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Blockchain-based fan tokens as a strategic resource for sports clubs: Opportunities, challenges, and a stakeholder-oriented model

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ABSTRACT

This article explores blockchain-based fan tokens, a type of cryptocurrency, as a strategic tool for sports clubs to raise funds and involve supporters more directly, offering new avenues for decision-making participation and exclusive fan activities. Drawing on expert interviews in professional football, we identify a spectrum of opportunities, such as revenue growth, global engagement, and enhanced supporter loyalty, alongside significant challenges, including regulatory uncertainty, environmental considerations, and the integration with existing governance structures. In response to these insights, the study proposes a stakeholder-oriented model linking observed advantages and drawbacks with decision-making criteria shaped by stakeholder attributes. The model helps clubs balance diverse interests and potential outcomes when determining whether and how to implement fan tokens. Through this approach, this study provides clubs and associated stakeholders a tool to assess strategic options, accommodate various perspectives, and inform further innovation in digital sports management.

1. Introduction

The proliferation of fan tokens in the sports industry has witnessed a remarkable surge since 2020 (CoinGecko, 2025), as top-tier football clubs and national teams have adopted the technology. For example, FC Barcelona launched its fan tokens in January 2020, selling them within two hours and generating \$1.3 million in revenue (Cohen, 2020). The Italian national team experienced a similar outcome, completing its fan tokens sale in under 24 h (Marca, 2022). In 2021, Lionel Messi's transfer to Paris Saint-Germain highlighted the fan token concept even further, with part of his sign-on bonus provided in PSG fan tokens (Evans, 2021). Socios, the leading fan token issuance platform, onboarded Messi as a brand ambassador (Socios, 2022a) and introduced official fan tokens tied to UEFA club competitions (Socios, 2022b). However, recent critiques caution against the speculative nature of fan tokens, drawing parallels with gambling practices (Lopez-Gonzalez & Griffiths, 2023).

Fan tokens are digital crypto assets connecting supporters and professional sports teams by granting certain participation rights, trading opportunities, and access to exclusive offerings. They can be classified as hybrid assets that combine elements of utility and investment tokens (Treiblmaier, 2023). Unlike non-fungible tokens (NFTs), which typically

serve as digital collectibles with unique identifiers and crypto-based memberships, often providing passive benefits (Ante, 2024; Ante & Fiedler, 2024), fan tokens generally enable holders to influence selected club decisions through votes or feedback loops. This interactive element distinguishes fan tokens from other digital assets, making them more engagement-oriented than static collectibles. Their blockchain-based structure delivers trust and efficiency (Ante et al., 2023), and they can be traded on secondary markets, providing both loyalty and speculative features (Scharnowski et al., 2022; Socios, 2022c). Stronger supporter involvement may reshape stakeholder roles as fans gain a more active part in directing their teams, prompting deeper examination. Furthermore, fan tokens often incorporate loyalty and gamification features, as highlighted by Lopez-Gonzalez and Griffiths (2023), emphasizing their dual role in both fan engagement and financial speculation. This differentiation helps position fan tokens as unique digital artifacts in the sports ecosystem.

The development and support of fans are paramount to the prosperity of professional sports teams (Grant et al., 2011). Fans, defined as individuals exhibiting a keen interest in a particular team or actively following its endeavors (García & Welford, 2015), constitute key stakeholders of professional sports clubs (Covell, 2005; Senaux, 2008).

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Nonetheless, fans should not be regarded as homogeneous (Ross, 2007) since they comprise disparate (sub-)groups contingent upon various criteria (Jaeger, 2021). Consequently, one must identify and develop these groups to strengthen the team's position, resulting in more attendance, referrals, merchandise sales, and advantages over competitors (McDonald et al., 2013).

From a scientific standpoint, fan tokens remain a relatively under-explored topic. The existing literature has primarily focused on empirical analyses of fan tokens, examining factors that influence their returns and their relationship with other crypto assets and stocks. While there is a connection between stocks and fan tokens of clubs, this relationship appears to be diminishing over time (Ersan et al., 2022). Mazur and Vega (2022) found that fan tokens experience a short-term price increase on their first trading day but exhibit long-term underperformance compared to other crypto assets. Demir et al. (2022) showed that UEFA Champions League match results had a significant impact on token price, whereas results for league matches remain insignificant. Schellinger et al. (2022) also investigated the influence of football match results on fan token prices, revealing that unexpected defeats have a significant negative impact, while expected victories have a positive effect. The authors highlight the high volatility and downside risks associated with fan tokens, which are even greater than those associated with Bitcoin and other crypto assets. Despite these risks, Vidal-Tomás (2022) notes that fan tokens offer holders a diversification opportunity, as they have little correlation with the Chiliz token (the native payment token of the Socios platform) and the broader crypto market. The author also points out that, on average, fans have not lost money with fan tokens due to their positive long-term performance. Nevertheless, the high volatility and downside risk of fan tokens cannot be overlooked, and investors should exercise caution when considering this asset class.

The study by Ante et al. (2023) examines the phenomenon of blockchain-based fan tokens from a theoretical point of view based on the Socios platform through a case study approach. Specifically, the authors conceptualize fan tokens, extending the existing fan engagement theory established by Huettermann et al. (2019) and Yoshida et al. (2014), resulting in a framework that encompasses three separate layers: 1) trust and efficiency (via blockchain technology); 2) utility (via voting rights); and 3) financialization (since tokens are financial instruments). While previous finance-focused studies have primarily targeted speculators and investors (Ante & Fiedler, 2024; Ante, Saggi, et al., 2024; Saggi et al., 2024), the fan token framework developed by Ante et al. (2023) provides a theoretical understanding of this phenomenon, capturing essential characteristics of fan tokens without breaking down individual aspects. However, research in this field still lacks a multifaceted examination of opportunities and challenges of fan tokens, as well as the necessary preconditions for issuing or using them. There is a clear research gap: studies highlight price and performance, yet lack stakeholder-oriented frameworks assisting clubs in strategic decision-making on fan token utilization.

Although stakeholder theory provides a valuable lens for analyzing the strategic implications of fan tokens, it is crucial to recognize the unique stakeholder dynamics present within professional sports. In this context, the power relations among stakeholders are shaped by complex interactions between club management, investors, fans, sponsors, and sports associations. Previous studies highlight potential conflicts between club investors, who may prioritize revenue generation, and fan groups, who often emphasize community and loyalty (Bauers et al., 2020; Bauers & Hovemann, 2019a; Rohde & Breuer, 2017). Additionally, power imbalances may arise when financial stakeholders exert significant influence over club decisions, potentially undermining fan engagement initiatives (Hajli, 2025; Vale & Fernandes, 2018). Furthermore, stakeholder dependencies are particularly pronounced within professional sports, as clubs often rely on fan loyalty and sponsor support to maintain financial stability (García & Welford, 2015). This intricate web of power dynamics and interdependencies necessitates a stakeholder-oriented approach to fan token implementation, as varying

interests can significantly affect the adoption and perceived value of such digital assets.

The choice of stakeholder theory as the theoretical foundation of this study is further justified by the Theory Borrowing Model proposed by Hanafizadeh and Alipour (2025). According to this model, a theory is appropriate for borrowing when its assumptions and reasoning mechanisms are aligned with the new context. In the case of fan tokens, stakeholder theory meets these criteria because it inherently addresses the power dynamics, dependencies, and potential conflicts among diverse stakeholders, which are pivotal in the strategic management of fan tokens. The theory's focus on balancing interests and addressing power imbalances aligns with the challenges sports clubs face when leveraging fan tokens for fan engagement and revenue generation. Consequently, stakeholder theory provides a robust framework for examining how fan tokens impact stakeholder roles and relationships within professional sports.

This article aims to address this gap by investigating the strategic opportunities that fan tokens present for sports clubs, examining how these opportunities can be effectively leveraged to enhance long-term fan engagement and generate sustainable revenue streams. Additionally, we assess the challenges and risks associated with the adoption of fan tokens, particularly focusing on stakeholder interests, governance structures, and potential regulatory concerns. To provide a comprehensive framework for decision-making, we develop and evaluate a stakeholder-oriented model that systematically guides sports clubs in assessing the adoption, implementation, and strategic utilization of fan tokens. To achieve this goal, we adopt a qualitative approach that draws on expert interviews with professionals from German professional football clubs, associations, and sports rights marketers. Our study provides a comprehensive understanding of the opportunities and challenges of fan tokens from the perspective of German professional football clubs, taking into account their structural peculiarities, such as the 50+1 ownership structure that limits the degree to which investors can influence most clubs (Bauers et al., 2020; Bauers & Hovemann, 2019a; Rohde & Breuer, 2017).

To give the results a generalized utilization perspective, the development of a comprehensive and formal model is essential for guiding professional sports clubs in assessing their fan token strategies. We propose a model that combines established stakeholder theory with various decision-making elements, including control variables, risk factors, stochastic elements, and interaction effects. Specifically, we draw on stakeholder theory (Freeman, 1984) and Mitchell et al.'s (1997) framework of stakeholder classification and identification based on the constructs of power, legitimacy, and urgency. Our model sheds light on how fan tokens could alter the roles of the various stakeholders of sports clubs (Senaux, 2008). We provide professional sports clubs and central stakeholders in this field with a structured and data-driven approach to evaluating the implications of fan tokens. Our study's results enrich the existing knowledge base of fan tokens and offer practical insights to practitioners and policymakers in the sports industry. First, sports clubs can establish and implement decision-making criteria drawn from the opportunities and challenges outlined in the study. These criteria can then be incorporated into the subsequent model (or a more straightforward version of it) for evaluating their fan token strategy. Consequently, the findings from this study should primarily be viewed as an initial foundation. To use these results more practically, additional research is necessary.

This article proceeds as follows. Section 2 of this article provides the theoretical background, including stakeholder theory within the context of sports (2.1) and an introduction to blockchain applications in the sports sector, focusing on fan tokens (2.2). Additionally, this section delves into the concept of fan tokens and examines existing literature on the opportunities and challenges. In Section 3, we describe the methodological approach employed in this study. Section 4 presents the findings from expert interviews, including the opportunities and challenges related to fan tokens. Building on these results, Section 5 proposes

a stakeholder-oriented model from the perspective of sports clubs for assessing the utilization of a fan token strategy. Section 6 discusses the results and Section 7 concludes.

2. Theoretical background

2.1. Stakeholder theory in the context of professional sports clubs

Stakeholder theory is a well-established and widely researched concept that emphasizes the importance of organizations considering the interests of all stakeholders rather than just shareholders (Freeman, 1984). Stakeholders are defined as individuals or groups who can impact or be impacted by the organization (Wagner Mainardes et al., 2012), and their relationships with the organization can influence their level of contribution (Dalakas & Phillips Melancon, 2012). For instance, in the context of sports organizations, stakeholders such as fans, investors, sponsors, players, and coaches may exhibit greater support and spending behavior when they have strong connections to the club. Identifying and serving the needs of key stakeholders is therefore critical for the success of (sports) organizations (Biscaia et al., 2018; Bryson, 2004). Hirschman's (1970) conceptual framework proposes that unsatisfied stakeholders possess three behavioral options. They can 1) withdraw (*exit*), 2) express dissatisfaction (*voice*) or 3) accept (*loyalty*). Using the example of fans as stakeholders of a professional sports club, there is naturally an interest on the part of the club to prevent an exit (i.e., fans not being fans anymore), which presupposes that fans can communicate their dissatisfaction, allowing the club to react accordingly. Since fans are divided into heterogeneous groups (Jaeger, 2021; Ross, 2007) – not every fan can or wants to protest against the club's strategy in the stadium or the general meeting of the member association (Bauers et al., 2023) – clubs face the challenge of 1) identifying stakeholder groups correctly and 2) providing stakeholders tailored opportunities for their participation and communication.

The framework of Mitchell et al. (1997) represents arguably the most influential approach in the academic literature with regard to stakeholder identification. The model defines three types of attributes that can be used to evaluate the extent to which a stakeholder “really counts” for an organization. These are *power*, *legitimacy*, and *urgency*. The model has already been applied in the context of professional sports clubs, thus providing academia with an overview of the stakeholders of sports organizations. For example, Senaux (2008) identifies seven stakeholder categories that include 1) *shareholders*, 2) *players*, 3) *leagues and federations*, 4) *local authorities*, 5) *support associations*, 6) *spectators, supporters*, and 7) *television and other sponsors*, showing that, for example, all of these stakeholder groups possess at least a certain degree of power to influence the club. This results in significant power games since the objectives of the stakeholders vary significantly. Therefore, individual interests among stakeholders cannot all be fully taken into account. Senaux (2008) suggests that more diverse governance approaches that foster a “club culture” and align the diverse objectives of stakeholders represent a suitable option to deal with the topic. One challenge in identifying and assessing stakeholders, according to Mitchell et al.'s (1997) model, is that the dimensions of power, urgency, and legitimacy are often classified as only present or absent; stakeholders have varying levels of the attributes, which should optimally be included in an assessment. This has been done, for example, in Biscaia et al.'s (2018) process of developing a fan identity framework, where the dimension of *legitimacy* was further divided into *external* and *internal*. In line with Mitchell et al. (1997), we operationalize stakeholders in professional sports clubs according to the attributes of power, legitimacy, and urgency.

2.1.1. Power

The stakeholder theoretic attribute of power refers to the ability of a stakeholder to influence the decision-making processes and outcomes of an organization. A stakeholder with a high level of power may have

greater control over the direction and actions of the organization and may be able to shape its policies and strategies to their benefit. On the other hand, a stakeholder with low power may have little say in the decision-making processes and may be less able to affect the organization's actions (Mitchell et al., 1997). Power dynamics among stakeholders can impact the distribution of benefits and costs within an organization and can influence the overall success or failure of the organization (Senaux, 2008). Mitchell et al. (1997) categorize power on the basis of Etzioni's (1964) description of power in an organizational setting, which builds on the resource with which power is executed. Coercive power involves physical resources such as force or violence. Additionally, utilitarian power is exercised through material or financial resources. Lastly, normative power is based on symbolic resources such as prestige or esteem.

In the context of the stakeholders of professional sports clubs, coercive power can be exercised, for example, by players who refuse to continue their sporting performance (i.e., they strike), which in turn can have implications of coercive power (e.g., financial losses) and normative power (e.g., lower reputation due to lack of success) (Schmidt & Berri, 2004). Further examples of coercive power are the voting rights of shareholders in private clubs or of fans or members in membership-based organizations (McDonald et al., 2013). An example of normative power is fans stopping their active support or staying away from a game in protest (Earl & Kimport, 2009). Therefore, fans exert power since their absence will directly result in lower match attendance and gate receipts and indirectly result in lower income from media rights and sponsorships (Adam et al., 2020). Furthermore, fans 'voices' (Hirschman, 1970) their claims and affect team performance through the atmosphere they create in the stadium (Edensor, 2015).

2.1.2. Legitimacy

Legitimacy is the perceived fairness and appropriateness of a stakeholder's actions, decisions, and involvement in a particular situation or issue (Mitchell et al., 1997). This attribute is often evaluated based on the stakeholder's ability to demonstrate their authority, expertise, and credibility in relation to the issue at hand. In stakeholder theory, legitimacy is seen as an important factor in determining the level of influence and power a stakeholder has within a given system or organization. Weber (1947) describes legitimacy and power as distinct attributes that combine to create *authority*, but they can also exist independently. Stakeholders with high levels of legitimacy are more likely to be listened to and taken seriously by other stakeholders. In contrast, those with low levels of legitimacy may face challenges in being heard and having their interests considered.

For stakeholders of professional sports clubs, legitimacy can be operationalized as the degree to which stakeholders' concerns are “heard” by the club's management. Thus, the views and opinions of a legitimate stakeholder category are viewed as appropriate by the management of the club and/or other stakeholders (Biscaia et al., 2018). For example, fans seem to possess legitimacy since they regularly attend matches, purchase club merchandise, and are committed and loyal to the club, usually for a lifetime. However, a club's management may or may not listen to fan protests regarding topics such as “unwanted” sponsors or social responsibility (Bauers et al., 2023; Ginesta, 2013; Herold et al., 2022), thereby affecting the (self-)perceived legitimacy of fans.

2.1.3. Urgency

In stakeholder theory, the attribute of urgency refers to the need for immediate action or attention of an organization in regard to a particular stakeholder group or issue (Wagner Mainardes et al., 2012). This attribute is typically used to prioritize the needs and concerns of different stakeholders and to determine the appropriate course of action for addressing those needs in a timely and effective manner (Mitchell et al., 1997). An urgent stakeholder group or issue may require more immediate attention and resources than others in order to prevent

negative consequences or to capitalize on potential opportunities.

From the perspective of professional sports clubs, fans, as stakeholders, regularly have claims about a club's transfer strategy, ticket prices, and other factors that they communicate through different platforms (Xue & Mason, 2011). Players may also claim to be transferred to other clubs due to financially or sporting lucrative offers (Ericson, 2000). It can be assumed that a high urgency of requests is associated with a higher probability of a response (Easley & Lenox, 2006).

2.1.4. Interrelation of attributes

While Mitchell et al. (1997) framework provides a useful tool for identifying stakeholders based on the attributes of power, legitimacy, and urgency, it is important to recognize that these attributes do not function independently. Instead, they often interact and influence each other, creating dynamic stakeholder relationships. For instance, a stakeholder group with high legitimacy but low power may struggle to exert influence unless urgency amplifies their concerns, as seen when fan protests escalate in response to controversial management decisions. Conversely, stakeholders with high power but low legitimacy, such as external investors, may face resistance from fan groups who view their involvement as a threat to the club's values. This interplay highlights the importance of considering how these attributes combine to shape stakeholder salience rather than assessing them in isolation.

In the context of professional sports, the interplay between power, legitimacy, and urgency becomes even more complex due to the unique dynamics within clubs and their ecosystems. Fans, for instance, are generally perceived as legitimate stakeholders due to their longstanding support and emotional investment, yet their power to influence strategic decisions varies significantly (García & Welford, 2015). When fan groups organize collective actions or public protests, the urgency of their demands can increase their salience, compelling club management to respond despite the fans' limited formal power. Similarly, sponsors and investors may wield considerable power due to financial contributions. Still, if their actions are perceived as undermining the club's identity, their legitimacy may be questioned by core supporters. Therefore, understanding how these attributes interact is essential for managing stakeholder relations in professional sports clubs.

2.2. Blockchain applications in the sports sector

Blockchain is a distributed ledger technology for the secure representation and transfer of value on the internet. Blockchain networks are secured using cryptographic techniques, peer-to-peer (P2P) networks, and economic incentives, thereby eliminating the need for intermediaries (Beck et al., 2016; Nakamoto, 2008; Steinmetz et al., 2020). In addition, blockchains can feature smart contracts that enable the implementation of business logic via decentralized anchored scripts. These scripts are executed upon receiving a predefined trigger, such as a transaction, and allow for the creation and development of decentralized applications (dApps), decentralized autonomous organizations (DAOs), and digital tokens (Ante, 2021; Buterin, 2014). The potential of blockchain technology and smart contracts is enormous, as can be seen particularly in the financial/crypto asset sector (Cong et al., 2021; Cong & He, 2019) but also, e.g., energy markets (Ante et al., 2021) or supply chains (Kamilaris et al., 2019). However, blockchain technology has considerable potential for many other sectors and applications, such as the sports sector (Scharnowski et al., 2022; von Rueden, 2020).

Scharnowski et al. (2022) break down blockchain-based applications in the sports sector into seven distinct areas, including cross-organizational management tools, shared data platforms, cryptocurrency payments, non-fungible tokens (NFTs), smart legal contracts (for athletes), funding, and utility tokens for fan engagement (i.e., fan tokens). The use of blockchain technology can create new revenue streams and assist organizations in developing more efficient data management (Naraine, 2019). In addition, blockchain technology can be used to create, store, and manage athlete contracts or sponsorship

agreements using smart contracts (Bernstein, 2018). The sale of digital tokens can be used as a tool to fund, e.g., new stadiums, player transfers, or even individual sports careers (Carlsson-Wall & Newland, 2020; Naraine, 2019). NFTs can be used for more reliable and tamper-proof tickets (Regner et al., 2019) or digital trading cards and collectibles of athletes or clubs (Ante, 2022).

Fan tokens are one major application area of blockchain technology in the sports sector. They represent utility tokens issued by sports clubs, associations, or other entities and can be described as an in-between of ownership of the club (i.e., shares) and traditional association membership (Baker et al., 2022). Currently, the largest provider and market leader for fan tokens, Chiliz (operated by the Socios.com platform), describes fan tokens as a crypto asset being named after a sports team or organization that grants holders voting rights that enable them to participate in decision-making processes regarding the organization (Chiliz, 2018). Fan tokens can be conceptualized using the three dimensions: 1) trust and efficiency (via blockchain technology), 2) utility (via voting rights), and 3) financialization (since tokens can be traded). (Ante et al., 2023). According to Scharnowski et al. (2022), fan tokens offer a range of participatory possibilities that can be categorized into three channels. The first channel is the governance channel, which enables token holders to participate in club-related decisions, such as jersey design or goal music, by exercising their voting rights. Each token holder receives one vote per token, and the voting process can only be conducted through the Socios app. Smart contracts on the blockchain facilitate automatic and binding decision-making (Mazur & Vega, 2022; Scharnowski et al., 2022). Mazur and Vega (2022) describe three dimensions that a fan token offers to a buyer: Fandom, investment, and patronage. These dimensions represent a unique connection between fans and clubs, financial commitment to digital assets, and support for a team in good or bad times. In summary, fan tokens provide both monetary and non-monetary value to their holders by granting them voting rights and demonstrating their support and identification with the club through ownership of a fan token (Mazur & Vega, 2022; Scharnowski et al., 2022).

While the current literature and case studies on fan tokens shed light on various opportunities and challenges, they do not extensively delve into a strategic management perspective. Scharnowski et al. (2022) point out revenue opportunities for clubs and a new form of interaction with the fan base that can strengthen fan identification, engagement, and participation. However, fan tokens are extremely volatile and carry a large downside risk (Demir et al., 2022; Mazur & Vega, 2022; Scharnowski et al., 2022; Vidal-Tomás, 2022). Scharnowski et al. (2022) locate challenges in increasing restrictions, regulations, and even bans by regulatory authorities regarding fan tokens. Newall and Xiao (2021) point towards a similarity between fan tokens and gambling and mention a need for stronger fan token regulations. In fact, the UK regulator banned football club Arsenal London's advertising of its fan token offering because the ads did not alert fans to potential risks (Russell-Jones, 2021). An analysis by the European Parliament's Subcommittee on Economic and Monetary Affairs raises the question of how the payment of players with fan tokens is treated in terms of taxation. The report also states that European regulators will continue to monitor fan token developments (Houben et al., 2021).

In the following sections, we apply stakeholder theory as the analytical framework to evaluate the opportunities and challenges associated with fan tokens. This perspective will guide the analysis in both the multi-dimensional exploration of fan token impacts (Section 4) and the development of the stakeholder-oriented model (Section 5). By incorporating a strategic management perspective, we aim to address the existing research gap by systematically analyzing how fan tokens can be integrated into sports organizations' stakeholder strategies.

3. Methods and data

Qualitative research methods are frequently utilized to explore

uncharted and innovative subject matter, whereas quantitative investigation facilitates standardized data scrutiny (Lindner, 2020). Among various qualitative research methodologies, the qualitative expert interview stands as a prominent and efficacious means of procuring novel data (Myers & Newman, 2007). In order to scrutinize the viewpoints of German professional football, a qualitative research modality was selected due to its capacity to grant access to the expert's erudition and vantage point. Moreover, this investigative method proves particularly advantageous in the context of the scarcity of experts on the subject of fan tokens within German football and the deficit of empirical research precluding the employment of quantitative data collection. Consequently, implementing qualitative expert interviews emerged as the most suitable strategy to address the research queries and engender novel insights within this incipient domain of inquiry.

In relation to the expert interview, the notion of expertise encompasses individuals endowed with specialized pragmatic or experiential acumen, empowering them to efficaciously delineate the concrete sphere of action for others through their interpretations. The appellation of an expert is conferred upon individuals contingent upon their engagement and the realm of research or professional endeavor in which they participate (Bogner et al., 2014). The roster of experts interviewed is delineated in Table 1 for contextualization. Interviews were conducted between February and August of 2022. Each interview lasted between 46 and 83 min, depending on the depth of responses. The semi-structured interview protocol was designed to cover key thematic areas, including fan engagement strategies, financialization aspects of fan tokens, and governance implications. Questions were designed to be open-ended to facilitate in-depth exploration of each topic.

In order to achieve a comprehensive perspective, specialists from clubs affiliated with the three tiers of German professional football were solicited. However, select clubs within the 3rd league and 2nd Bundesliga were unable to accommodate interview inquiries, attributing this to insufficient or a complete lack of familiarity with fan tokens.

Considering the fact that numerous international football associations have already implemented fan tokens (Socios, 2022c), a German football association was incorporated into the sample to foster an all-encompassing comprehension of the subject matter. This inclusion is significant, as associations, which comprise a conglomerate of various football clubs, yield multifaceted outcomes and supplementary viewpoints on the topic. Moreover, it is of particular interest that half of the clubs within the 1st and 2nd Bundesliga engage sports rights marketing firms to enhance their clubs' visibility (Neumann, 2021). These sports

rights marketing agencies act as consultants and play a central role in establishing a link between clubs and suppliers. In doing so, they can represent the club's position on the issue of fan tokens. Consequently, sports rights marketing agencies affiliated with German professional football clubs were integrated into the sample.

Considering that not all members of a club or organization possess expert knowledge, interviewees were chosen based on their foundational understanding of sports marketing, blockchain technology, and fan tokens. Each selected expert demonstrated proficiency in sports management through their respective club position, as well as a rudimentary comprehension of blockchain technology and fan tokens. Saldana (2011) posits that no definitive guideline exists for determining the number of interviews to be conducted, as this aspect is contingent upon the unique characteristics of the research project. In this particular investigation, interviews were carried out until no additional information could be procured to address the research question (i.e., saturation effect).

The methodological framework integrates recommendations delineated by Myers and Newman (2007) as well as Saldana (2011) to devise and execute qualitative interviews. The research team elected to undertake individual interviews, employing a semi-structured interview protocol comprising open-ended queries in order to elicit unprejudiced perspectives. This technique facilitated improvisational and adaptive engagement whilst simultaneously ensuring the pertinent inquiries were addressed (Myers & Newman, 2007). To establish a consistent comprehension of the subject matter, participants were initially prompted to articulate their definition of "fan token." Subsequently, the interview focused on the opportunities and challenges concomitant with fan tokens, their practical applications, and the prerequisites for successful incorporation into German professional football. These interrogatives were formulated and arranged in correspondence with the study's research questions.

The interview protocol functioned as a flexible scaffold to guarantee coverage of essential topics while concurrently permitting adaptability and receptiveness contingent upon the progression of the discourse. Participants were apprised of the research objectives prior to the interview, although the interview protocol was not disclosed beforehand. Except for one instance conducted telephonically, the interviews were conducted virtually. Ultimately, the methodological approach to the qualitative interviews, informed by prevailing best practices, yielded comprehensive and impartial data concerning fan tokens within the context of German professional football.

The investigation relied on stringent transcription methodologies to convert the audio recordings of interviews into written form. To safeguard the anonymity of the research participants, both the transcripts and the presentation of findings were anonymized. During the transcription phase, superfluous elements such as gap fillers and disfluent speech were excluded, as they lacked a significant contribution to the analytical process. The collected data underwent a qualitative content analysis, incorporating open coding techniques as outlined by Saldana (2011). Initially, the transcribed material was condensed and paraphrased, ensuring the preservation of essential content without distortion or omission. Subsequently, the complete text passages were subjected to open coding, with individual codes being systematically categorized into opportunities and challenges to enhance their pertinence to the research inquiries. Inductive categories, including economic, social, technological, political, legal, and environmental dimensions (Debnath et al., 2021), were subsequently derived from the coding process. To ensure the validity of the derived categories, another researcher conducted a secondary round of validation utilizing the textual data. In cases of disagreement between the first and second researchers, a third independent researcher was consulted to resolve conflicts and achieve consensus. The MAXQDA software was employed for data extraction and analysis. Examples from the interviews were translated from German into English to facilitate the dissemination of the findings within this article.

Table 1
Synopsis of Expert Interviewees.

ID	Role	Field of expertise	Relevant experience	Organization
E1	Marketing	Digital transformation	6 years	Football club (1st Bundesliga)
E2	Innovation Manager	Digital transformation	6 years	Football club (1st Bundesliga)
E3	Innovation Manager	Digital innovation	4 years	Football club (1st Bundesliga)
E4	Marketing	Digital innovation	2 years	Football club (1st Bundesliga)
E5	Innovation Manager	Digital innovation	2.5 years	Football club (1st Bundesliga)
E6	Information Technology	Digital innovation	9 years	Football club (2nd Bundesliga)
E7	Marketing	Sports marketing	9 years	Football club (2nd Bundesliga)
E8	Marketing	Sports marketing	4 years	Football club (2nd Bundesliga)
E9	Manager	Digital innovation	1 year	Football association
E10	Business Development	Sports marketing	4 years	Sporting rights marketing agency
E11	Innovation manager	Digital strategy	5 years	Sporting rights marketing agency

The qualitative findings from the expert interviews directly informed the development of the stakeholder-oriented model. Insights gained during the interviews helped identify key stakeholder interests, conflicts, and strategic considerations, which were then systematically integrated into the model. By iterating between data analysis and model construction, we ensured that the model accurately reflects the practical realities and stakeholder dynamics observed in the field.

4. Opportunities and challenges of fan tokens

In this section, we provide an in-depth analysis of the opportunities and challenges associated with fan tokens in the context of German professional football clubs and their stakeholders. As previously described, the results are structured along economic, social, technological, political, legal, and environmental dimensions, which are used to explore the interdisciplinary aspects of fan tokens. Table 2 provides a high-level summary of the results.

Table 2
Summary of Opportunities and Challenges Associated with Fan Tokens.

Dimension	Opportunities	Challenges
Economic	<ul style="list-style-type: none"> - Corporate finance (E 2,5,6,8,9,10) - Fundraising through Fan Token Offerings (FTOs) (E 4,6,7) - Incentivization and rewards (E 1,2,6,7) - New target groups (E 1,2,6) 	<ul style="list-style-type: none"> - Financial risks (E 1,2,3,4,5,9,11) - Market volatility (E 1,2,3,4,5,9,11) - Lack of internal resources (human resources, knowledge, funding) (2,3,5,6,8,9,10)
Social	<ul style="list-style-type: none"> - Fan engagement (E 1,2,6,7,9) - Enhanced fan experience (E 1,2,3,5,6,9,11) - Strengthened fan-club bond (E 1,2,3,5,6,9) - Access to exclusive content (E 1,2,3,5,6,9,11) 	<ul style="list-style-type: none"> - Membership devaluation (E 1,2,4,6,7,8,10,11) - Exclusivity concerns / exclusion of fan groups (E 3,4,7) - Risk-aversion (E 2,5,7,8,9,10,11) - Resistance to digitalization (E 3,4,5,6,7,8,9,10)
Technological	<ul style="list-style-type: none"> - Adoption of innovative technologies (E 1,2,3,4,6,7,10,11) - Secure and transparent transactions (E 3,4,6,7,9,11) - Integration with NFTs and smart contracts (E 1,3,6,10,11) - Club digitalization (E 2,3,4,7,11) - Digitization of membership (E 2,3,4,7,11) 	<ul style="list-style-type: none"> - Infrastructure requirements (E 1,2,4,6,7,9,10,11) - Network congestion, scalability, and interoperability (E 1,3,4,6,10,11) - Lack of technological knowhow (E 5,8,9) - Access barriers (E 1,2,3,4,7,9,10) - Blockchain market maturity (E 1,2,4,6,7,9,10)
Political	<ul style="list-style-type: none"> - Democratization of club decisions (E 2,3,6,7,11) - International fan involvement (E 2,6,7) - Increased traceability and transparency of club decisions (E 6,7,9) - Decentralized community-driven clubs (E 3, 9) 	<ul style="list-style-type: none"> - Governance regulations (for member associations) (E 3,4,6) - Fair distribution of voting rights (E 4,6,7,9,10,11) - Stakeholder alignment (E 5) - Dilution of club (management) power (E 5,6,8,9,10)
Legal		<ul style="list-style-type: none"> - Legal uncertainty (E 2,4,5,6,9) - Potential future regulations (E 4,9) - Legal risks associated with token issuance (E 2,5,9)
Environmental	<ul style="list-style-type: none"> - Adoption of energy-efficient blockchain solutions (E 6) - Energy savings through digitized voting (E 3) 	<ul style="list-style-type: none"> - High energy consumption of the blockchain (E 1,6,7)

4.1. Economic dimension

From an economic perspective, fan tokens offer clubs a new revenue stream through the sale and resale of tokens (E 2,5,6,8,9,10). As one expert stated, “*First of all, it is a source of money. I think that’s the primary reason why soccer is even looking at it at all*” (E 5). The funds generated from fan tokens can contribute significantly to clubs’ financial resources and enable them to invest in various projects, such as infrastructure development or youth training centers (E 4,6,7). One expert illustrated this point by saying, “*For example, if you now think that it could also be a kind of digital cooperative, where you acquire a token [...] that you then invest money somewhere in a social project or an infrastructure project such as a new building for the youth training center*” (E 7).

Moreover, fan tokens can function as a fundraising tool through mechanisms like Fan Token Offerings (FTOs), providing clubs with an alternative and potentially more efficient method for raising capital (E 4,6,7). This fundraising potential can help clubs diversify their revenue sources and reduce their reliance on traditional sources of income (E 4,6,7).

Another economic advantage of fan tokens lies in their ability to incentivize and reward transactional or charitable fan actions (E 1,2,6,7). By offering fans the opportunity to earn tokens through purchasing merchandise, attending matches, or donating to social causes, clubs can create a positive feedback loop that encourages fan loyalty and increases revenue (E 1,2,6,7). One expert commented on this aspect, stating, “*The tokens could be a form of incentivization [...] to give the fans the feeling that what I do well at the club is seen, it is rewarded, I can collect points, collect tokens, whatever, and these, in turn, bring me something*” (E 2). Another expert mentioned, “*If you actually manage to combine the linking of a loyalty program, perhaps with a fan token, and really create real-life added value, that is the supreme discipline for me*” (E 1).

Fan tokens also have the potential to attract new target groups, including younger generations interested in innovative technologies (E 1) and people familiar with digital and crypto platforms (E 2,6). One Expert describes this with the statement, “*it’s the case that I can use it to address target groups that I might not be able to reach so easily as a club at the moment. A very, let’s say, technology- or digital-savvy target group*” (E 2).

However, clubs must also be aware of the potential financial risks associated with fan tokens, such as market volatility, price manipulation, and regulatory uncertainties (E 1,2,3,4,5,9,11). Clubs must be aware of their social presence and protect buyers from potential price losses (E 6).

Another challenge mentioned is a lack of internal resources, i.e., knowledge gaps (E 2,3,5,8,9), lack of human resources (2,5,6,8,10), and financial resources (E 3,8) to address the topic more intensively. One expert describes this through the statement, “*We also lack these expert opinions. We would have to buy them in or rely on what experts tell us*” (E 5). “*We have focused on other topics that we are implementing [...] If we were ten more, I don’t know, we might have tried to resolve the issue of fan tokens in our company*” (E 5).

4.2. Social dimension

Fan tokens offer various opportunities for clubs in terms of fan engagement. They enable fans to have a say in club-related decisions through voting mechanisms, giving fans a sense of value and voice within the club (E 1,2,6,7,9). “*Through fan tokens you have the opportunity to say, okay, the fan is part of the whole thing. The fan is somehow actively involved in all the topics and has a say in them*” (E 9).

Furthermore, fan tokens can strengthen the emotional bond between fans and clubs by offering affiliation to an exclusive community or access to exclusive content, enhancing fan identification and pride (E 1,2,3,5,6,9,11). Expert 3 describes this as when a fan token is purchased, “*a fan has entitlements or exclusive entitlements. Coupled, in principle, with what is now a membership, where you are simply a club member, that you are then tied even more to the club via this token and can participate in even more*

things.” (E 3).

On the other hand, fan acceptance and utility emerge as social challenges. The experts assert that the real added value that fans get from holding such tokens is generally negligible (E 10). Furthermore, the voting rights that fans obtain through current fan token models are considered largely irrelevant (E 4). In this context, fan tokens are perceived by fans as a competitive product to association membership and as a devaluation of their membership status (E 1,2,4,6,7,8,10,11). One Expert comments on this challenge *“I still see the danger in the constructs that have been presented to us so far that I will annoy a classic member to the extent that someone will suddenly get rights via a token that a member has not previously been granted”* (E 1). Another Expert expresses the challenge as follows: *“There is a danger that the body of the general meeting will simply be watered down or may somehow lose its legitimacy. Because what should be voted on at the general meeting that cannot also be voted on via tokens?”* (E 7).

Resistance to digitalization among fans and clubs is another social challenge (E 3,4,5,6,7,8,9,10). One expert expresses this concern by stating, *“I think digitalization is a topic that many people still fear”* (E 7). Risk aversion is also considered a social challenge. German clubs are reluctant to be pioneers in fan tokens and prefer to wait for further developments (E 2,5,7,8,9,10,11). One expert states, *“Germans are simply very risk-averse. We like to think things through from A to Z first, instead of just doing or trying them out”* (E 5). This is also why the negative example of Borussia Dortmund with regard to fan tokens in German professional soccer has deterred German clubs from pursuing the issue again (E 2,4,5,6).

4.3. Technological dimension

Fan tokens offer clubs the opportunity to engage with new and innovative technologies, such as blockchain and cryptocurrencies (E 2,3,4,6,7,9,10,11). By adopting these solutions, clubs can not only digitalize products and processes but also keep up with technological advancements in the sports industry (E 1,4,6,7). As one expert commented, *“we are also increasingly concerned about how we can create special offers for young fans for the next generation. And that [fan tokens] can be a very, very interesting technology”* (E 1). Furthermore, the use of blockchain technology can ensure the security and transparency of fan token transactions, thereby fostering trust and confidence among fans and stakeholders (E 3,6,7,9). One expert describes fan tokens as *“a way to become more transparent and a bit more open with the community and fans. Blockchain is traceable. [...] because we can just say, absolutely transparent, you have this number [of votes], these are the co-determination rules, these are the results.”* (E 9).

Another technological opportunity arising from the use of fan tokens is the potential integration with other digital solutions, such as NFTs and smart contracts (E 1,3,6,10,11). This integration could create new avenues for fan engagement, merchandise sales, and ticketing, as well as enhance the overall fan experience (E 1,6,10). One expert suggested that fan tokens could be *“a good first way to get people to NFT or get started in blockchain”* (E 10), highlighting the potential of fan tokens to serve as an entry point into other digital technologies. By leveraging these synergies, clubs can develop a comprehensive digital ecosystem that caters to the evolving needs and preferences of their fan base (E 1,3,6,10).

Fan tokens also offer the potential to digitize and modernize traditional forms of association membership (E 2,3,4,7,11). One expert stated, *“that’s the good thing about the whole issue again. I believe that it requires or promotes a rethink, that this whole classic form of membership is broken up a bit and that it is rethought a bit, and we look at how we can perhaps make it more contemporary in a different way”* (E 2). Fan tokens can also enhance the verification and participation of voting by members outside the general meeting (E 3,4). As one expert remarked, *“every member gets a fan token, and this can then be used, for example, to give someone the right to vote at a general meeting. So that would clearly be a form of digitalization of the association system that I would support.”* (E 4).

However, the implementation of fan tokens also poses technological challenges, such as the need for robust infrastructure and a certain market maturity to support the adoption and use of fan tokens (E 1,2,4,6,7,9,10,11). Clubs must invest in the necessary infrastructure, security measures, and technical expertise to ensure the safe and seamless operation of fan token platforms (E 2,3,5,8,9).

Additionally, they must be prepared to manage potential technical issues, such as network congestion, scalability, and interoperability with other platforms, which could impact the overall user experience and adoption of fan tokens (E 1,3,4,6,10,11). One expert emphasized the importance of addressing these challenges, stating, *“what can I actually place for further offers there naturally still”* (E 6).

Another challenge with current models is the technological complexity and accessibility for fans (E 1,2,3,4,7,9,10). One expert describes this challenge with the words that with fan tokens in its current form, *“you simply let a selection take place, because not everyone has access to such tokens or not everyone is so well read or so digitally fit that he can get these fan tokens”* (E 7). In addition, expert 10 states that in the context of access barriers, *“the fans are not yet at a level of an understanding of this technology.”*(E 10).

4.4. Political dimension

In the political (or governance) dimension, fan tokens have the potential to democratize club decisions by allowing fans to participate in club-related matters through digital voting (E 2,3,6,7,11). This opportunity enables international and non-regional fans who cannot attend annual general meetings to engage in club decisions actively. One expert stated, *“of course, this could particularly appeal to international fans because otherwise they would not have the opportunity to participate. They cannot come to the stadium; they cannot be at fan meetings”* (E 6). Another expert suggested that a fan token *“has the potential to be a very inclusive tool, namely, to allow everyone to enter the association”* (E 11).

Furthermore, fan tokens can facilitate the creation of decentralized community-driven clubs based on the concept of Decentralized Autonomous Organizations (DAOs) (E 3,9). One expert discussed this possibility, stating, *“above all, I see an enormous opportunity in the direction of DAOs [...] where everything will be organized in some form via such tokens not just once a year but on a regular basis and the association will then be democratized a bit more”* (E 3). This democratic aspect of fan tokens can lead to better traceability and transparency of club decisions (E 6,7,9).

However, the political implications of fan tokens also involve potential regulatory challenges, as clubs, particularly member associations, must navigate a complex landscape of international and national regulations related to digital assets, such as the consideration of the articles of association (E 3,4,6). One example is the fair distribution of votes in fan token-based voting, which is essential to avoid potential legal problems or violations of the rules for statutory decision-making (E 4,6,7,9,10,11). One expert supports this with the statement, *“we don’t want to give people the opportunity to influence some decisions through greater financial power.”* (E 4).

In addition, the lack of will or the possibility to give power to the fans is also a challenge (E 5,6,8,9,10). One expert clarifies this with the statement that *“no club in the world, even if the structure of a club is first designed, wants that the fans have too much right of co-determination.”* (E 5). It must be clarified within the club which decisions can be made via fan token voting (E 5). One expert summarizes that *“at the end of the day, we don’t have the power to decide and say to our fans, please help us decide, because a sponsor would have to do that.”* (E 5). Consequently, fan token votes on club issues must also be aligned with boards, investors, and other stakeholders (E 5).

4.5. Legal dimension

A legal challenge related to fan tokens is the regulatory uncertainty surrounding their classification as, e.g., security or utility tokens.

Depending on the classification, clubs may face different legal requirements and consequences (E 2,4,5,6,9). As one Expert states, “it’s not even foreseeable yet what will be allowed and what will not” (E9), this uncertainty further complicates clubs’ decision-making processes and may deter them from pursuing fan tokens as a viable option. In Addition, tax treatment and cross-border tradability (cf. E 6), as well as legal protection in the event of a price crash, must also be regulated (E 9). Legal requirements for the advertising of speculative objects must also be implemented and complied with (E 2,5).

4.6. Environmental dimension

Energy savings from replacing physical on-site voting with fan token-based digital voting can be cited as an opportunity (E 3). One expert describes this as “That you no longer need a general meeting where 20,000 people come to the stadium, which is a huge effort [...] But that this is coupled much more automatically via such tokens.” (E 3). The application of energy-efficient blockchain solutions also represents an opportunity (E 6).

However, the energy consumption associated with blockchain technology may pose an important challenge from an environmental perspective (E 1,6,7). As the use of fan tokens is based on blockchain technology, this could lead to increased energy consumption (E 7). This concern is particularly relevant for clubs that are committed to sustainability and environmental protection (E 1). However, the environmental impact of fan tokens can be mitigated through the adoption of more energy-efficient blockchain solutions, such as Proof of Stake (PoS), instead of energy-intensive consensus algorithms like Proof of Work (PoW) (E 4,6).

5. A stakeholder-oriented model for assessing fan token strategies in sports clubs

5.1. Model description

While a systematic identification and overview of the potentials and challenges of fan tokens already represents a contribution to academia and practice, the question arises as to how exactly these various identified points can and should be interpreted by sports clubs. While a comprehensive answer to this question cannot be given in the context of this article, we propose a formal model for a sports club to assess the utilization of a fan token strategy. This model draws on stakeholder theory and relies on the stakeholder assessment framework of Mitchell et al. (1997) and the stakeholder categories posited by Senaux (2008). It represents an option for sports clubs to build on the identified set of opportunities and challenges that may arise from the utilization of fan tokens in order to come to an individual decision for or against the use of a fan token.

Thus, sports clubs can derive and operationalize criteria based on the opportunities and challenges presented in the previous section and then apply them to the following model (or a simplified form of it) to assess their fan token strategy. To illustrate this, we show an example calculation of a simplified model in the following section. This is intended to increase the understanding of fan tokens for stakeholder decision-making and the applicability of the model. Further research or detailed operationalization of variables is required for further and practical use.

Let t represent the period at which the sports club is deciding with respect to a fan token strategy. We represent the set of stakeholder categories as $j = \{1, 2, \dots, 7\}$, where the indices correspond to the stakeholder categories of Senaux (2008). The chosen decision alternatives for the fan token strategy are represented by the set $i = \{1, 2, 3\}$, where 1 denotes a FTO, i.e., the commercial issuance of a token, 2 denotes a non-commercial issuance of a token, and 3 denotes the decision not to issue a token at all. Overall, these strategies represent only examples, as there may be other viable options. We then define the

stakeholder value function $V_i(t)$ as:

$$V_{ij}(t) = \omega_j \sum_{k=1}^3 \omega_{jk} \left\{ \sum_{l=1}^{L_{ijk}} \omega_{jkl} [P_{ijkl}(t) - C_{ijkl}(t)] \right\} \quad (1)$$

Where ω_j is the weight assigned to a stakeholder category j , ω_{jk} is the weight assigned to a stakeholder attribute k (power, legitimacy, or urgency) for a stakeholder j in line with Mitchell et al. (1997). ω_{jkl} is the weight assigned to a potential or challenge l for a stakeholder j under the attribute k . $P_{ijkl}(t)$ and $C_{ijkl}(t)$ represent the potential and challenge functions and L_{ijk} denotes the total number of potentials and challenges. The weights represent the relative importance of various factors that influence the strategic decision-making process concerning fan tokens. They are inherently variable and context-dependent, as they are shaped by the specific circumstances, stakeholder groups, and strategic objectives of the respective sports club. Consequently, determining these weights in practical settings can be a complex task. A viable approach to addressing this challenge involves actively engaging key stakeholders through participatory modeling techniques. Such methods facilitate a collaborative assessment of the relevance and impact of each factor, thereby promoting a nuanced and contextually grounded assignment of weights. This participatory process may encompass structured workshops, expert panels, or surveys, each designed to systematically capture and integrate diverse perspectives. By employing these techniques, sports clubs can ensure that the assigned weights accurately reflect the relative importance of each factor, thus aligning the model more closely with the specific realities and strategic needs of the organization.

The club’s goal is to maximize the total value across all stakeholder categories, which can be expressed as:

$$\max_i \sum_{j=1}^7 V_{ij}(t) \quad (2)$$

Control variables, risk factors, stochastic elements, and interaction effects can be incorporated into the model as follows:

Control variables $X_{ij}(t)$ are factors that may influence the decision-making process, but are not directly related to the fan token strategy. Examples of control variables are club revenue, team performance, and stadium capacity. The stakeholder value function can be adjusted to account for these control variables:

$$V_{ij}(t) = \omega_j \sum_{k=1}^3 \omega_{jk} \left\{ \sum_{l=1}^{L_{ijk}} \omega_{jkl} [P_{ijkl}(t) - C_{ijkl}(t)] + \beta_{ij} X_{ij}(t) \right\}, \quad (3)$$

where β_{ij} represents the influence of the control variables on the value of the j -th stakeholder category under the i -th fan token strategy at time period t .

To account for risk factors $X_{ij}(t)$, such as regulatory risks or financial risks, we can incorporate them into potentials $P_{ijkl}(t)$ and challenges $C_{ijkl}(t)$ as follows:

$$P_{ijkl}(t) = p_{ijkl}(t) - \alpha_{ij} X_{ij}(t), \quad (4)$$

$$C_{ijkl}(t) = c_{ijkl}(t) + \alpha_{ij} X_{ij}(t), \quad (5)$$

where α_{ij} represents the influence of risk factors on the potential and challenge functions.

To account for uncertainty in the model, we introduce stochastic elements, $S_{ij}(t)$, which are random variables that introduce uncertainty into the functions $P_{ijkl}(t)$ and $C_{ijkl}(t)$, affecting them for the j -th stakeholder category under the i -th fan token strategy at time period t :

$$P_{ijkl}(t) = p_{ijkl}(t) - S_{ij}(t), \quad (6)$$

$$C_{ijkl}(t) = c_{ijkl}(t) + S_{ij}(t), \quad (7)$$

Interaction effects occur when the impact of a decision on one stakeholder is influenced by the presence or actions of another

stakeholder. To account for interaction effects between stakeholders, we introduce an interaction term, $S_{ij}(t)$, between stakeholder j and stakeholder m . The stakeholder value function can be modified as follows:

$$V_{ij}(t) = \omega_j \sum_{k=1}^3 \omega_{jk} \left\{ \sum_{l=1}^{L_{jk}} \omega_{jkl} [P_{ijkl}(t) - C_{ijkl}(t)] + \beta_{ij} X_{ij}(t) + \sum_{m=1, m \neq j}^7 \gamma_{ijm} I_{ijq}(t) \right\}, \tag{8}$$

where γ_{ijm} represents the influence of the interaction term between the stakeholders j and m for fan token strategy i at time period t .

With these extensions, the club’s optimization problem (see eq. 2) becomes subject to the modified stakeholder value function, potential and challenge functions, and the constraints introduced by control variables, risk factors, stochastic elements, and interaction effects.

This model allows a sports club to assess the utilization of a fan token strategy by incorporating the power, legitimacy, and urgency of different stakeholders, as well as considering the opportunities, challenges, control variables, risk factors, stochastic elements, and interaction effects. A sports club can use this model to make informed decisions regarding the issuance and use of a blockchain-based fan token and evaluate how the various stakeholders will be affected by such a fan token at different time periods.

A club may need to estimate some of the parameters in the model, such as the weighing factors using historical data, expert judgment, or other relevant sources of information. Furthermore, the club should consider the robustness of the model to uncertainties and parameter estimation errors, which can be addressed through sensitivity analysis, scenario planning, or other decision-making techniques under uncertainty. By solving the optimization problem, the club can identify the optimal decision alternative for its fan token strategy, while accounting for the complex interdependencies among the various stakeholders and external factors.

5.2. Exemplary model estimation

5.2.1. Assumptions and baseline setup

In this section, we provide an exemplary estimation of the stakeholder-oriented model proposed in the paper for assessing fan token strategies in sports clubs. This example, based on a hypothetical scenario, illustrates the application of the model and its key elements, albeit simplified to enhance comprehension.

The assumptions underpinning this estimation are as follows:

- We consider three stakeholder categories, represented as $j = \{1, 2, 3\}$. These are fans ($j = 1$), investors (shareholders; $j = 2$), and regulatory bodies (local authorities; $j = 3$).
- We examine three decision alternatives for the fan token strategy, represented as $i = \{1, 2, 3\}$. These are fan token offering (FTO, $i =$

1), non-commercial issuance of a token ($i = 2$), and not issuing a token at all ($i = 3$).

- We assign the weights for each stakeholder group as $\omega_1 = 0.4$ (for Fans), $\omega_2 = 0.4$ (for investors), and $\omega_3 = 0.2$ (for regulatory bodies). These weights reflect the relative importance of each stakeholder category in the decision-making process. The weights are illustrative and were randomly assigned to demonstrate the model’s functionality. As the model is primarily conceptual at this stage, these weights do not reflect empirical data but rather serve as a hypothetical example to showcase the model’s structure and potential application. Future studies would require data-driven estimation of these weights, tailored to specific stakeholder contexts and validated through empirical analysis.
- For each stakeholder group, we select two opportunities (potentials) and two challenges, drawn from the summary of opportunities and challenges associated with fan tokens from the study, which are shown Table 3.
- Opportunities and challenges are estimated for (1) worst-case (low potential, high challenges), (2) baseline (moderate potentials and challenges) and (3) best-case (high potentials, low challenges) scenarios.

The stakeholder value function $V_i(t)$ for each combination of decision alternative and stakeholder category is calculated using the formula:

$$V_{ij}(t) = \omega_j [P_{ijkl}(t) - C_{ijkl}(t)] \tag{9}$$

Here, $P_{ijkl}(t)$ represents the potential function, $C_{ijkl}(t)$ represents the challenge function, and ω_j represents the weight assigned to a stakeholder category j .

Subsequently, we calculate the total value for each decision alternative by summing up the stakeholder value functions across all stakeholder categories:

$$Total\ value\ (i) = \sum_{j=1}^3 V_i(t) \tag{10}$$

The decision alternative with the maximum total value is selected as the optimal decision.

5.2.2. Scenario analysis

Relying on the above-mentioned assumptions, the total values for each decision alternative (FTO, non-commercial issuance, not issuing a token) per scenario are estimated. As an example, for the baseline scenario, the stakeholder values are found to be 52, 4, and -48 respectively. The decision alternative with the maximum total value is the first one, i.e., issuing a fan token via FTO. Fig. 1 visualizes the estimation results for each strategy, showing stakeholder-specific results. Each bar corresponds to a decision alternative. The total value of the entire bar

Table 3
Selected potentials and challenges for each stakeholder Group in the fan token strategy model.

Stakeholder Group	Type	Description	Quantification for scenarios*		
			Worse case	Mixed case	Best case
Fans	Opportunity	Enhanced fan experience	$P_{11k1} = 70$	$P_{11k1} = 90$	$P_{11k1} = 100$
Fans	Opportunity	Access to exclusive content	$P_{11k2} = 50$	$P_{11k2} = 70$	$P_{11k2} = 80$
Fans	Challenge	Exclusivity concerns	$C_{11k1} = 80$	$C_{11k1} = 70$	$C_{11k1} = 60$
Fans	Challenge	Resistance to digitalization	$C_{11k2} = 60$	$C_{11k2} = 50$	$C_{11k2} = 40$
Investors	Opportunity	Fundraising through FTOs	$P_{12k1} = 85$	$P_{12k1} = 95$	$P_{12k1} = 105$
Investors	Opportunity	New target groups	$P_{12k1} = 75$	$P_{12k1} = 85$	$P_{12k1} = 90$
Investors	Challenge	Financial risks	$C_{12k1} = 60$	$C_{12k1} = 50$	$C_{12k1} = 40$
Investors	Challenge	Legal uncertainty	$C_{12k2} = 100$	$C_{12k2} = 90$	$C_{12k2} = 80$
Regulatory Bodies	Opportunity	Increased traceability and transparency of club decisions	$P_{13k1} = 70$	$P_{13k1} = 80$	$P_{13k1} = 90$
Regulatory Bodies	Opportunity	Democratization of club decisions	$P_{13k2} = 60$	$P_{13k2} = 70$	$P_{13k2} = 80$
Regulatory Bodies	Challenge	Legal uncertainty	$C_{13k1} = 90$	$C_{13k1} = 80$	$C_{13k1} = 70$
Regulatory Bodies	Challenge	Governance regulations	$C_{13k2} = 100$	$C_{13k2} = 90$	$C_{13k2} = 80$

* The quantification estimates are illustrative, based on arbitrarily chosen numbers to demonstrate the model.

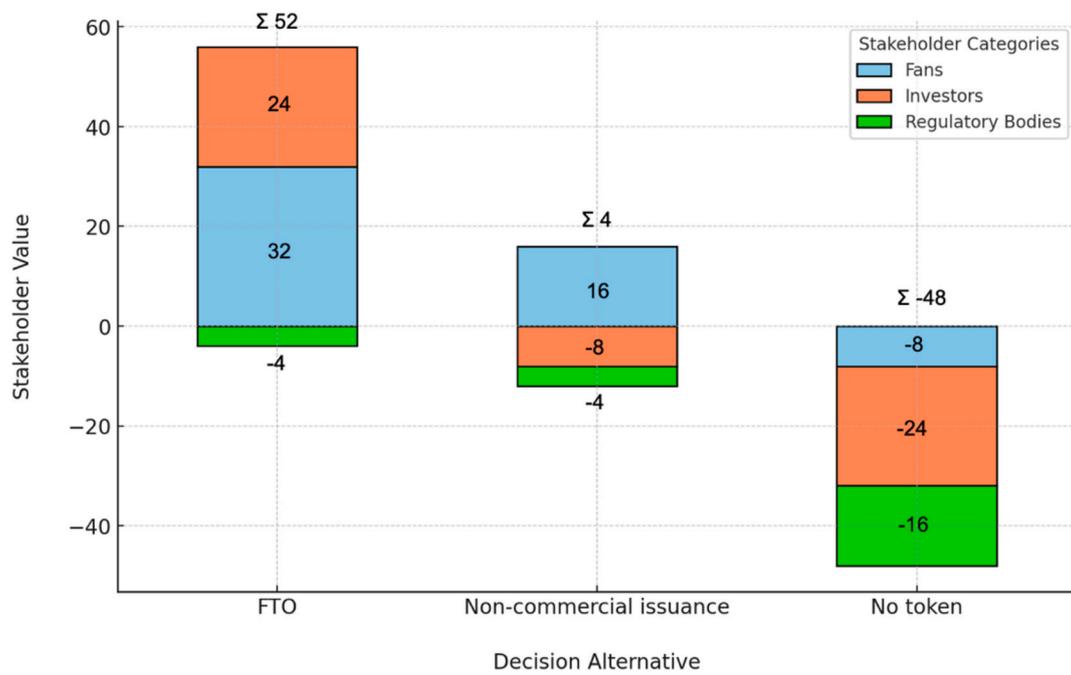


Fig. 1. Stakeholder value based on different fan token strategies.

represents the total of that decision alternative, which is the combined value of all stakeholder categories for that decision alternative.

If, for example, the weights of the stakeholder would be adjusted to 0.6 for fans, 0.3 for investors and 0.1 for regulatory bodies, the total values for each decision alternative (FTO, non-commercial issuance, not issuing a token) are found to be 64, 16, and - 38 respectively. The decision alternative with the maximum total value would remain the issuance of a fan token via FTO.

To evaluate the robustness of stakeholder values under uncertainty, we conducted a Monte Carlo simulation. The simulation introduced

stochastic fluctuations to the baseline potentials and challenges for each stakeholder category (fans, investors, regulators). Fluctuations were modeled as random variables drawn from a normal distribution $N(0,10)$ and applied to the fixed baseline values for each scenario (best-case, mixed-case, worst-case). For each of the 1000 iterations per scenario, the stakeholder value function was recalculated for each decision alternative (FTO, non-commercial issuance, no token). Key metrics, including the median, mean, standard deviation, and range, were derived to summarize the results. Pairwise *t*-tests were conducted to compare stakeholder values between alternatives. Fig. 2 shows the simulation

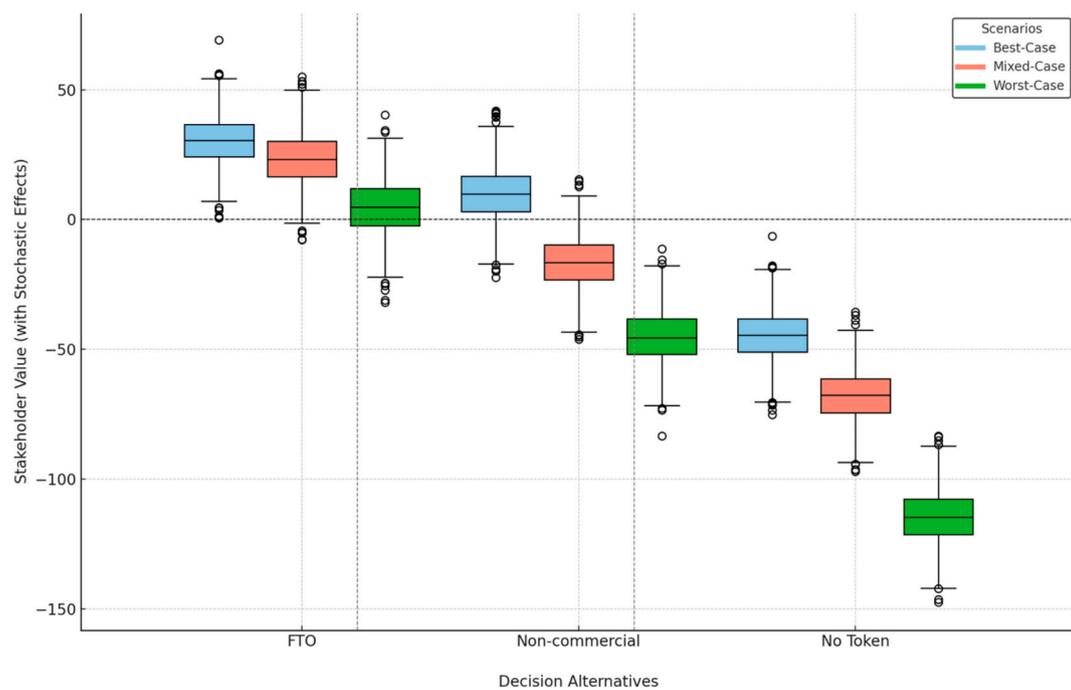


Fig. 2. Stakeholder value based on different fan token strategies. The figure visualizes the results of Monte Carlo simulations. Each decision alternative shows the distribution of total stakeholder values over 1000 iterations for each scenario. The boxes represent the interquartile range (IQR), a horizontal line marks the median, and the whiskers show the range of most data points. Outliers are shown as individual dots.

results; detailed statistics are provided in Table 4. The decision to conduct an FTO consistently shows the highest median and favorable outcomes across scenarios, with moderate variability in the worst case. The decision to issue no token consistently produces negative results, with the worst case showing the most unfavorable outcomes.

The presented estimations represent simplified representations to showcase the operational mechanics of the model. In an authentic application scenario, the model would necessitate a much more nuanced execution and detailed interpretation. The quantification of potential and challenge functions would be predicated on a comprehensive scrutiny of each identified opportunity and challenge, complemented by a detailed stakeholder analysis to assign appropriate weights. Furthermore, the model warrants the accommodation of several other factors, such as control variables, risk factors, and interaction effects. As such, the outcomes derived from this exemplified application should not be misconstrued as a definitive or exhaustive evaluation of fan token strategies but rather a theoretical illustration of the model’s applicability.

6. Discussion

The interviews in this study indicate several key findings related to the opportunities and challenges connected to blockchain-based fan token issuance. The participants identified possible benefits, such as increased fan engagement, loyalty, and revenue generation. These results align with existing literature, which suggests fan tokens can offer an additional revenue stream and strengthen ties between sports clubs and their supporters fans (Ante et al., 2023; Schellinger et al., 2022). The expert interviews, yet, also presented concerns about obstacles linked to fan tokens. Participants mentioned technological complexity, regulatory uncertainty, and potential reputational risks for the club. Such issues underscore the significance of addressing both internal and external stakeholder concerns and applying suitable risk management strategies.

The formal model introduced in this study applies a systematic method to assess the decision to adopt a fan token, reflecting the various opportunities and drawbacks identified in the interviews. Incorporating Mitchell et al.’s (1997) dimensions of authority, legitimacy, and urgency enables sports clubs to consider multiple stakeholder perspectives and gauge potential consequences of their decisions. The model is designed with flexibility, which helps clubs reassess shifting stakeholder positions over time, particularly given the quick changes in club digitization, blockchain technology, and fan token offerings. By integrating authority, legitimacy, and urgency, along with a balanced view of opportunities and drawbacks emerging from fan token usage, the model can aid sports clubs in determining the best course of action for their specific circumstances.

Beyond applying existing frameworks, this study advances the theoretical understanding of stakeholder dynamics by specifically examining how blockchain-based fan tokens challenge traditional governance models in sports. By integrating stakeholder theory with

digital innovation contexts, the study offers novel insights into how emerging technologies influence stakeholder relationships, highlighting both opportunities and tensions that arise when blending traditional fan engagement with digital asset-based involvement.

6.1. Implications

This study’s findings advance academic theory in several respects. First, by applying Mitchell et al. (1997) stakeholder assessment framework and Senaux (2008)’s stakeholder categories within the context of blockchain-based fan tokens, the study adds to the literature on sports club governance and stakeholder management. The comprehensive formal model introduced here addresses a gap in previous work by offering a rigorous and thorough strategy for sports clubs to evaluate whether to issue blockchain-based fan tokens. In doing so, the study not only highlights the relevance of stakeholder theory in navigating the complex dynamics of fan token adoption but also extends its application to emerging digital contexts.

By explicitly addressing the interplay of authority, legitimacy, and urgency in the context of digital asset issuance, the model underscores how stakeholder priorities may shift when clubs adopt innovative technologies. This theoretical extension is particularly significant given that blockchain-based fan tokens represent a novel intersection between financial innovation and stakeholder engagement, which has not been systematically analyzed before. Therefore, the study contributes to the understanding of how digital transformations in the sports sector influence governance practices and stakeholder management strategies.

Furthermore, in aligning our model with established theoretical frameworks, we position it within the taxonomy of theories for blockchain applications as outlined by Hanafizadeh and Alipour (2024). Specifically, our model can be identified as a theory for design and action, as it not only explains the stakeholder dynamics involved in fan token adoption but also provides practical guidance on implementing stakeholder-oriented strategies in the context of sports governance. By categorizing the model in this way, we make explicit its dual function of both understanding and guiding decision-making processes related to blockchain-based fan tokens. This theoretical positioning underscores the study’s contribution to refining stakeholder theory by incorporating digital transformation challenges unique to the sports sector.

This research adds new perspectives on the advantages and potential hurdles linked to blockchain-based fan tokens as a distinctive category of crypto asset (Ante et al., 2024; 2023; Demir et al., 2022; Ersan et al., 2022; Scharnowski et al., 2022). The interview findings provide an in-depth view of the factors shaping sports clubs’ decision-making processes, making a significant contribution to scholarship on blockchain applications within the sports sector (Carlsson-Wall & Newland, 2020; Schellinger et al., 2022). Ideally, future research will expand on these results. By integrating these elements into the formal model, the study enhances comprehension of how sports clubs may approach blockchain-based fan token issuance. These findings have notable implications for

Table 4

Monte Carlo Simulation Results. The table shows the results of Monte Carlo simulations. Each decision alternative shows the distribution of total stakeholder values over 1000 iterations for each scenario. The Δ columns show how much better or worse one decision alternative performs compared to the next in the pairwise comparison and indicate the statistical significance of the differences between alternatives based on a two-sample t-test. Statistical significance at the 1 %-level is denoted with ***.

Scenario	Decision alternative	Median	Mean	SD	Range	Δ FTO	Δ Non-commercial	Δ No token
Best case	FTO	30.57	30.55	9.70	(0.59; 69.26)	–	20.74***	75.15***
	Non-commercial	9.83	9.94	10.08	(–22.41; 41.93)	–20.74***	–	54.41***
	No token	–44.58	–44.53	9.81	(–75.20; –6.47)	–75.15***	–53.41***	–
Baseline case	FTO	22.21	23.25	10.29	(–7.77; 54.98)	–	38.72***	89.89***
	Non-commercial	–16.51	–16.54	9.91	(–46.08; 15.52)	–38.72***	–	51.17***
	No token	–67.68	–67.86	10.04	(–97.07; –35.57)	–89.89***	–51.17***	–
Worst case	FTO	4.86	4.83	10.21	(–31.88; 40.29)	–	50.45***	119.65***
	Non-commercial	–45.59	–45.17	10.35	(–83.37; –11.23)	–50.45***	–	69.20***
	No token	–114.79	–114.57	10.20	(–147.42; –83.42)	–119.65***	–69.20***	–

sports clubs that introduce blockchain-based fan tokens. Employing the formal model can facilitate more effective strategies for engaging with supporters and other stakeholder groups. The study also assists in shaping ideas on “sustainable participation” within professional football (Bauers et al., 2023), given that clubs may introduce barrier-free participation options through token-based initiatives.

The results also hold value for clubs seeking to blend traditional member participation with digital fan involvement. The ‘50 + 1 Rule’ and democratic member participation permit club members to influence organizational decisions. Each member has an equal vote in the general meeting of the association (Adam et al., 2020). This context clarifies why German clubs have not yet embraced *Socios.com* (Bauers et al., 2023). At present, democratic participation is not mandatory for voting rights. As a result, clubs must develop a suitable framework to reconcile token-based participation with democratic member participation. The identified opportunities and potential obstacles linked to fan tokens support the development of novel forms of fan involvement.

An additional point for football clubs is the emphasis on stakeholder engagement in decision-making. By applying the formal model and incorporating the dimensions of authority, legitimacy, and urgency in stakeholder relations, clubs can better comprehend and address the concerns and expectations of diverse stakeholder groups. This active approach to stakeholder management can build trust and promote more collaborative relationships, yielding greater value for all involved (Freeman, 1984).

The identification of opportunities and obstacles linked to fan tokens offers sports clubs beneficial perspectives on this emerging technology. Through thorough evaluation of these aspects, clubs can craft strategies that leverage potential advantages of fan tokens while reducing possible risks. This may involve developing strong marketing efforts to highlight the merits of fan tokens for supporters (Naraine et al., 2021) and instituting appropriate security protocols to prevent issues such as fraud or cyberattacks (Chen & Doran, 2022; Evans & Jenkins, 2018).

Insights on opportunities, obstacles, and control variables gleaned from expert interviews can help regulators achieve a deeper view of this emerging technology, leading to policies and regulations focused on addressing particular concerns and advantages related to fan tokens. By addressing legal uncertainties and risks, such as classification and market practices, regulators and licensors can reduce potential hazards and encourage innovation and beneficial results for sports clubs and their stakeholders.

This formal model provides a thorough representation of stakeholder viewpoints, benefits, obstacles, risks, and relationships. It can also function as a helpful resource for regulators, allowing them to evaluate trade-offs and impacts connected to different weighting approaches for football club stakeholders, including authority, legitimacy, and urgency. By examining various scenarios and outcomes, regulators can gain valuable insights on the likely effects of particular regulatory actions, supporting a balance between encouraging innovation and safeguarding stakeholder interests.

While the discussion has highlighted the multifaceted opportunities and challenges associated with fan token adoption, it is equally important to acknowledge potential tensions and contradictions. By examining the diverse perspectives of experts, we identified areas where opinions converge and diverge, particularly regarding stakeholder engagement and the balance between digital innovation and traditional fan involvement. Addressing these areas can provide valuable insights for sports clubs navigating the strategic use of fan tokens.

6.2. Limitations and future research

This investigation has certain constraints that warrant acknowledgment. First, the interview sample may not reflect all sports clubs and stakeholders. Future work might broaden the sample to include a wider variety of clubs, stakeholders, and regions, improving the generalizability of the outcomes. It is also relevant to mention the specific focus

on German professionals from the soccer sector, which may introduce unique conditions. Experts from other countries and sports could identify different prospects and obstacles. The results should thus be applied cautiously and confirmed in other contexts. As indicated in the introduction, the German football environment, represented by the 50 + 1 Rule, features distinctive factors not found in other domains (Bauers et al., 2020; Bauers & Hovemann, 2019b).

A second limitation is the exclusive focus on football clubs, potentially reducing the coverage of other stakeholder groups (Senaux, 2008). Club representatives are able to comment on the obstacles and prospects of fan tokens linked to fan engagement, but direct feedback from fans themselves may lead to different conclusions. Readers should remain mindful of this article’s standpoint, and future research might expand the scope by examining a wider range of stakeholder categories. This approach could reveal and analyze differing interests (Klenk & Nagel, 2012).

A third consideration concerns the formal model, which depends on various parameters and weights that may be somewhat subjective. Future work might investigate additional methods for establishing these parameters and weights, including expert elicitation or participatory modeling approaches. Though this study presents a model and its input criteria, a football club cannot simply implement it without further validation. The variables and parameters proposed here should be tested through other mechanisms, such as surveys, which can enable quantification of the potentials and obstacles of fan tokens, along with Mitchell et al.’s (1997) concepts of authority, legitimacy, and urgency, followed by trials in multiple scenarios and longitudinal validation. These findings highlight that the model has not yet undergone thorough scrutiny or testing with domain experts, indicating a limitation in the current research. A valuable step forward would be to include subject matter experts in the validation phase, potentially refining and reinforcing the model based on their insights.

7. Conclusion

This study introduces a model for assessing how sports clubs make decisions regarding blockchain-based fan tokens. Drawing on the stakeholder assessment framework proposed by Mitchell et al. (1997), the stakeholder categories identified by Senaux (2008), and findings from expert interviews, the formal model offers a strategy for analyzing potential outcomes of fan token adoption. It accounts for authority, legitimacy, and urgency across different stakeholder groups, along with benefits, drawbacks, control parameters, risk factors, interaction effects, and stochastic elements.

The qualitative work, incorporating interviews with professionals from the football sector and the development of a formal model, reveals valuable observations about the intricacies of the decision-making process. The findings underline the relevance of stakeholder involvement, the importance of balancing benefits and drawbacks, the role of control parameters and interaction effects, and the need to evaluate a range of scenarios when deciding on the use of fan tokens. This study advances academic discourse by expanding perspectives on stakeholder relationships in the context of emerging technologies, including blockchain-based fan tokens, and by introducing a thorough, adaptable model for fan token decision-making.

Expert insights reveals several opportunities and challenges across diverse dimensions. Economically, fan tokens can offer new avenues for corporate financing, fundraising, and incentivizing supporters, yet concerns persist regarding financial risks, market volatility, and limited internal resources. Socially, benefits include enhanced engagement, immersive fan experiences, and strengthened bonds between clubs and supporters, while potential drawbacks encompass membership devaluation, exclusion of certain fan groups, and resistance to digitalization. From a technological standpoint, clubs can harness innovative solutions with secure transactions and integrations such as NFTs but must address infrastructure requirements, network scalability, and gaps in technical

expertise. Politically, fan tokens may foster democratization, expanded fan involvement, and heightened transparency, though issues surrounding governance regulations, fair voting rights, and stakeholder alignment remain. Legally, clubs face uncertainties about appropriate regulatory frameworks and potential risks tied to token issuance. Environmentally, energy-efficient blockchain applications and digitized processes could produce positive outcomes, yet the high energy consumption of some systems demands careful consideration.

Practical considerations for sports clubs emphasize the benefit of prioritizing stakeholder interests, establishing strategies that leverage positive aspects of fan tokens while minimizing risks, integrating control parameters and interaction effects, and applying optimization methods to assess trade-offs and impacts. By drawing on the results of the formal model, sports clubs can reach well-founded decisions that increase stakeholder value and encourage steady supporter engagement and organizational effectiveness.

This article presents a detailed framework for examining sports clubs' choices to adopt blockchain-based fan tokens. It acknowledges the multidimensional character of stakeholder interactions, possible benefits, drawbacks, risks, and evolving relationships. By applying these findings, sports clubs can implement well-informed strategies that strengthen overall stakeholder value and contribute to a stable and successful future for the sector.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data availability

The authors do not have permission to share data.

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