The Interplay Between Digital Artifacts and Value Creation in the Ecosystem Design

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Abstract: Since Satoshi Nakamoto's first publication of the Bitcoin whitepaper in 2008, blockchain based technologies has gradually permeated various aspects of our lives. From the emergence of cryptocurrencies like Bitcoin to the development of platforms such as Ethereum, and the rise of phenomena like NFTs and Fan Tokens, the impacts of this technology has been diverse. While speculation surrounding these innovations persists, there exist successful use cases that have breathed new life into industries and enhanced customer interaction with established brands. One such domain where this is evident is the sports industry. Historically, sports teams, particularly football clubs, have sought avenues to capitalize on their fan base, aiming to diversify revenue streams. The advent of Fan Tokens has facilitated this endeavour, allowing teams to monetize fan engagement effectively. Consequently, an exploratory study comprising multiple case analyses was undertaken to examine how digital artifacts, exemplified by Fan Tokens, contribute to value creation within an ecosystem, fostering innovation and monetization for sports enterprises. The findings of this study elucidate the correlation between the characteristics of digital artifacts and the sources of value creation within an ecosystem. Furthermore, they underscore how these characteristics catalyse the formation of such ecosystems, thus propelling innovation and revenue generation within the sports industry.

Keywords: Ecosystem, Digital artifact, Value creation, Value capture

1. Introduction

In the ever evolving and closely interconnected landscape of contemporary digital society, the advancement of technology has brought forth novel digital tools that not only mirror technological advancement but also actively shape individuals' interactions with their surroundings. Particularly within the realm of sports, we encounter a domain marked by its broad appeal and emotional engagement. Sports serve as a universal language, transcending cultural and linguistic barriers. The fervour surrounding sporting occasions serves as fertile ground for the exploration and implementation of technologies aimed at amplifying the emotional bond between fans and teams (Fonti et al., 2023). Additionally, sports teams benefit from a vast supporter base that, owing to globalization and digital connectivity, can be accessed and engaged with globally, presenting a distinct opportunity for the implementation of technology solutions that enhance fan interaction.

An exemplary illustration of this phenomenon is the advent of Fan Tokens, which have heralded a new era in fan engagement by converting the traditional passive relationship into an active and personalized involvement. These tokens, often leveraging blockchain technologies, empower fans to directly partake in the team's dynamics and access exclusive privileges. This presents an avenue for entrepreneurs and established firms to capitalize on the opportunities afforded by these Fan Tokens, as identified in digital artifacts (Kallinikos et al., 2013), thereby devising innovative ways to monetize their customer base and offer novel services and value propositions (Autio et al., 2018; Sanasi et al., 2021; Silva et al., 2021). Nevertheless, despite the nascent exploration in literature regarding the potential of digital artifacts (Kallinikos et al., 2013; Ojala et al., 2023; Sanasi & Ghezzi, 2022) and the scrutiny of ecosystems and their internal dynamics (Adner, 2017; Felch & Sucky, 2022; Ghezzi et al., 2009), the assessment of a digital artifact's impact on ecosystem formation remains an uncharted territory. Consequently, this research endeavors to bridge the gap between digital artifacts and ecosystems by addressing the question: "How do digital artifacts enable the creation of an ecosystem?" Through an exploratory multiple case study, this research assesses how the introduction of Fan Tokens has facilitated the formation of ecosystems transcending the conventional boundaries between sports and technology, thereby fostering a synergistic relationship among technology providers, sports clubs, and fans.

This study contributes to existing literature in three key aspects. Firstly, it delves into how the inherent attributes of digital artifacts (such as Fan Tokens) have spawned new business prospects and avenues of engagement for technology providers. Secondly, it sheds light on how traditionally sports-centric clubs have embraced technological advancements through the adoption of these innovations, elucidating the activities and resources involved. Lastly, it examines the positive impact of digital artifacts on fan engagement and the

resultant creation and capture of value sources within and beyond the ecosystem stemming from the development and utilization of digital artifacts.

2. Literature Review

2.1 Ecosystem Theory

The ecosystem theory has encountered a proliferation of concepts, leading to redundancy and overlap across theoretical domains, resulting in confusion regarding the definition and value addition of an ecosystem perspective within a specific environment (Adner, 2017). Adner (2017, p. 4) defines an ecosystem as "the alignment structure of the multilateral set of partners that need to interact in order for a focal value proposition to materialize." Adner (2017) further distinguishes between ecosystem-as-affiliation, viewing the ecosystem as a community of associated actors, and ecosystem-as-structure, perceiving the ecosystem as a configuration of activities centered around a focal value proposition.

From Adner's definition, four elements characterize ecosystems: activities, actors, positions, and links. In ecosystem theory, the locus of value creation resides in the presence of interdependencies and complementarities among actors, contributing to the creation of a focal value proposition for customers (Kapoor, 2018). Complementarities denote an economic relationship between offers in terms of value creation potential (Felch and Sucky, 2022), while interdependencies represent a structural relationship between offers in terms of their interconnectedness for value creation and the impact of changes in one offer on the contribution of others to value creation (Kapoor, 2018). Kapoor (2018) also identifies three fundamental objects for an ecosystem: bottlenecks, complementors, and platforms. These aspects, including technology architecture, interdependencies, and integration systems, significantly influence value creation within an ecosystem (Kapoor, 2018).

Value creation mechanisms have garnered attention from various perspectives (e.g., Amit and Zott, 2001). Zott and Amit (2010) and Amit and Zott (2001) delineate the four sources of value creation: novelty, lock-in, complementarities, and efficiency. Amit and Han (2017) discuss new sources of value creation in a digitally enabled world where digital platforms and ecosystems play a pivotal role. Lepak et al. (2007) also contribute to the understanding of different types of value, distinguishing between use value and exchange value. Use value pertains to the quality perceived by customers concerning their needs (Bowman and Ambrosini, 2000), while exchange value refers to the monetary amount realized at a specific point in time (Bowman and Ambrosini, 2000).

2.2 Digital Artifacts Theory

Despite attempts by several authors to define digital artifacts (Ekbia, 2009; Zittrain 2008), only Kallinikos et al. (2013) explicitly outline their characteristics. Kallinikos and colleagues (2013) highlight the distinctions between digital artifacts and physical entities of non-digital constitution across dimensions such as editability, openness, distributedness, and interactivity. Additionally, digital artifacts are often embedded in mutable interdependencies with other entities in broader digital ecosystems and can generate other digital objects distributed in the same or other ecosystems, thereby linking with ecosystem theory (Kallinikos et al., 2013). These findings suggest the ever-evolving nature of digital ecosystems due to the incomplete and mutable nature of digital artifacts (Kallinikos et al., 2013). Ojala et al. (2023) develop a framework based on these characteristics to leverage digital artifacts for the internationalization of new ventures.

Thus, the concept of "ecosystem" has gained significant attention among scholars and practitioners, particularly in the past two decades (Adner, 2017; Jacobides et al., 2018). Moreover, several authors concur on the pivotal role played by digital artifacts (Kallinikos et al., 2013; Ojala et al., 2023) in ecosystem development. However, while the literature has elucidated the definition, structure, and internal dynamics of ecosystems, the question of how actors within an ecosystem (Adner, 2017) interact and align to create value in the presence of a digital artifact (Kallinikos et al., 2013) remains unanswered. Hence, this research will focus on how digital artifacts, through their characteristics, facilitate ecosystem creation. This inquiry is encapsulated in the research question: *How do digital artifacts enable the creation of an ecosystem?*

3. Methodology

This study utilizes a qualitative (Gartner and Birley, 2002) and exploratory research design employing a multiple case study approach (Yin, 1984; Eisenhardt, 1989; Eisenhardt & Graebner, 2007) to examine the emergence of ecosystems facilitated by digital artifacts. Specifically, the multiple case study approach is

selected because literature acknowledges its greater robustness compared to a single case study (Yin, 1984), and it facilitates the derivation of generalized findings, allowing for comparisons among diverse manifestations of the phenomenon (Eisenhardt & Graebner, 2007). The digital artifact (Kallinikos et al., 2013) serves as the primary unit of analysis (Yin, 1984), pivotal in the formation of an ecosystem wherein actors collaborate around a shared value proposition (Adner, 2017). In this study, the Fan Token, defined as a utility token (Glossario blockchain, 2022) created utilizing blockchain technology (Glaser, 2017; Nakamoto, 2008; Ante et al., 2023), is regarded as the digital artifact.

3.1 Case Sampling

In this study, a heterogeneous approach was adopted for case selection, aiming to encompass cases representing diverse patterns of behaviour, outcomes, decisions, and evolutionary stages within the analyzed process. Heterogeneity is pursued to recognize and compare various types associated with the same phenomenon, offering a comprehensive understanding of the involved dynamics (Yin, 1984). To implement this approach effectively, it was crucial to pre-determine the number and nature of cases to be examined (Yin, 1984). Following the identification of the research question, key stakeholders involved in the ecosystem were identified. These include technology providers responsible for creating and selling Fan Tokens, sports teams collaborating with technology providers to enhance fan engagement, and the sports team supporters, who are the end users of digital artifacts. Among the various types of sports teams engaged in Fan Token initiatives, the decision was made to focus solely on football clubs. This decision stems from the global popularity and widespread following of football, with approximately 3.5 billion supporters and over 250 million players across more than 200 countries. Additionally, football accounts for 40% of the overall market value of the sports industry, exceeding $500 billion in 2022 (Fonti et al., 2023).

During the initial phase of case study selection, a geographical criterion was applied, limiting the selection to European football clubs. This geographical focus was deemed significant due to the varying dynamics and opportunities within the Fan Token industry across different regions. To ensure accuracy and reliability, the official FIGC database was utilized. The research identified 70 football teams engaged with Fan Token platforms. To refine the selection process, the focus shifted to technology providers, aiming to identify the most prominent and established ones to narrow down the selection field for football teams. The selection criterion was based on the technology providers with the highest Fan Token market cap in the European landscape. Selection of Socios and Binance was prioritized to focus on companies with greater significance and impact in the industry, ensuring the analysis is more meaningful and representative, particularly in the European context. Moreover, Socios and Binance were chosen for their heterogeneity, with Socios representing a more diversified player and Binance a more focused one. From the numerous teams associated with Socios, Juventus FC, AC Milan, and Lega Serie A were selected as the subjects of study. This selection aimed to explore highly diverse cases to provide a varied representation of the Fan Token context in football. Among the two European teams partnered with Binance, FC Porto was chosen over S.S. Lazio to introduce a foreign team into the set of cases studied, offering a comprehensive and diversified overview of interactions between the platform and football teams, both domestically and internationally. Additionally, supporters were selected for AC Milan, Juventus FC, and FC Porto to better understand the overall environment surrounding Fan Tokens (see Appendix for further details on informants).

3.2 Data Collection

The data collection phase of the study employed a thorough strategy encompassing both primary and secondary sources to ensure data triangulation. Secondary sources such as YouTube videos, podcasts, whitepapers, and press releases were utilized to provide just confirmation to the primary sources, which include in-depth semi-structured interviews conducted with key informants. These 10 interviews, categorized into sections corresponding to the topics outlined in the literature review, were recorded, transcribed, and carried out in an interactive manner involving technology providers, sports teams, and sports team supporters. During the data collection phase, interviews with various stakeholders in the ecosystem were conducted while maintaining a neutral stance to uphold objectivity. Informants were perceived as knowledgeable agents, and the research aimed to conduct a generalizing analysis, treating the case studies as multiple experiments (Gioia et al., 2013). Following Yin's methodological approach (Yin, 1984), "analytical generalization" integrated existing theories with empirical evidence, contributing to a comprehensive understanding of the impact and dynamics of the digital artifact on the ecosystem. This approach allowed for flexibility in exploring emerging themes spontaneously. The richness of the dataset was further enriched by the inclusion of secondary data from external documents, ensuring a robust foundation for subsequent analysis.

3.3 Data Analysis

Following the completion of the data collection phase, the research progressed to the analysis and interpretation of the gathered data, aiming to develop a discussion based on the findings. Adhering to the "logic of replication" (Eisenhardt and Graebner, 2007), each case was treated as an independent experiment in both internal and cross-case analyses. The emphasis was placed on comprehending the ecosystem mechanisms and interactions facilitated by the digital artifact. Subsequent to the analysis of individual cases, a cross-case comparison was conducted to identify similarities and differences, addressing the research question. The analysis employed coding, utilizing an inductive Grounded Theory methodology (Glaser and Strauss, 2017). An inductive coding tree, incorporating constructed and in vivo codes (Glaser and Strauss, 2017; Gioia et al., 2013), was employed to capture the language of the informants, both from primary and secondary analysis transcripts. Through an iterative process, the codes were consolidated into first-order concepts, followed by a second-order analysis that aggregated the categories into overarching themes. This iterative process ultimately led to the development of an empirical model (Eisenhardt, 2023) illustrating how the digital artifact enables the creation of an ecosystem.

4. Results

Following an in-depth analysis of the results obtained from interviews conducted with key stakeholders across the ecosystem, a systematic process has been delineated concerning the development of Fan Tokens and their associated ecosystem by the involved firms. This process is delineated into two main phases: Phase 1 – *Focal Value Proposition Creation*, wherein the primary actors within the ecosystem synchronize their efforts in terms of aligning activities, resources, and competencies, envisioning, and exerting efforts to enhance the added value of the focal value proposition. Phase 2 – *Ecosystem Alignment Structure* involves the incorporation and activation of sports team supporters, who through the utilization of Fan Tokens, generate value for the technology provider (e.g., Binance and Socios) and for the sports teams (e.g., FC Porto, AC Milan, Juventus FC). Additionally, this phase encompasses the establishment of new partnerships with other actors (e.g., NFT Kings and Lega Serie A) for the provision of resources and inputs to develop complementary products aimed at delivering value to the sports team supporters.

4.1 Focal Value Proposition Creation

The catalyst for the formation of this type of ecosystem is the Fan Token. Both technology providers interviewed (Binance and Socios) have asserted that the Fan Token serves as the catalyst for establishing a new business venture. For instance, the Partnership Manager at Socios stated: "*As far as the token [Fan Token] is concerned, it was the simplest and most easily applicable decision at the time because it did not require a lot of effort.*" Additionally, the CEO of Socios, in a YouTube interview, mentioned: "*So, we decided to create an ecosystem based on blockchain in order to engage and monetize sports fans all over the world.*" During this phase, technology providers recognize the Fan Token as an opportunity to establish a new business unit (e.g., Binance) or initiate a new digital startup from scratch (e.g., Socios). Subsequently, they determine which technological infrastructure to utilize, whether leveraging existing infrastructure (e.g., Binance) or developing an entirely new one (e.g., Socios). As elucidated by the Head of Marketing and BD at Binance: "*There is no separate technical department. The technicians in Binance are generalists, so they carry out the tasks. As I mentioned earlier, at a technical setting level, the fantoken part is not different from the Binance core; it's essentially the same thing, but more focused on the fantoken.*"

During this phase, technology providers start collaborating with other actors to co-create the Fan Token, as explained by Socios' Partnership Manager: "*Together with the collaborative teams, we propose a poll, and once we decide on it and receive approval from the team, we upload that poll with all the associated experiences and rewards onto the platform.*" Throughout the alignment process between the technology provider and the actors, interdependencies are established, determining what each firm will provide to the other and vice versa, as stated by AC Milan's Associate Strategy Manager: *"...what we give Socios when we enter into a partnership with them is access to a fanbase of hundreds of millions of fans around the world... They have resources dedicated to Milan, we have a resource dedicated to Socios, and then we agree on what activities to do, when to do them...*".

4.2 Ecosystem Alignment Structure

In this phase, the overall structure of the ecosystem is nearly finalized with the involvement of sports team supporters and the inclusion of other stakeholders (e.g., Lega Serie A), who contribute relevant inputs to the ecosystem, as articulated by Lega Serie A's Partnership Manager: "*To conclude, with Socios, which is a very*

active partner and wants to activate a lot of users to make them interact in their platform, we did the activity related to matchball, so the NFC ball.". During this phase, the alignment structure is established where actors engage with each other to realize a central value proposition.

With the engagement of sports team supporters, the sports teams can interact with their fans through the capabilities provided by the Fan Token, as described by the Juventus FC's Head of Operations and Strategy: "*Then over time we saw that it works more what it involves. In fact, as we did on 'design your own shirt' which we then made, marketed and so on, you leave the grids much more open, but the ingredients you go for are controlled. So you leave space and you leave freedom…*". Additionally, they can now connect with fans worldwide, who were previously inaccessible to their favorite football team, as highlighted by AC Milan's Associate Strategy Manager: "*Now we are able to reach foreign fans such as fan from Turkey, Indonesia, etc., that previously was impossible to reach.*"; and FC Porto's Marketing Manager: "*So, for our fans across the world, we do think it will bring us new fans and share our image throughout the world…*".

With the opportunity to engage and reach a broader audience, both sports teams and other stakeholders, including technology providers, can extract value through the utilization of Fan Tokens and other digital assets (e.g., Matchball NFC from Lega Serie A, or NFTs), as stated by Juventus FC's Head of Operations and Strategy: "*On an economic level there was a huge benefit because we did a very important revenue sharing …So we benefit economically and in terms of value from what? From the fans! That's something we like anyway, it's a more direct channel…*". Moreover, sports team supporters themselves are more involved due to the interaction possibilities enabled by the Fan Token, as expressed by Subject A: "*I do believe that fan tokens can open an incredible door to the sporting world and not just to fans. As I said before, the ability to access luxury areas … made me realise the power of constant work and commitment in using tokens*".

5. Discussion

In our swiftly advancing digital era, where digital artifacts are supplanting physical counterparts (Kallinikos et al., 2013; Ekbia, 2009; Kallinikos and Mariategui, 2011), and the establishment of ecosystems (Adner, 2017; Jacobides et al., 2018) is imperative for both existing and emerging firms to thrive and innovate, there arises a crucial need to illuminate the connection between these previously disparate research realms. Furthermore, it is essential to examine this nascent phenomenon that is breathing new life into the sports industry with notable success stories, reshaping its rapport with customers (sports team supporters), and generating novel revenue streams alongside conventional ones in this "traditional" sector.

This study underscores that digital artifacts have the potential to foster the development of business ecosystems. Specifically, the attributes of digital artifacts (Kallinikos et al., 2013) facilitate the emergence of a business ecosystem (Adner, 2017; Jacobides et al., 2018) owing to their associations with mechanisms for value creation (Amit and Zott, 2001) and value capture (Lepak et al., 2007; Cortimiglia et al., 2011). Each of these attributes, and their correlations with value creation and capture mechanisms, exhibits distinct relevance within the two phases delineated in the preceding section (Phase 1 – Focal Value Proposition Creation, and Phase 2 – Ecosystem Alignment Structure).

5.1 Theoretical Contributions

The empirical model derived (Table 1) illuminates how the inherent attributes of digital artifacts (Kallinikos et al., 2013) can stimulate the activation of mechanisms for both value creation and capture (Amit and Zott, 2001; Lepak et al., 2007) within each represented phase. Put simply, the characteristics of digital artifacts can promote the establishment of a business ecosystem through their correlation with these mechanisms.

The characteristics of editability and openness inherent in digital artifacts (Kallinikos et al., 2013) encompass the ability to modify and update digital elements and to be accessible and modifiable by a program. These attributes can trigger sources of value creation, such as novelty and efficiency (Amit and Zott, 2001), during the initiation of interdependencies among actors in the initial phase of "Focal Value Proposition Creation". Through these characteristics (editability and openness), firms engaged in crafting a focal offer can innovate and enhance efficiency in conducting transactions with customers. Moreover, these features (editability and openness) facilitate the design and arrangement of elements constituting the focal value proposition (digital artifact), thus ensuring efficiency and novelty. This is achieved by reducing transaction costs through faster and easier transmission of information and enhancing transaction efficiency through instantaneous updating and modification of the focal offer. Additionally, these characteristics enable the creation of novel products that introduce new transactional methods and structures with previously unrelated parties, thereby eliminating inefficiencies and fostering new markets.

The characteristics of interactivity and distributedness associated with digital artifacts (Kallinikos et al., 2013) entail the ability for customers to interact with and activate functions embedded in the digital artifact and the nature of being borderless and distributed within a broader digital ecosystem. These attributes can activate sources of value creation, such as lock-in and complementarities (Amit and Zott, 2001), during the "Ecosystem Alignment Structure" phase (Adner, 2017). Through these characteristics (interactivity and distributedness), firms operating within the ecosystem can generate value for customers by leveraging lock-in and complementarity sources (Amit and Zott, 2001). Interactivity fosters increased lock-in value creation by facilitating customer retention and loyalty in repeat transactions. Meanwhile, distributedness fosters enhanced complementarity value creation by providing opportunities to reach various actors (e.g., customers, partners, etc.) without boundary constraints, enabling firms already within the ecosystem to establish new partner networks for co-creation and the provision of relevant inputs for complementary products.

Through customer interaction and access to complementary products worldwide, firms within the ecosystem can capture value from customer utilization of digital artifacts. By leveraging the utilization of digital artifacts by customers, firms can capture various types of value to augment their revenues, acquire new customers, and gain better insights into their audiences through data analysis.

To summarize these findings into the proposition that addresses the question underpinning this study:

The intrinsic characteristics of digital artifacts enable the establishment of an ecosystem through their associations with mechanisms for value creation and capture within each necessary phase for creating the respective ecosystem.

Table 1: Empirical model

Phases	**Characteristics of digital artifacts**	**Sources of value creation and capture**
Focal Value Proposition Creation	Editability and Openness	Novelty and Efficiency
Ecosystem Alignment Structure	Interactivity and Distributedness	Complementarity, Lock-in and Value capture

6. Conclusion

This study explored how digital artifacts can facilitate the establishment of an ecosystem. It was determined that digital artifacts, owing to their inherent attributes, have the capacity to stimulate mechanisms for both value creation and capture within an ecosystem. Furthermore, these attributes prove beneficial across each phase required for ecosystem development. In addition to this finding, the research contributes to enriching the Ecosystem theory. The motivation behind this study stemmed from a recognized gap in the literature between two previously disconnected streams: ecosystem theory and digital artifacts. Through this research, these two theories have now been integrated, laying the groundwork for future investigations.

The study employed an exploratory approach, utilizing multiple case studies involving a sample of four cases, identified with six companies and three sports fans interviewed. The sports business sector was selected as the industry of focus due to its distinctive characteristics (Fonti et al., 2023) and significant market value. Specifically, the application of Fan Tokens within the football industry (a subset of the sports industry) served as the foundation for addressing the research question. The result of this endeavour is an empirical model that aids in comprehending how to develop a business ecosystem by leveraging the attributes of a digital artifact.

In conclusion, this study has yielded new and original insights, albeit with limitations stemming from the small sample size and subjectivity inherent in qualitative research. Indeed, future studies could benefit from a larger sample size to facilitate more precise generalization of the findings. Nonetheless, the integration of ecosystem and digital artifact theories has opened up a new avenue for research, offering opportunities for the development of novel theories and frameworks.

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Appendix: Table

Data type		Quantity	Original data source
Primary	**Semi-structured interviews**	10 in-depth interviews	Informants
		Socios	
		(2 interviews)	Alexandre Dreyfus - Founder & CEO Alberto Crespi - Partnership Manager Italy
		Binance	
		(1 interview)	Lorenzo Capone and Filippo Balsano - Head of Marketing and BD
		Lega Serie A	
		(1 interview)	Enrico Scavini - Partnership Manager
		Juventus FC	
		(1 interview)	Tomas Arico - Head of Strategy and Operations
		FC Porto	
		(1 interview)	Barbara Borges - Marketing Manager
		AC Milan	Riccardo Martinelli – Associate Strategy Manager
		(1 interview)	
		Sports team supporters	
		(3 interviews)	Subject A, Subject B and Subject C
	Asynchronous communication	57 informal emails	Informants