowledge on fan tokens from the sports management perspective, thus expanding existing knowledge on fan engagement (Tranfield, Denyer, & Smart, 2003). The choice of SLR was motivated by the primary aim of examining the extent and function of fan tokens from the viewpoint of sports fan engagement. The methodological basis of this review article follows the guidelines of the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) (Page et al., 2021), as well as guidelines for systematic literature review and Evidence-Based Systematic Mapping in Software Engineering (EBSE) (Kitchenham & Brereton, 2013; Kitchenham et al., 2007; Petersen et al., 2015). This combination of guidelines ensures a comprehensive analysis of both quantitative and qualitative research, leading to a more robust data synthesis.

Motivations of the SLR Study

Sports is one of the most established phenomena worldwide, involving billions of people. Consequently, it plays a fundamental role in society (Lombardo, 2012), thanks to its multidimensionality, which contributes to the community's well-being in various ways, from educational and recreational

to political and fiscal aspects. With technological advancements, the impact on sports management has become increasingly challenging (Ratten, 2019).

In this scenario, the rise of NFTs comes into play, where they can become standalone brand assets, influencing marketing funnel stages from pre-purchase awareness to post-purchase loyalty, suggesting that NFTs enable brands to create highly engaging brand communities by blending ownership of products both online and offline, potentially creating a solid bond between the brand and consumers (Colicev, 2023). This technological advancement provides new management approaches that offer greater efficiency, transparency, and stakeholder engagement (Carlsson-Wall & Newland, 2020). This connection can revolutionize fan interactions with content and how teams, players, and leagues manage monetization and their digital presence (Baker, Pizzo, & Su, 2022; Scharnowski et al., 2023). Major sports leagues, including the NBA and NFL, are investing in blockchain technology-based solutions, such as NBA Top Shot, a platform developed in partnership with Dapper Labs, allowing trading of digital collectibles or "moments" from the NBA, such as videos of iconic plays (Young, 2021).

Conducting research in this field can help identify various use applications for fan tokens with transformative potential for sports enthusiasts. Additionally, it can assist in understanding the challenges regarding implementing this technology, which may be crucial for developing practical solutions that meet user needs. Moreover, it is possible to identify gaps in existing knowledge and suggest areas for further studies, contributing to advancing scientific research in sports management.

Research Strategy

To gather pertinent literature for this systematic review, a search strategy reflecting the scope and objectives of the research was formulated. Search strings were defined in two main domains: "fan token" and "sport." For the "fan token" domain, variations of keywords such as "fan token," "NFT," "non-fungible token," and "non fungible token" were included. In the "sport" domain, the term "sport" (or "sports" in plural) was included. The search algorithm was constructed by intertwining these two domains with an AND operator, resulting in the following search string: sport* AND (("fan token") OR ("NFT") OR ("non-fungible token") OR ("non fungible token")). To ensure comprehensive exploration, relevant articles were sought from multiple data sources, including the Institute for Scientific Information (ISI) Web of Science, Scopus, ScienceDirect, Institute of Electrical and Electronics Engineers (IEEE) Xplore, Dimensions, and Springer Link. Also, we included other articles through manual searches on Google Scholar to encompass a broader range of literature.

Specific inclusion and exclusion criteria guided the selection of studies for this systematic literature review to ensure the relevance and quality of the research considered. Only peer-reviewed research articles in English were included, as this language dominates the academic discourse and provides access to a broader range of scholarly work. Additionally, the availability of the full text was a prerequisite, allowing for a thorough examination of each study's methodology and findings. The review focused exclusively on studies directly related to the use of fan tokens in the sports industry, excluding any work that only mentioned fan tokens superficially or addressed them outside the scope of sports. These stringent criteria were essential in narrowing down the literature to studies that specifically addressed the research questions and contributed valuable insights into the application of fan tokens in enhancing fan engagement and the management of sports entities. Two independent and experienced researchers conducted the electronic search without language or time filters. Third, research resolved any conflicts.

After the initial search, we conducted a forward and backward snowballing process to identify any additional related studies not found in the initial search. Backward snowballing involves examining the references of articles, while forward snowballing involves examining articles that cited the selected studies (Wohlin, 2014). Using the snowballing strategy, a total of 32 potential studies were found, with 16 already in the initial research database, 2 were book chapters, 1 was a conference paper that we did not consider in this review, and 10 studies did not adhere to the study scope after full reading; thus, three studies were found within the scope according to all the research criteria and were included.

This method involves using the reference lists of the initially selected "seed" papers to discover new studies ("snowballed" papers) that were not captured in the initial search but are relevant to the research topic. For instance, the paper by Singhal, Gupta, Bhushan, & Choudhuri (2023) led to the inclusion of Zarifis & Cheng (2022), while Chen (2024) pointed to Zaucha & Agur (2024). Notably, Ersan, Demir, & Assaf (2022), it was initially cited by Mazur & Vega (2023) in their pre-print version from 2022, updated in the final published version. This process was instrumental in broadening the scope of the review and ensuring that all relevant literature was considered.

Quality assessment

The studies were evaluated to ensure their quality based on established guidelines for systematic reviews. Therefore, we assessed the quality and finalized the eligibility for inclusion of the studies (Kitchenham & Brereton, 2013; Petersen et al., 2015; Wohlin, Mendes, Felizardo, & Kalinowski, 2020). Thus, five quality criteria (QC) were developed, each with a possible score of 1 (yes), 0.5 (partially), or 0 (no). The total scores of the five QCs were calculated, and articles were

classified into three categories: good ($4 < \text{score} \leq 5$), fair ($3 \leq \text{score} \leq 4$), and poor ($0 \leq \text{score} < 3$). Articles in the excellent and fair categories were included, while those in the poor category were excluded. All articles selected for this review had scores above three, indicating fair or sound quality. Therefore, all selected articles were included in this review study, with no exclusion based on the quality criteria of the studies. The QCs analyzed were:

- QC1: Does the study have a clearly defined research objective?

To be considered for inclusion, a primary study must have a clear objective related to fan tokens. A study that does not meet this criterion will not be included in the subsequent data extraction and synthesis process, as it can only adequately present fan token applications with a defined research objective.

- QC2: Does the study clearly define a fan token and its application in sports?

A clear definition is necessary as it can help develop a comprehensive understanding of fan tokens in sports.

- QC3: Does the study clearly describe its methodology?

The applied methodology is crucial for determining the article's relevance to this research.

- QC4: Does the study propose practical applications for the use of fan tokens?

The proposed solutions from a study and their feasibility are essential for designing practical, available, and applicable methods.

- QC5: Does the study discuss its limitations?

The discussion about the current limitations of the applicability and use of fan tokens can reveal the direction of future

studies on this research topic.

Bibliometric Analysis

The data extraction process began with the download of selected articles to compose the SRL, with their basic information recorded (e.g., title, year of publication, authors, publishing journal, and affiliation) to assess the impact of these publications, enabling the understanding of a specific research field from its scientific structure. It becomes necessary to analyze the structure of the works and how authors organize themselves in this context. (Horta, Ströele, Braga, David, & Campos, 2018). This bibliometric analysis composition used during a systematic review can also be observed in articles such as Principe et al. (2022). Google Scholar was used to centralize the search for the researcher's h-index. Thus, the analysis of the articles' impact in this SRL followed the following format:

- Analysis of authors' impact (Egghe & Rousseau, 2008; Hu, Yang, Zu, & Huang, 2021)
- Classification of journals (Canales, 2020; Vairavan, Prayle, & Davies, 2020)

Research Question Protocol (RQ)

The research questions (RQ) in our RSL protocol are framed using the 5W1H approach (i.e., what, why, where, when, who, and how). (Liu, Lu, Zhu, Paik, & Staples, 2023) carried out this same idea; however, we added one more question for this research: How Much, thus resulting in 5W2H as a premise. This comprehensive analysis enables a better understanding of the use and application of fan tokens in the sports industry, as shown in Table 1.

Table 1. Research questions with the 5W2H approach

RQ	5W2H	Research question	Motivation
1	What	What is a fan token?	To observe how primary studies define the concept of fan tokens.
2	Why	Why is the fan token adopted in the sports industry?	To understand the forces to adopt fan tokens in sports.
3	Where	Where is the fan token distributed in the sports context?	To identify how fan tokens are distributed to fans.
4	When	When is the use of fan tokens valid?	To distinguish the key objectives of using fan tokens in the sports industry.
5	Who	Who is involved in developing fan tokens in the sports context?	To identify who the stakeholders are in the development of fan tokens in sports.
6	How	How is the fan token applied in the sports industry?	To determine how a fan token is used in the sports industry.
7	How Much	How much can fan tokens transform sports clubs' finances and operations?	To understand in monetary and operational terms what the behavior of a fan token is like.

RQ: Research Question and 5W2H: five questions starting with the letter W (What; Why; Where; When; Who) and two questions beginning with the letter H (How; How Much). Source: Created by the authors.

In RQ1, our objective is to extract the definition of fan tokens from primary studies, which will provide insights into the fundamental dimensions of using this digital asset. RQ2 aims to identify essential issues related to the use of these tokens. This research question will allow us to understand the distribution of these fan tokens to fans in RQ3 and when their use is valid in RQ4. RQ5 focuses on understanding the stakeholders involved in developing fan tokens in sports. RQ6 aims

to expand knowledge about the sports ecosystem by identifying documented uses and applications of fan tokens. By doing so, we can understand how fan tokens are interconnected and determine when it makes sense to use them as an engagement strategy, up to understanding the variation in their cost and the challenges in an operational way in RQ7.

Data Analysis, Synthesis, and Reporting

During the final phase, we extracted data from each study

that met the inclusion criteria, followed by analysis relevant to the research questions. The fundamental attributes of the studies were carefully extracted and examined to answer the research questions. To address the initial research question, we analyzed each article's proposal and provided a taxonomy of the presented use cases.

While an answer to the research question may be found in the initial analysis, a more comprehensive synthesis of the studies is needed to extract the details of fan token usage and utilization. Addressing the third, fourth, and fifth research questions, barriers, challenges, and stakeholders associated with fan tokens in the sports industry can be identified, as per information in the analyzed articles. We also discuss how these limitations and strategies have been adopted. The insights obtained in this systematic review are detailed in Section 4.

To manage the results of our electronic search, we initially exported them to the Rayyan web platform to organize the articles, excluding duplicates. We then conducted the entire process of inclusion and exclusion through double-anonymized validation using three reviewers (Ouzzani, Hammady, Fedorowicz, & Elmagarmid, 2016). For study quality and the snowballing method, we utilized Zotero® 6.0.19, an open-source desktop software that is free, easily accessible, and user-friendly for researchers, in addition to Google® Sheets for ongoing double-anonymized verification.

Results

This section will present the workflow with the review framework and each step employed for study selection, assessment of study quality, and analysis, both quantitative (bibliometric) and qualitative (research questions).

SLR framework

Six electronic databases, ISI Web of Science, Scopus, ScienceDirect, IEEE Xplore, Dimensions, and Springer Link, were used to review the literature systematically. The search phrase was developed using the Boolean operators [AND] and [OR] (among the descriptors). Initially, 2,253 studies were identified, but after removing all inconsistencies (duplicates, retractions, and out-of-scope), 38 studies were used for full-text reading. After this stage, 20 articles remained, and we began the snowball process to identify other articles that could not be determined using the keywords. In this way, we included three studies and manually added two more studies that we found on Google Scholar and did not appear in the snowball process. Therefore, the 25 studies included in this review met the established criteria regarding methodological quality, and none were excluded. In this way, the 25 articles remained for quantitative and qualitative analysis (see Figure 2), last updated in May 2024.

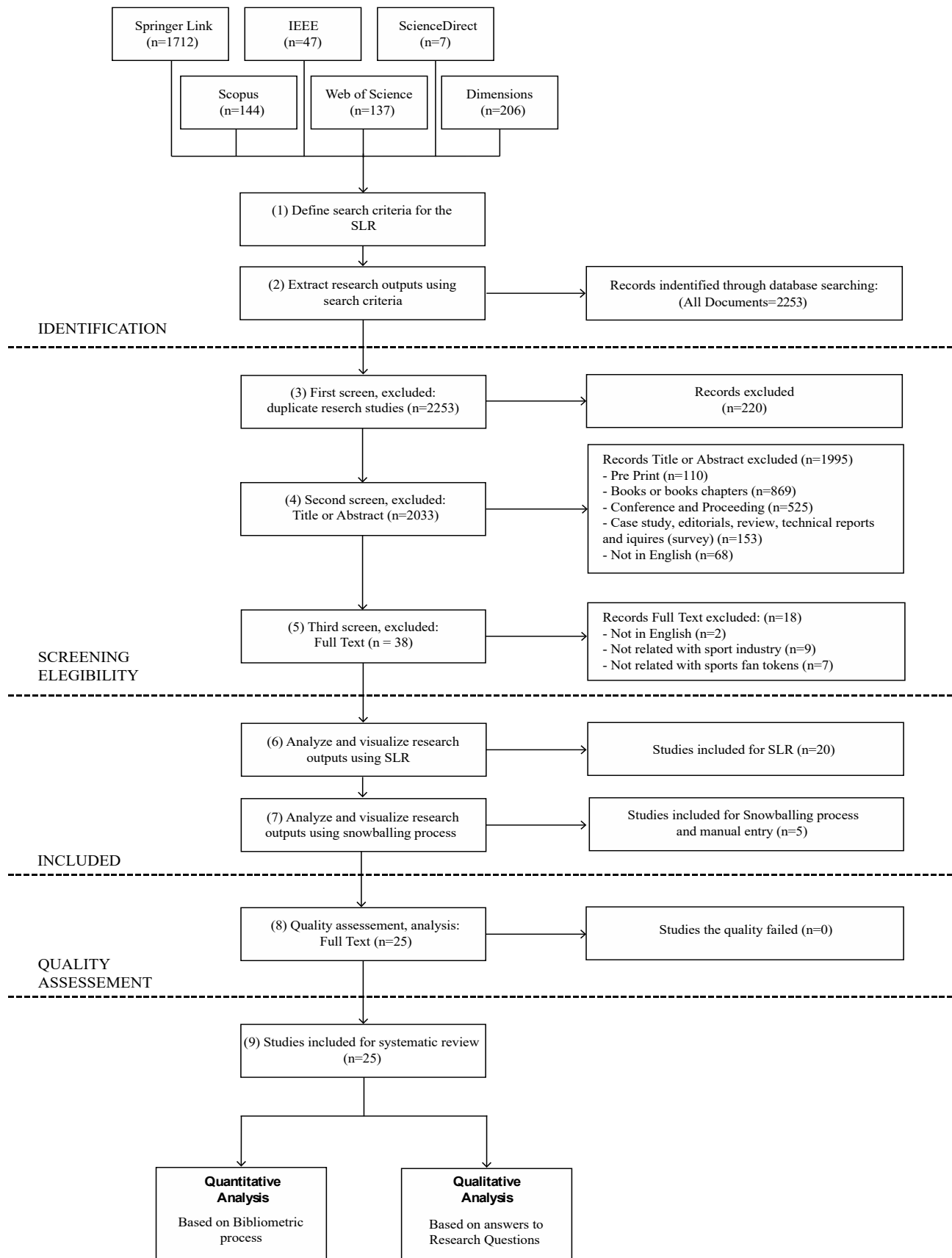


Figure 1. The overview process of the literature review was adapted from Page et al. (2021) and Kitchenham et al. (2007). IEEE: Institute of Electrical and Electronics Engineers and SLR: systematic literature review. Source: Created by authors.

According to the guidelines established by Kitchenham & Brereton (2013), Petersen et al. (2015), and Wohlin et al. (2020) for a systematic literature review (SLR), the review process can introduce threats to the validity of the studies. Consequently, following the study selection shown in Section 3 and the framework represented in Figure 1, we developed strategies to mitigate the influence of these studies based on their quality. The validity of this construct can be compromised by the possible incompleteness of the search words and the ambiguity of the terms used.

However, this ambiguity was mitigated by applying strict inclusion and exclusion criteria and conducting thorough screenings of titles, abstracts, and full texts during the study selection process. Publication bias, favoring studies with positive outcomes over those with negative findings, also poses a threat. This bias arises from the higher likelihood of studies reporting significant findings being accepted for publication. To counterbalance this effect, all included studies were meticulously evaluated against quality criteria by four researchers who reviewed these studies to ensure adherence to the predefined protocol.

Bias in the data extraction phase occurs when two researchers extract the assigned studies and validate each other's results. A predefined quality protocol was used to facilitate the extraction, considering the researchers' different experiences and knowledge reserves. Thus, studies that scored less than three were deemed inadequate and failed the quality criterion based on five questions needing identification (Table 2). In this way, all 24 selected studies met the methodological quality criteria.

Table 2. The methodological quality of the included studies

Authors	Questions					Total
	1	2	3	4	5	
Alaminos et al. (2024)	1	.5	1	1	1	4.5
Ante et al. (2024)	1	1	1	1	1	5
Ante et al. (2024)	1	1	1	.5	.5	4
Assaf et al. (2024)	1	1	1	1	.5	4.5
Baker et al. (2022)	1	.5	1	.5	0	3
Chen (2024)	1	1	1	.5	0	3.5
Demir et al. (2022)	1	1	1	1	1	5
Demir and Ramazan (2022)	1	.5	1	.5	0	3
Ersan et al. (2022)	1	.5	1	.5	1	4
Foglia et al. (2024)	1	1	1	1	1	5
Glebova and Mihal'ová (2023)	1	1	1	.5	.5	4
Lopez-Gonzales and Griffiths (2023)	1	.5	1	.5	0	3
Lopez-Gonzalez and Petrotta (2023)	1	1	1	.5	0	3.5
Manoli et al. (2024)	1	0	1	.5	.5	3
Mazur and Vega (2023)	1	1	1	.5	0	3.5
Read et al. (2023)	1	1	1	.5	0	3.5
Saggu et al. (2024)	1	.5	1	.5	0	3
Scharnowski et al. (2023)	1	.5	1	1	0	3.5
Singhal et al. (2023)	1	1	1	.5	0	3.5
Soltsev et al. (2022)	1	.5	1	1	1	4.5
Stegmann (2023)	1	1	1	1	1	5
Vidal-Tomás (2023)	1	1	1	.5	0	3.5
Wilson et al. (2022)	1	1	1	0	1	4
Zarifis and Cheng (2022)	1	1	1	.5	.5	4
Zaucha and Angur (2022)	1	.5	1	0	.5	3

Source: Created by authors.

Bibliometric analysis

The impact was initially assessed for the bibliometric analysis based on the number of articles published per year (2022, 2023, and 2024). Figure 2 illustrates the number of articles published each year. Therefore, it can be observed that the subject related to fan tokens in sports is in its initial stage but shows an increase in the number of articles each year.

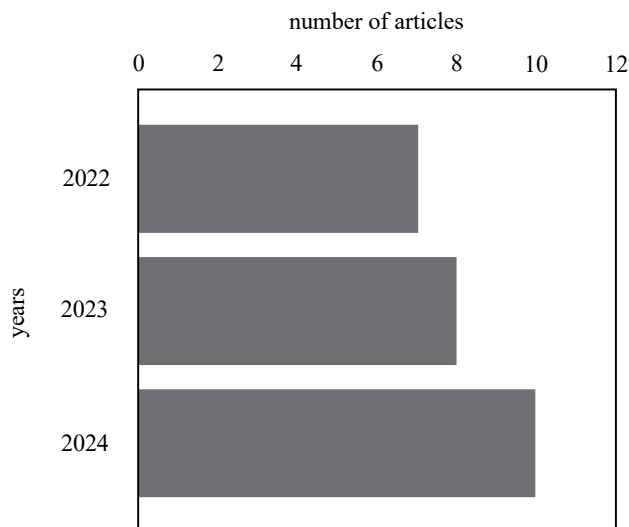


Figure 2. Number of articles published each year available.

Legend: Source: Created by authors.

Specifically, publications on fan tokens began in 2022 with seven studies, while in 2022, this number increased to eight, and in 2024, it increased to ten studies. This highlights the interest and relevance of this topic in the academic community, as the market also introduces other uses for this digital asset. Notably, despite conducting a comprehensive search on fan tokens in the sports industry, the first selected article is dated 2022. Fourteen years after Nakamoto's article introducing blockchain technology (Nakamoto, 2008), publications on using this technology for sports benefits, in this case, through the lens of fan tokens, began. Therefore, it is emphasized that the theme of fan tokens in the sports industry presents much potential that can be explored in the coming years.

This research, 22 scientific journals were identified, and the articles used for this review were published. The journal Research in International Business and Finance, Ersan et al. (2022), Foglia et al. (2024), and Saggu, Ante, & Demir (2024) had the highest number of studies included in this review, with three papers, followed by the International Journal of Sports Marketing and Sponsorship, Chen (2024), and Stegmann et al. (2023) with two. Additionally, another 20 journals were identified, each with only one publication.

The impact of the journals with the most publications in the database was assessed using several key metrics across the 22 identified journals. Two journals demonstrated superior

performance, particularly notable for publishing more than one article. According to the Scimago Journal & Country Rank (SJR), the Research in International Business and Finance ranked in the first European quartile with a score of 1.29. It also boasts an H-Index of 73, a Journal Impact Factor (JIF) of 6.5, and a Journal Citation Indicator (JCI) of 2.05. In contrast, the International Journal of Sports Marketing and Sponsorship has an SJR of 0.6, an H-Index of 33, a JIF of 2.2, and a JCI of 0.6. The analysis captured each journal's performance in terms of impact and prestige. However, it is essential to note that for some of these journals, more data is needed regarding the Eigenfactor Score (eigenfactor.org), which is specific to ISI-ranked journals, thereby limiting the comparison across all metrics.

In the subsequent stage, the articles were condensed to determine which researchers had the most impact. For this analysis, two authors, Dr. Lennart Ante and Dr. Hibai Lopez-Gonzalez were compared, as both have two articles included in this study's database. Dr. Lopez-Gonzalez, a professor at the Faculty of Information and Audiovisual Media at the University of Barcelona, holds a PhD in Public Communication. His research interests include the pathological behaviors of individuals engaged in gambling and sports betting. His notable works in this review include "Gambling-like Features in Fan Tokens" and "Gambling-like Digital Assets and Gambling Severity: A Correlational Study with U.S. Sports Bettors Consuming Cryptocurrencies, NFTs, and Fan Tokens," which explore the gambling-like characteristics of fan tokens. Dr. Lopez-Gonzalez has 2,343 citations and an H-Index of 24 on Google Scholar, underscoring his significant influence in his field.

Dr. Lennart Ante, CEO and Co-Founder of the Blockchain Research Lab in Germany, a non-profit organization dedicated to independent science and research on blockchain technology, holds a PhD in Economics. His contributions to this study include "Voting Participation and Engagement in Blockchain-based Fan Tokens" and "The Impact of Football Games and Sporting Performance on Intra-day Fan Token Returns." Additionally, he co-authored the study "Anticipatory Gains and Event-driven Losses in Blockchain-based Fan Tokens: Evidence from the FIFA World Cup" with Saggiu. Dr. Ante has 2,255 citations and an H-Index of 19 on Google Scholar, reflecting his significant impact on blockchain technology and its application to sports.

Analyzing these two researchers' citation counts and H-index highlights their substantial contributions and influence within their respective areas of expertise, emphasizing their relevance to the ongoing discourse in fan token and blockchain research.

Research questions

In this section, we present the qualitative stage of the analysis. A discussion of the responses identified in the studies for

each of our research questions is provided. All responses are organized below in the order and as the questions were presented.

RQ1: What is a fan token?

A fan token is a digital asset that has enabled sports fans to take various actions with their teams, using blockchain technology to ensure efficiency and trust. Beyond promoting more significant interaction between sports clubs and their fans, fan tokens represent an innovative frontier in the digital financial market. They are part of the growing trend of asset tokenization, offering a new form of digital and economic engagement in sports and entertainment (Ante et al., 2024a; Manoli et al., 2024; Zaucha & Agur, 2024). According to Ante et al. (2024a): "Fan tokens, a class of crypto asset that grants holders access to voting on club decisions and other perks, serve as a mechanism for stimulating democratized decision-making and fan engagement in the sports and esports sectors."

These tokens are developed using blockchain technology, ensuring transaction transparency and security. Consequently, each token is unique and associated with a specific sports entity. They allow fans to participate in voting that influences minor decisions, such as the choice of music at games or uniform designs, and also provide access to exclusive content and experiences (Vidal-Tomás, 2023; Zarifis & Cheng, 2022).

Fan tokens are considered a form of "utility token." Still, beyond the aspect of engagement, they also emerge as a new, innovative source of revenue for sports entities, introducing a business model that capitalizes on the passion and loyalty of fans. Thus, the money raised from token sales can be reinvested to improve facilities, hire new players, or enhance various initiatives (Scharnowski et al., 2023). Despite these advantages, fan tokens have risks. Market volatility can lead to significant financial losses, and the absence of comprehensive regulation may leave room for fraudulent activities and market manipulation (Foglia et al., 2024; Mazur & Vega, 2023).

These tokens are revolutionizing fan engagement and bringing new challenges and opportunities at the intersection of sports, technology, and finance. They represent a clear example of how the boundaries between entertainment, consumer engagement, and financial investment are increasingly intertwined in the digital age (Foglia et al., 2024; Manoli et al., 2024; Scharnowski et al., 2023; Zarifis & Cheng, 2022).

RQ1 Insight: What is a fan token?

A fan token is a type of cryptographic digital asset based on blockchain technology that allows fans to actively participate in some decisions and the daily life of their teams through the right to vote on various issues. Fan tokens also serve as a means of engagement and loyalty for the community, creating

a channel of interaction between fans and sports entities. Economically, fan tokens represent a new source of revenue for the issuing organizations, with the token's value often linked to the performance and popularity of the corresponding sports entity in the market.

RQ2: Why are fan tokens adopted in the sports industry?

The sports industry uses fan tokens because they offer a new way to engage fans. They represent an innovative tool for managing and monetizing fan interaction, strengthening loyalty and connection (Ante et al., 2024a).

The adoption of fan tokens in the sports industry has been driven by economic and technological factors that transform how clubs interact with their fans (Vidal-Tomás, 2023). The tokens represent a new form of revenue for the clubs and provide a new way of engaging with fans, allowing for minor interaction, participation in smaller club decisions, and access to exclusive content (Singhal et al., 2023).

On the other hand, fan tokens are also seen as speculative assets whose prices can fluctuate significantly based on team performance, player popularity, and other market variables. This volatile nature introduces an element of risk for investors, potentially affecting the perception and financial stability of the clubs involved (Scharnowski et al., 2023).

Therefore, there is a growing awareness of the similarities between fan tokens and gambling (Lopez-Gonzalez & Griffiths, 2023; Lopez-Gonzalez & Petrotta, 2023), such as gamification and the possibility of trading on cryptocurrency exchanges, which can turn these tokens into collectibles whose value fluctuates over time (Lopez-Gonzalez & Griffiths, 2023). This perspective is complemented when game outcomes impact token returns, highlighting the strong connection between sports performance and the appreciation of these digital assets (Ante et al., 2024b).

While fan tokens offer new opportunities for clubs to generate revenue and increase fan engagement, they also introduce challenges related to market volatility and the need for robust regulations to protect fans and maintain the integrity of the sports market (Foglia et al., 2024; Mazur & Vega, 2023). These aspects underscore the complexity and multifaceted nature of fan tokens within the context of the sports industry.

RQ2 Insight: Why are fan tokens adopted in the sports industry?

Fan tokens transform the interaction between sports clubs and their fans by enabling participation in decisions and access to exclusive content, strengthening the emotional bond and increasing engagement. These digital tokens also open new revenue streams by tapping into fans' enthusiasm. However, the volatile nature of these assets, which fluctuates based on

sports performance and market speculation, presents significant risks. Additionally, their gambling-like characteristics necessitate clear regulations to protect consumers and maintain market integrity. Therefore, while fan tokens offer unique opportunities, they require careful management and adequate regulation to mitigate potential risks.

RQ3: Where is the fan token distributed in the sports context?

Fan tokens are primarily distributed through specialized platforms collaborating directly with sports entities (Lopez-Gonzalez & Griffiths, 2023). The leading platform offering these tokens in the context of sports is Socios.com, developed by the company Chiliz and pioneering in this sector (Ante et al., 2024a; Vidal-Tomás, 2023). Fan tokens enable holders to participate in decisions related to the club, such as jersey design and other promotional activities, thus offering a new way of interaction between fans and sports entities (Alaminos, Salas, & Fernández-Gámez, 2024). In addition to Socios, other platforms such as Binance have also started offering fan tokens, expanding access to and trading these digital assets (Demir & Ramazan, 2022; Scharnowski et al., 2023).

These tokens are acquired through an Initial Token Offering (FTO), similar to an Initial Coin Offering (ICO), where tokens are made available to the public. After the initial offering, the tokens can be traded on the secondary market on various cryptocurrency platforms. This offering process and subsequent trading establish the token price based on market supply and demand (Assaf et al., 2024).

Additionally, new tokens are distributed to fans periodically. This distribution is related to market dynamics and may occur during promotional activities and/or significant events, such as major games. However, this distribution is strategically planned to maintain fan engagement and increase the token holder base (Scharnowski et al., 2023). These tokens are also used as a marketing tool, providing fans with a way to participate more actively in club activities while also generating a source of revenue (Ante et al., 2024b).

Therefore, fan tokens in sports are primarily distributed through strategic partnerships between fan engagement platforms and sports clubs. Initial sales and secondary markets facilitate the acquisition of these digital assets. Integrating these tokens into the financial market highlights the growing merger between digital finance and sports entertainment, presenting opportunities and challenges for investors and fans (Ante et al., 2024b; Assaf et al., 2024; Scharnowski et al., 2023).

RQ3 Insight: Where is the fan token distributed in the sports context?

The distribution of fan tokens in the sports context is primarily carried out through specialized platforms that collabo-

rate directly with sports entities to launch the tokens. The tokens are strategically distributed in alignment with significant events, enhancing fan engagement and using these tokens as a powerful marketing tool. This approach helps to strengthen the bond between the parties and expand revenue opportunities. The merging of digital finance with sports entertainment brings new opportunities, challenges, and the need for regulations due to the complexity of this new facet of the sports economy.

RQ4: When is the use of the fan tokens valid?

Fan tokens are valid if they are in circulation and supported by the platform and the club offering them (Lopez-Gonzalez & Griffiths, 2023; Solntsev, Alekseeva, & Susov, 2022; Vidal-Tomás, 2023). These tokens are used primarily to increase fan engagement and open new revenue sources for clubs. They are also used to vote on club decisions during specific periods when voting is open for token holders to participate (Ante et al., 2024a).

Fan tokens, as blockchain-based digital assets, give holders special rights. This form of digital interaction enables increased loyalty and fan engagement. It allows for a new form of monetization, aligning with the expectations of younger generations and the growing digitization of sports entertainment (Manoli et al., 2024; Singhal et al., 2023; Solntsev et al., 2022). They also introduce gamification features into the fan experience, typically offering a rewards system and competitions that incentivize and lead to more significant interaction. These aspects transform fan activity into a more interactive and rewarding experience, promoting a "serious leisure" model in fan culture (Manoli et al., 2024; Stegmann et al., 2023).

Furthermore, fan tokens can be traded as financial assets, enabling gains depending on market demand (Saggu et al., 2024), thus creating an economic dimension that benefits both token owners and sports entities in terms of increased liquidity and potential market value growth (Scharnowski et al., 2023; Solntsev et al., 2022; Zaucha & Agur, 2024). However, trading these tokens also involves risks, including the introduction of gambling-like features (Lopez-Gonzalez & Griffiths, 2023), which can lead to problematic gambling-related behaviors (Foglia et al., 2024; Lopez-Gonzalez & Griffiths, 2023). The strategic use of fan tokens also highlights the importance of data as capital and the ethical implications associated with digital assets. Clubs should implement these technologies ethically and responsibly, ensuring that they positively contribute to the fan experience without compromising the core values of sports (Read & Smith, 2023; Zarifis & Cheng, 2022).

The use of fan tokens is valid when it strengthens the relationship between fans and clubs, offering mutual benefits that transcend mere commercialization, and when it is implemented ethically and regulated. This approach can benefit the

sports industry on various levels, from increasing revenues to creating a richer and more engaging fan experience (Ante et al., 2024b; Lopez-Gonzalez & Griffiths, 2023; Manoli et al., 2024; Read & Smith, 2023; Stegmann et al., 2023; Zarifis & Cheng, 2022).

RQ4 Insight: When is the use of the fan tokens valid?

Fan tokens validate themselves as a mechanism for engagement and monetization in the sports industry, enabling fans to actively participate in some decisions and obtain tangible benefits that strengthen their bond with their team. They not only offer a chance for financial appreciation in secondary markets but also enhance the sense of community and identity among fans. However, given their inherent volatility, there must be careful regulation to protect the interests of fans and the integrity of sports. The valid uses of fan tokens, as identified in academic articles, include:

- Voting on non-critical club decisions.
 - Access to exclusive or signed merchandise.
 - Opportunities to experience unique events and obtain tickets.
 - Holding tokens as collectible items of sentimental value.
 - Demonstrating support and belonging to the club.
- Trading as financial assets with potential for value appreciation.

RQ5: Who is involved in developing fan tokens in the sports context?

Various stakeholders are involved in developing fan tokens within the sports context, ranging from sports clubs and their management teams to technology companies, investors, fans, and regulatory bodies (Lopez-Gonzalez & Griffiths, 2023; Vidal-Tomás, 2023; Wilson et al., 2022). The primary entities driving the development and distribution of fan tokens include sports clubs and specialized technology companies, such as Chiliz's Socios Collectibles. These organizations collaborate to create digital assets that offer fans unique privileges, enhancing their engagement and connection with their favorite teams. This collaboration leverages the clubs' brand loyalty. It utilizes the technical expertise of firms like Chiliz to innovate and secure these digital assets, providing a new layer of interaction and value for fans (Ante et al., 2024a; Demir et al., 2022; Ersan et al., 2022).

Investors and fans constitute a crucial group of stakeholders (Wilson et al., 2022). While some fans purchase fan tokens to support their favorite clubs and enjoy the associated benefits, others see them as speculative investments, hoping to profit from fluctuations in token prices (Scharnowski et al., 2023; Vidal-Tomás, 2023). This dual role of fan tokens, both a fan engagement tool and a speculative asset, highlights the

diverse motivations driving their purchase and use. The cryptocurrency market's volatility (Mazur & Vega, 2023), where fan tokens are traded, adds another layer of complexity, affecting both the clubs' ability to generate stable revenue from the tokens and the risk exposure of fans and investors (Ersan et al., 2022; Solntsev et al., 2022).

To deepen the discussion on the involvement of various stakeholders, it is essential to recognize the growing role of blockchain and fintech technologies in the sports industry (Wilson et al., 2022). Blockchain technology provides a secure and transparent foundation for creating fan tokens, enabling fans to participate more actively in club decisions (Ante et al., 2024b). Furthermore, NFTs emerged as a new form of collectible sports memorabilia, allowing digital ownership of iconic moments, game-worn uniforms, and other items that offer new revenue streams for athletes and sports organizations (Glebova & Mihal'ová, 2023; Singhal et al., 2023).

Integrating fan tokens and blockchain technologies in the sports industry reshapes how brands engage with their fans, creating opportunities for branding, monetization, and community building (Demir & Ramazan, 2022; Vidal-Tomás, 2023). The use of NFTs allows sports brands to launch products that act as standalone components of the brand, expanding brand awareness and engaging previously inaccessible audiences, such as Generation Z. These digital products not only serve as new sources of revenue but also as tools to enhance fan engagement during challenging times, such as the COVID-19 pandemic, where physical attendance at stadiums was limited (Chen, 2024; Ersan et al., 2022).

However, sports brands' adoption of fan tokens and NFTs also presents significant challenges, including issues of valuation, alignment between brands and consumers, integration of physical products with digital assets, cryptocurrency market volatility, regulatory matters, and the need for effective communication strategies. These barriers need to be addressed to maximize the potential of these technologies (Foglia et al., 2024; Scharnowski et al., 2023).

RQ5 Insight: Who is involved in developing fan tokens in the sports context?

The rise of fan tokens in sports illustrates a revolution in the interaction between clubs and their fans, marking the beginning of an era where digitalization transforms engagement into a two-way street with exclusive opportunities and shared experiences. Tokens go beyond simple monetization, touching the core of being a true fan by offering a share in the action and an active voice in club decisions, thus redefining the notions of loyalty and belonging. Brand communities become the new "virtual stadiums" where the passion for sports finds free expression, enhanced by the authenticity and proximity these spaces provide. However, this uncharted path brings regulatory challenges and market volatilities that test the resilience and adaptability of clubs in their quest for innovation.

Ultimately, fan tokens are not just an emerging tool in sports marketing; they are an invitation to reimagine the dynamics between sports brands and their fans, promising an ascent to engagement that transcends the physical and digital boundaries, shaping the future of loyalty.

RQ6: How is the fan token applied in the sports industry?

Fan tokens are introducing an innovative interaction layer between clubs and their followers. Based on blockchain technology, these tokens allow fans to participate in club decisions, access exclusive content, and experience unique events (Ante et al., 2024a; Lopez-Gonzalez & Petrotta, 2023; Vidal-Tomás, 2023). They are used to increase fan engagement with trivial club decisions (Lopez-Gonzalez & Griffiths, 2023) ranging from choosing merchandise designs to selecting locations for friendly matches, providing fans with a sense of belonging and tangible influence over some club decisions (Ante et al., 2024a; Demir et al., 2022). Renowned football clubs like Juventus, Barcelona, and Paris Saint-Germain have been pioneers in adopting fan tokens, signaling the start of a trend that extends to other sports (Manoli et al., 2024). These tokens represent a new source of revenue and a method to expand fan bases globally, establishing a stronger bond between clubs and their followers (Demir et al., 2022; Zarifis & Cheng, 2022). Unlike traditional shares, fan tokens do not confer ownership rights but offer exclusive benefits that reinforce the loyalty of their holders (Manoli et al., 2024).

The digitalization facilitated by fan tokens aligns with the trends of sports consumption on digital platforms, meeting modern fans' expectations for more immersive and personalized interactions (Manoli et al., 2024; Singhal et al., 2023). This move towards broader digitalization is a natural response to the growing demand for digitally accessible sports content and meaningful social media interactions. Through this digitalization, clubs can reach a global audience, expanding their reach far beyond geographical barriers and creating an international community of supporters. Additionally, the initial offerings of these tokens open a significant financial opportunity for clubs to capitalize on the loyalty and engagement of their fans (Foglia et al., 2024).

Despite its positive potential, the expansion of fan tokens is not free from criticism. Clubs face challenges when implementing these initiatives, including concerns about the excessive commercialization of sports, the exclusion of fans who cannot or do not want to acquire tokens, and the volatility in the value of the tokens (Mazur & Vega, 2023; Scharnowski et al., 2023). Therefore, clubs must adopt strategies to mitigate these concerns, ensuring that fan tokens complement rather than replace traditional forms of fan engagement (Manoli et al., 2024).

In this way, clubs must seek a balance between innovation and inclusion, not to tote a significant portion of their fan

base. The careful integration of fan tokens into the clubs' engagement strategies can help maintain the authenticity of the fan-club relationship while exploring new digital opportunities (Manoli et al., 2024; Vidal-Tomás, 2023). However, for this innovation to be sustainable in the long term, clubs must carefully navigate the associated challenges, ensuring that the benefits for fans outweigh the potential disadvantages (Scharnowski et al., 2023). The future of fan tokens and their widespread adoption in the sports industry remains uncertain, but the potential for a new era of engagement is undeniable (Baker et al., 2022; Manoli et al., 2024).

This innovative NFT marketing and community engagement approach highlights non-fungible tokens' vast and largely untapped potential as standalone brand assets (Zarifis & Cheng, 2022). By linking a brand's NFT strategies with the marketing funnel stages, from brand awareness to post-purchase loyalty, NFTs offer a new dimension to branding, digital marketing, and consumer engagement (Manoli et al., 2024). They allow brands to venture beyond traditional marketing methods, exploring the intersection between technological innovation and emotional connection with consumers (Zarifis & Cheng, 2022).

RQ6 Insight: How is the fan token applied in the sports industry?

The function of a fan token is to facilitate interaction between clubs and supporters through an innovative platform that allows for direct engagement and participation in decisions, deepening fans' sense of belonging. It also serves as a vector for potential new revenue streams, although this aspect should be approached cautiously to maintain the integrity of sports and authentic relationships with followers. Through fan tokens, clubs expand their fan bases, overcoming geographical barriers and fostering a united community driven by passion for the sport. Aligned with digitization, these tokens encourage innovation, creatively introducing clubs into the digital landscape and appealing to a younger audience. However, implementing fan tokens brings significant challenges, including concerns about exclusivity and volatility, necessitating a careful balance between commercialization, fan inclusion, and maintaining an authentic and valuable experience for supporters.

RQ7: How much can fan tokens transform sports clubs' finances and operations?

Fan tokens, emerging from the interaction between blockchain technology and the world of sports, represent a significant innovation with broad implications for clubs, fans, and the sports ecosystem. These digital assets, anchored in blockchain technology, offer a new avenue for fan engagement and open up possibilities for revenue generation and the democratization of fan participation in minor club decisions (Ante et al., 2024a; Ante et al., 2024b; Glebova & Mihal'ová, 2023;

Scharnowski et al., 2023). Fan tokens are beginning to stand out as a phenomenon of increasing interest within the sports context, promoting a deeper connection between clubs and their global followers (Ersan et al., 2022; Glebova & Mihal'ová, 2023).

The introduction of fan tokens to the market, as detailed by Ersan et al. (2022), has brought to light the complex dynamics between these new assets and the actions of sports clubs. Through the methodology of Time-Varying Parameter Vector Autoregression (TVP-VAR), it was observed that despite fan tokens being considered independent assets from club actions, they demonstrate a remarkable ability to transmit shocks within the market, underscoring their growing influence (Vidal-Tomás, 2023). Furthermore, although subject to external influences such as game results and cryptocurrency market activities, the variation in fan token prices highlights their volatility and the potential risk for unsuspecting investors (Lopez-Gonzalez & Griffiths, 2023).

On the other hand, it's important to emphasize the broader impact of blockchain and fintech technologies on professional sports (Demir & Ramazan, 2022; Solntsev et al., 2022; Vidal-Tomás, 2023). They point out that beyond fan tokens, the tokenization of tickets and merchandise opens new frontiers for innovation in sports, promising operational efficiency and new forms of fan engagement (Glebova & Mihal'ová, 2023). While fan tokens can serve as a new engagement tool, they also bring challenges related to price volatility and ethical issues that require appropriate regulation and consumer protection measures (Ante et al., 2024b; Read & Smith, 2023).

Furthermore, research on the dynamics of fan token prices during and after football matches illustrates the direct impact of sporting performance on the returns of these digital assets. Studies show abnormal variations in fan token returns correlated with match outcomes (Ersan et al., 2022). This phenomenon underscores the importance of considering external factors and sporting performance when analyzing investments in fan tokens (Demir & Ramazan, 2022; Lopez-Gonzalez & Griffiths, 2023).

However, the emergence of fan tokens is challenging. Issues related to regulation, ethics (Read & Smith, 2023), and price volatility (Mazur & Vega, 2023) are recurrent in academic discussions, reflecting the need for a clear regulatory framework and investor protection measures. For example, research by Scharnowski et al. (2023) highlights the high volatility of fan tokens as a potential risk for investors, pointing to the need for more outstanding education and transparency in the market.

Furthermore, the analysis of the connectivity between fan tokens and other classes of crypto assets, as observed in works by Foglia et al. (2024), reveals an emerging financial ecosystem in which fan tokens play an increasingly central role. Although still in its early stages, this ecosystem suggests a future

in which fan tokens could offer a new form of fan engagement and a robust tool for club financial management.

Finally, applying the theory of technological determinism to the study of fan tokens and blockchain technology in sports offers a theoretical framework for understanding the transformative influence of these technologies on the sports ecosystem. This framework suggests that technological innovations, such as fan tokens, not only reshape interactions between clubs and fans but also have the potential to redefine the business model and operations of sports clubs, paving the way for a future where blockchain technology plays a central role in the sports industry.

RQ7 Insight: How much can fan tokens transform sports clubs' finances and operations?

Fan tokens are opening new frontiers in the sports industry, transforming how fans interact with their favorite clubs. This innovation not only strengthens the connection between clubs and followers by allowing their participation in club decisions but also unveils an emerging business model promising to revolutionize revenue generation. Each ticket, every piece of merchandise, and even exclusive moments can be tokenized, ensuring authenticity and creating a rewards economy directly linked to fan engagement. As we move forward, it is crucial to address the challenges of volatility and regulation with a clear vision, protecting investors and ensuring the integrity of this ecosystem. Fan tokens are not just a technological step forward; they are the gateway to a more inclusive, engaging, and financially sustainable sports ecosystem, redefining the value of fan loyalty in a digital era.

Study limitations and future research directions

This study's main limitation lies in its dependence on the quality and scope of existing studies. Due to the emerging nature of fan tokens, the available literature still needs to be expanded and predominantly focused on technological and market aspects, potentially not fully reflecting these assets' social and ethical impacts. Additionally, the price volatility of fan tokens and the lack of precise regulation introduce a layer of uncertainty that may have influenced the analysis results and limited the ability to generalize findings to different contexts or geographical regions.

Despite these challenges, the future of fan tokens in the sports industry appears promising, with vast potential for innovation and redefining brand and fan engagement strategies. As blockchain technology evolves, these digital tools transform sports marketing and set new standards for interactions among clubs, sports-supporting brands, and consumers. Considering the limitations, future research should focus on expanding the body of studies on fan tokens in sports with empirical investigations exploring their long-term impacts on fan

behaviors and loyalty. Studies could also analyze the effectiveness of fan tokens in improving fan experience and the financial sustainability of clubs, as well as developing strategies to mitigate risks associated with these digital assets. Developing and implementing a comprehensive regulatory framework that addresses identified challenges, such as market speculation and the ethical implications of token use, is essential. Future studies should also address the interactions of fan tokens with issues of inclusion and accessibility, ensuring that fan engagement promotes fair and equitable participation, free from economic and social barriers.

Conclusion

Fan tokens represent a significant innovation in engagement between sports entities and their fans, offering an additional layer of interaction and participation thanks to blockchain technology. This study has detailed the transformative role of fan tokens in fan engagement within the sports ecosystem, highlighting it as an innovative fusion of technology and sports. Using blockchain technology to develop fan tokens has provided a secure and transparent platform, allowing for more direct and meaningful interaction between clubs and fans. Through specialized platforms, fan tokens are traded to the interested fan base, allowing them to participate in their team's decisions, even minor ones, attend exclusive events, and access specialized content, strengthening the bond between fans and clubs and fostering a sense of community. This advancement represents not only a new class of digital assets but also a new engagement strategy that empowers fans to have an active voice in the operations of their favorite teams, redefining the relationship between sports entities and their followers.

The analysis conducted in the study has shown that fan tokens not only strengthen community ties and increase fans' sense of belonging and loyalty but also provide essential security, robustness, and transparency through blockchain technology, which are crucial for mitigating fraud risks and promoting greater trust and fairness in fan token operations. Such characteristics are vital for the success and acceptance of this technology in the mainstream market. However, the study also acknowledges the challenges faced, such as the market volatility of crypto-assets and the need for clear and compelling regulations. Despite these challenges, fan tokens stand out as a remarkable example of digital innovation in sports, offering valuable insights for academics, sports managers, and fans on how technology can enrich fan experiences and strengthen the internal operations of sports entities. With the continued development of blockchain technology and a regulatory approach, fan tokens have the potential to set a new standard in fan interactions and loyalty in an increasingly digital era, leveraging an already organized and passionate community for the sports institution in the real world.

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Declaration of interest statement

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Author's contribution

Conceptualization: VAP, GCPSMS, RGSV, RAMN; Methodology: VAP, GCPSMS, RGSV, RAMN; Formal analysis: VAP, GCPSMS, RGSV, RAMN; Investigation: VAP, GCPSMS, RGSV, RAMN; Writing: VAP, RGSV, RAMN; Visualization: VAP, GCPSMS, RGSV, RAMN; Supervision: VAP, RGSV, RAMN.

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Datos de los/as autores/as y traductor/a:

Vitor Ayres Príncipe
Giullio César P. S. M. da Silva
Rodrigo Gomes de Souza Vale
Rodolfo de Alkmim Moreira Nunes

vitorprin@gmail.com
giulliocesar.gc@hotmail.com
rodrigogsvale@gmail.com
rodolfoalkmim@gmail.com

Autor/a – Traductor/a
Autor/a
Autor/a
Autor/a