

Play-to-Earn Blockchain Games

Full Paper

Arthur Carvalho

Farmer School of Business
Miami University
arthur.carvalho@miamioh.edu

Chad Anderson

Farmer School of Business
Miami University
chad.anderson@miamioh.edu

Mala Kaul

College of Business
University of Nevada, Reno
mkaul@unr.edu

Abstract

Play-to-earn (P2E) games backed by blockchain technology enable players to earn tangible rewards through in-game activities. P2E has emerged as a revolutionary convergence of gaming and decentralized finance that ensures transparency, security, and verifiable ownership, fostering economic empowerment and novel digital interactions. In this paper, we investigate the technological and socio-economic dimensions of P2E by examining popular games (Axie Infinity and Hamster Combat) and platforms (Sandbox). Through these examinations, we identify four critical challenges faced by the P2E ecosystem, namely community sustainability, player health, affordability, and fair rewards. We further present actionable research opportunities to address these challenges, including the potential to explore solutions based on game theory, mechanism design, and information systems theories. Overall, our findings highlight the transformative potential of P2E games and underscore the unique opportunity for the information systems community to contribute to the evolution of this dynamic digital ecosystem.

Keywords

Blockchain, play-to-earn games, the dark side of IT, Tokenomics.

Introduction

Blockchain, the foundational technology behind cryptocurrencies and the Web3 movement, has catalyzed groundbreaking innovations across diverse sectors, including supply chain management (Kumar et al., 2020), healthcare (Anderson et al., 2023), and finance (Egelund-Müller et al., 2017). Within the gaming industry, blockchain has enabled the concept of play-to-earn (P2E) games. Historically, players engaged in video games primarily for entertainment, with no tangible financial returns for their time and efforts. In contrast, P2E games empower players to derive real-world financial value from their in-game actions and achievements. This value is typically represented as cryptocurrencies or tokens, securely stored on the blockchain, allowing for seamless transferability and trading within decentralized ecosystems.

P2E games have created new opportunities for economic empowerment and global inclusion, allowing players, especially in developing regions, to generate income through skillful gameplay or strategic participation (Kuo Siong Tan, 2024). Moreover, by leveraging token economies, P2E games have the potential to create robust digital communities where players and developers collaborate and share value. Blockchain technology supports this by ensuring transparency, security, and true ownership of digital assets. For example, players can verify the provenance and authenticity of in-game items and rewards, ensuring that their investments and payments remain secure and transferable. The sense of true ownership of digital assets, enabled by blockchain, may enhance player engagement and loyalty, as users can retain, trade, or monetize their in-game items and, more broadly, their gaming experience in broader ecosystems.

However, P2E games also face significant challenges that cannot be overlooked. Issues of sustainability are a prominent concern, as many P2E games struggle to maintain a balance between rewarding players and ensuring long-term economic stability within their ecosystems (Xie et al., 2024). Additionally, the health and well-being of players are increasingly under scrutiny, with excessive playtime often required to achieve meaningful rewards, leading to burnout and other negative health impacts. High entry costs further complicate accessibility, with some games requiring the purchase of expensive digital assets, thereby excluding a significant portion of potential participants. The speculative nature of some in-game assets and cryptocurrencies also introduces volatility, posing risks of financial losses for players (Zauch, 2024). These issues create a complex landscape for both P2E developers and players.

In this paper, we explore the multifaceted aspects of blockchain-based P2E games through an in-depth examination of popular games and platforms. Specifically, we analyze data collected from online P2E community discussions, as well as insights gleaned through direct participation in P2E games. This dual approach allows us to investigate a diverse set of operational mechanics, economic models, and community dynamics of P2E games from both player and systemic perspectives. Furthermore, we elaborate on the challenges P2E games face, including ecosystem sustainability, affordability, player health, and proper payment schemes. By delineating these issues, we identify research opportunities for information systems researchers and, thus, the potential to shape the future of P2E gaming.

Research Background

The concept of P2E games has emerged as a significant phenomenon in the gaming industry. This section provides an overview of the foundational principles underpinning P2E ecosystems.

Blockchain Technology

Blockchain is a decentralized database that records transactions in sequential batches, referred to as blocks, which are cryptographically linked to form an append-only chain of data. These blocks are stored across a network of computational devices, known as nodes, ensuring redundancy, transparency, and resistance to tampering and censorship. Due to its decentralized nature, blockchain operates without a central authority, relying instead on consensus mechanisms to validate transactions. Blockchain technology supports the creation of tokens, which can be broadly categorized into two types: fungible tokens and non-fungible tokens (NFTs). Fungible tokens hold the same value and properties as other tokens of the same type and are therefore similar to traditional currencies (e.g., dollars, euros) where one unit is interchangeable with any other unit. Consequently, fungible tokens often serve as currency within P2E games, facilitating transactions, rewarding players, and supporting in-game economies. In contrast, NFTs possess distinct properties that make them more like artwork or real estate that are distinct and not interchangeable. This enables NFTs to represent unique digital items in P2E games, such as characters, skins, or virtual land. NFTs are recorded on the blockchain to ensure verifiable ownership and scarcity, which allows them to be traded and monetized on blockchain-based marketplaces. This combination of token types forms the foundation of tokenomics, a system that governs the creation, distribution, and utilization of tokens to incentivize participation, drive engagement, and sustain economic stability within blockchain-based platforms. Innovative token-based economic models enable P2E games to align the interests of game developers and players, and potentially create dynamic and vibrant digital ecosystems.

Play-to-Earn Games

People often play games because they derive enjoyment from the experience (Hamari and Keronen, 2017), but the gaming industry has also developed ways for players to monetize their skills and engagement through both exogenous and endogenous reward systems. In exogenous reward systems, monetization occurs outside the game with examples that include esports and streaming where players earn revenue by entertaining fans (Hamari and Sjöblom, 2017). Endogenous reward systems, in contrast, generate financial benefits directly within the game. For example, some game platforms (e.g., Mistplay) incentivize players with points or virtual currency, which can be redeemed for gift cards or cash. In this paper, we focus on a specific type of endogenous reward system, where rewards come in the form of blockchain-based tokens that provide tangible value for player engagement. For instance, fungible tokens can be earned upon completing missions or achieving in-game milestones. Such tokens can be traded on cryptocurrency

exchanges, allowing players to convert their in-game accomplishments into real-world economic gains. Additionally, unique digital assets, such as avatars, can be issued as NFTs, providing players with ownership of distinctive game items. Blockchain-based marketplaces provide trading platforms for these NFTs, allowing players to invest in digital assets and earn profits when those assets appreciate in value. Additionally, tokens can also be used in decision-making processes and governance, thus potentially enhancing community engagement. Figure 1 illustrates the P2E ecosystem as a three-layer architecture: 1) the technical layer, which provides the blockchain infrastructure and enables the creation of tokens, 2) the economic layer, which structures incentives through token-based rewards and broader tokenomic mechanisms, and 3) the community layer, which incorporates DAOs, participatory rule systems, and (decentralized) governance structures to align the interests of players and developers.

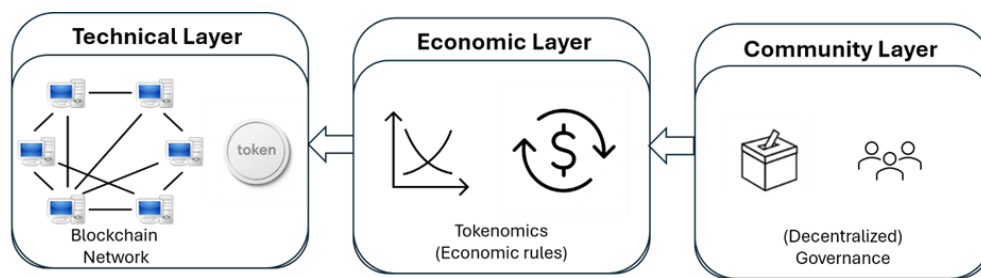


Figure 1. Three-layer architecture of P2E games.

Methods

To understand the current state of P2E, its reward systems, and potential challenges, we gathered information from three sources. Our primary source of information came from direct and active engagement with a range of P2E games. Specifically, we have participated in over two dozen P2E games and platforms since 2022. This approach allowed us to gain a firsthand understanding of the underlying mechanics, economic models, and community dynamics. During gameplay, we systematically acquired various types of tokens through purchases or rewards, thus integrating ourselves into the ecosystems to authentically experience their economic structures. Our second source of information consisted of data collected from messaging applications such as Discord and Telegram. These platforms included both official game channels and unofficial, player-led groups, providing a diverse array of perspectives. The unofficial groups, in particular, served as a rich source of unfiltered information, often offering candid insights into player experiences, grievances, and strategies. Combining this community interaction with active gameplay aligns closely with an ethnographic immersion approach (Hammersley and Atkinson, 2019), allowing us to holistically understand the P2E ecosystem from both participant and observer perspectives. Our third source of information consisted of online documents, encompassing a diverse array of materials such as white papers published by P2E game companies and articles featured in specialized magazines dedicated to blockchain, gaming, and digital innovation. White papers provided critical insights into the vision, architecture, and economic models underpinning specific P2E games and platforms, offering a foundation for understanding the theoretical frameworks and strategic intentions of developers. In addition, articles in industry-specific outlets served to contextualize these platforms within broader trends, such as advancements in blockchain technology, evolving user expectations, and market dynamics. Together, these resources provide both depth and practical relevance. Below, we discuss two P2E games and one platform that will be the focus of our findings.

Findings

Axie Infinity

Released in 2018 by the Vietnamese company Sky Mavis, Axie Infinity has become one of the most prominent examples of blockchain-based P2E games, particularly during its rapid growth phase between 2020 and 2021. As part of the game, players collect, breed, battle, and trade creatures called Axies, each one represented by an NFT. Players create teams of Axies to compete in turn-based battles and potentially earn rewards. The game operates through a dual-token economy system, consisting of Smooth Love Potion

(SLP) and Axie Infinity Shards (AXS). SLP is earned through gameplay and is consumed when players attempt to breed Axies. AXS, on the other hand, is the game's main currency, which can be used, for instance, within the Axies marketplace or as a governance token. The latter use allows holders to participate in decision-making processes regarding the game's future. Both SLP and AXS can be traded on exchanges, providing players the opportunity to convert in-game earnings into fiat currency.

As mentioned above, players can earn SLP after winning battles against other players. The amount of SLP depends on the opponent's ranking. A challenge that arises is that new players might have to buy Axies to be competitive, a point we elaborate on later when discussing affordability. Another source of income regards breeding Axies. Players who understand the mechanics of Axie genetics can optimize breeding to produce desirable traits, such as rare body parts or strong abilities for battles. Such Axies can then be used to gain SLP in battles or sold for a high price in the marketplace. The demand for new Axies is driven by new players entering the ecosystem or competitive players looking to strengthen their teams. This naturally raises concerns about community sustainability, as we discuss later.

Hamster Kombat

Released in 2024 on the Telegram messaging app and supported by the TON blockchain, Hamster Kombat quickly gained popularity, amassing over 300 million users within just a few months (Gorman, 2024). In this game, players assume the role of a hamster CEO managing a virtual cryptocurrency exchange. The primary gameplay revolves around tapping on a smartphone screen to generate in-game currency, which can be utilized to purchase upgrades for the managed exchange. These upgrades enhance the exchange's operations, resulting in an increase in passive income per hour in the form of in-game currency. Metrics such as passive income generation, the total number of friend invitations, and task completions were used to determine the amount of \$HMSTR tokens players received during the airdrop event in September 2024. The \$HMSTR tokens can now be exchanged for other tokens, cryptocurrencies, and fiat currency, introducing a tangible financial dimension to the game's ecosystem.

Hamster Kombat became so popular that some countries (e.g., Iran) banned the game, citing its potential as a distraction that prevented voters from casting ballots during elections (Gorman, 2024). The game developers capitalized on this widespread popularity by implementing a shared advertising revenue model. They launched social media and streaming channels, which amassed millions of followers, and then integrated those channels into the game as part of in-game missions, e.g., players had to visit the channels daily to win some in-game currency. A portion of the resulting advertising revenue was allocated to fund the release of the \$HMSTR token. However, as we will discuss later, the game faced considerable backlash following the token's release, with users expressing dissatisfaction over insufficient financial returns for their efforts (Qureshi, 2024).

Sandbox

Unlike Axie Infinity and Hamster Kombat, which focus on a single game, Sandbox is a blockchain-based virtual world that empowers users to create and monetize their games, digital assets, and experiences. Sandbox players can earn rewards in the form of the \$SAND token or digital items represented as NFTs by playing games, completing quests, or participating in platform activities. Game developers can design and create unique digital assets, such as avatars, game items, and virtual artwork, which can be sold as NFTs on the Sandbox Marketplace. The platform also incorporates a virtual real estate model, allowing users to purchase, develop, and monetize plots of virtual land.

The Sandbox platform has experienced great success due to partnerships with major brands, celebrities, and intellectual properties, such as Snoop Dogg, The Walking Dead, and The Smurfs, to create engaging content. For example, The Voice — the popular American singing reality competition television series — launched The Voice Coach Battle in 2024, where players could vote on their favorite performer while engaging in a gamified coaching experience. In these experiences, players can purchase exclusive avatars that unlock the potential to earn additional \$SAND through unique quests and challenges. However, the requirement of an upfront purchase raises affordability concerns, as the platform effectively operates as a P2E model. Moreover, this approach introduces financial risks for players, as the initial investment in avatars or assets may not yield the anticipated returns. Consequently, players may face the possibility of financial losses, a point we return to in the following discussion on research challenges and opportunities.

Discussion

From the examples of Axie Infinity, Hamster Combat, and Sandbox, it is evident that the current state of blockchain gaming is still evolving and faces several critical challenges. These challenges present valuable opportunities for information systems research to enhance this rapidly growing ecosystem. While we saw evidence of technology-related challenges facing P2E games (e.g., uninspiring graphics, subpar sound effects, and difficulties integrating digital wallets), we believe advancements in gaming engines and design tools will eventually address them. Thus, our primary focus lies in the social and economic issues that emerge within these technologically mediated environments, as they pose broader and more complex implications for P2E ecosystems and currently lack clear roadmaps for resolution.

Our discussion of those issues is structured within a sociotechnical research framework illustrated in Figure 2. Within this framework, the values for blockchain gaming we propose are embedded within social and technical subsystems, with the social subsystem comprised of structures and people, while the technical subsystem includes technologies and tasks. These sociotechnical systems have the potential to generate both intended and unintended consequences. The values also serve to reveal drivers (respectively, barriers) that facilitate (respectively, impede) the creation of sociotechnical P2E systems and provide a lens for assessing the consequences of those systems. Through this framework, we identify seven research opportunities for the study of blockchain gaming, which we elaborate on next based on the identified values.

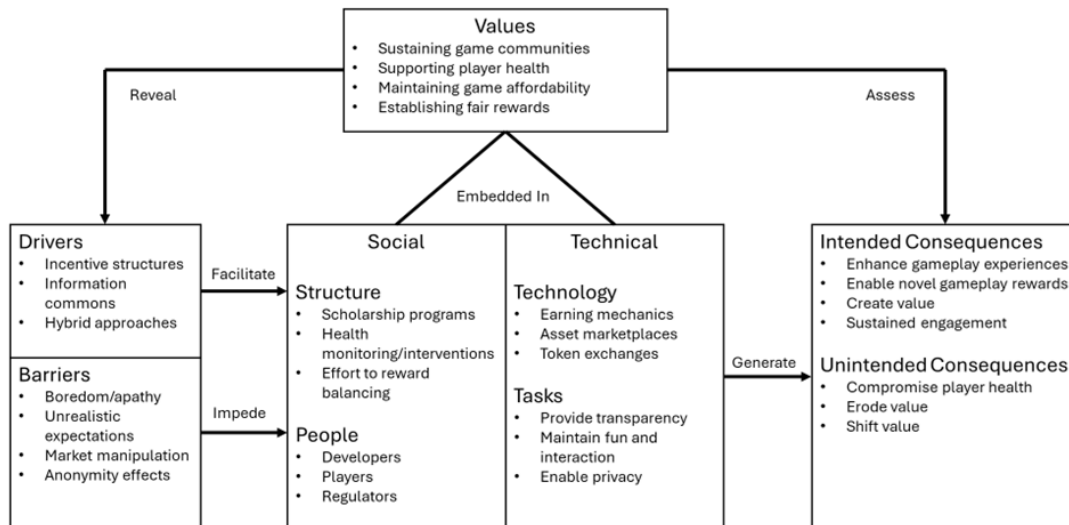


Figure 2. Sociotechnical Research Framework (adapted from Wang et al., 2025).

Community Sustainability

A crucial aspect of P2E games concerns the creation and maintenance of communities, as they serve as the backbone for fostering player engagement and collaboration. In particular, active communities drive demand for in-game assets, encourage trading, and contribute to the growth of a token economy. Moreover, well-maintained communities create a sense of belonging and shared purpose, which are critical for retaining users and motivating them to invest their time and resources. Hamster Combat successfully gamified community growth by implementing a bottom-up approach, wherein the number of friends invited by players was used as a key metric to determine payouts. Conversely, Axie Infinity adopted a more top-down, centralized approach to community building. Specifically, in 2024, Axie Infinity partnered with the cryptocurrency exchange Coinbase to offer users free Axies and tokens upon learning about the game and successfully completing educational quizzes (Jordan, 2024). The use of different approaches to incentivize community building leads to our first research opportunity.

Research opportunity #1: What are the most effective incentive structures to grow a P2E community?

Although P2E games have successfully leveraged both top-down and bottom-up approaches to attract new players into their ecosystems, the question of whether those players will continue to remain engaged over time remains open. One avenue to sustained engagement is empowering players by involving them in key

decision-making processes. For example, Hamster Kombat maintains an official Telegram channel, while Axie Infinity and Sandbox utilize Discord channels where players can voice concerns, offer suggestions, or connect with others to share game resources and tips. More recently, both Axie Infinity and Sandbox introduced *decentralized autonomous organizations*, commonly known as DAOs (Ellinger et al., 2024), which act as innovative social contracts between players and the P2E ecosystem. For example, Sandbox allows players to propose and vote on game-related features (e.g., filtering inventory or enabling window resizing) as well as funding decisions (e.g., whether to financially support the ambassador program). Similarly, Axie Infinity has initiated discussions on granting players voting power to govern the Axie Community Treasury. While DAOs present opportunities for community engagement and sustained participation (Ellinger et al., 2024), they also face well-documented challenges, such as the concentration of voting power, often tied to the number of tokens owned, and low voter turnout (Barbureau et al., 2023). These varied approaches to community engagement highlight another relevant research opportunity.

Research opportunity #2: What are the most effective participatory models for sustaining engagement and long-term growth in P2E communities?

We argue that P2E games can be conceptualized as *information commons*, defined as decentralized and accessible systems where individuals collaboratively create, manage, and share resources (Mindel et al., 2018). These systems are characterized by open access, minimal barriers to participation, and collective decision-making. Within this framework, game developers serve as producers or architects of the underlying infrastructure, while players take on dual roles as providers and appropriators — creating and consuming content such as new games, avatars, and game items in Sandbox or breeds in Axie Infinity. This perspective aligns with the theory of the sustainability of polycentric information commons (Mindel et al., 2018), which provides valuable insights into addressing the research opportunities identified above. For instance, the theory emphasizes the importance of decentralized governance, equitable participation, and mutual accountability, all of which can inform strategies for building sustainable P2E ecosystems. Moreover, prior research has applied this theory to demonstrate how blockchain technology functions as an information commons (Carvalho et al., 2020), further underscoring its relevance to the P2E domain.

Player Health

Rewards in P2E games are often tied to the amount of time players invest in the game. For example, Hamster Kombat incentivizes players to continuously tap their smartphone screens to earn rewards. Moreover, players can get further rewards (“keys”) by playing some mini-games. The repetitive and time-intensive nature of the gameplay has raised concerns. A notable example is a comment from a player, Kartik Shukla, on the official Telegram chat on September 17, 2024:

“I’m extremely frustrated with Hamster Kombat’s tap-to-earn game, which has devolved into a frustrating and exploitative experience. The game’s core concept is simple: tap to earn rewards [...] However, the developers have unnecessarily added multiple mini-games, requiring an absurd amount of time and effort to collect keys.”

Similarly, Axie Infinity’s official Discord channel has documented extensive discussions highlighting the excessive time commitment required for meaningful rewards. Below are examples of player comments from the General thread:

- “This game makes one feel miserable. what a way to burn players” (by Blitzkrieg on March 3, 2022)
- “You work, you eat, you sleep in interval of 40-60 mins before checking the game again. that is if you want to keep up with others” (by Bios on March 25, 2023)
- “Not getting lazy no.. I got burnt out., 10 hours playing a game is not fun” (By Something Random on February 27, 2024)

In our interactions within official chats, we noticed that reports of players spending 10 or more hours daily are not uncommon, underscoring the excessive demands these games place on their participants. Such prolonged and repetitive gameplay can lead to physical and mental health issues, including burnout, disrupted sleep cycles, and even chronic stress (Loton et al., 2016). These concerns bring into question the moral responsibilities of P2E platforms. For example, one can argue that developers should implement interventions to mitigate the adverse effects of excessive gameplay, such as introducing time management

tools and daily activity caps or incentivizing breaks to foster healthier gaming habits. These observations lead to the following research opportunity:

Research opportunity #3: What interventions can P2E games and platforms adopt to mitigate health risks associated with prolonged gameplay?

The issues underlying prolonged gameplay are exacerbated by boredom, driven by the lack of engaging gameplay and the repetitive nature of tasks in many P2E games. While financial outcomes are often the primary motivator for P2E players, the gaming experience must also be compelling (Lee and Park, 2023). Unfortunately, players have frequently raised concerns about the uninspiring and monotonous activities required to earn rewards in P2E games. A natural solution to address this problem is to design more meaningful, creative, and fulfilling activities or even in-game roles. For example, one potential model involves paying players to be game buddies or to take on tasks traditionally performed by non-player characters (NPCs), such as crafting and selling items, thus creating a more interactive and engaging experience with player-driven economies. The following research opportunity explores alternative game models that not only enrich gameplay but also build a more dynamic and fulfilling gameplay.

Research opportunity #4: What alternative game models can provide more engaging, fulfilling, and interactive experiences for players?

We recognize that some of the issues discussed above align with the broader discourse on the dark side of information technology (Tarafdar et al., 2013). However, a distinguishing challenge in the context of P2E games lies in the anonymity afforded by blockchain technology. For example, traditional interventions, such as cooldown timers to prevent excessive microtransactions in video games (Carvalho, 2021), rely on well-defined identifiers like credit cards. Identifiers in blockchain ecosystems, namely blockchain addresses, are less effective as they are easily created and discarded, i.e., it is rather straightforward to create Sybil accounts in P2E games. Furthermore, players are distributed globally, encompassing diverse preferences, legal jurisdictions, and varying levels of access to technological resources. These factors compound the difficulty of implementing uniform interventions, necessitating innovative, context-aware approaches to address the abovementioned challenges effectively.

Affordability

P2E games usually allow players to join and play for free, but to have the opportunity for meaningful earnings might require significant financial investment. For example, Sandbox offers reward pools for gameplay, which are predetermined amounts of \$SAND shared among players who complete the pool's game goals. Some pools are free to join while others require the purchase of NFTs to participate. For example, to unlock access to an exclusive reward pool in the Dystopian Universe and the Ragnarok games we had to pay 30 \$SAND (~12 USD) and 39.99 \$SAND (~15 USD) to purchase NFTs. To join the exclusive reward pool in the Solo Leveling – Unlimited game, we paid 100 \$SAND (~40 USD) for an NFT. In our experiences, the exclusive pools for NFT owners yielded payouts ranging from 48 to 55 \$SAND (~20 USD), whereas the free general pools only provided rewards between 1 and 3 \$SAND (~1 USD). These discrepancies highlight a pressing issue in balancing affordability and fair compensation, prompting the following research opportunity:

Research opportunity #5: What innovative reward models can balance affordability with long-term financial sustainability in P2E ecosystems?

The high cost of initial investment in some P2E games has led to the emergence of innovative solutions. For example, during Axie Infinity's peak, the expense of purchasing quality Axies became prohibitive. This prompted the creation of scholarship programs. In these programs, *managers* loan Axies to players, referred to as *scholars*, in exchange for a share of the earnings (Jirásek, 2022). Scholars play the game on behalf of their manager and typically split the earnings with revenue-sharing models such as 70-30 or 60-40, favoring the scholar. Scholarship programs significantly improved accessibility for low-income players, particularly in countries like the Philippines (Chow and de Guzman, 2022), where many scholars were able to earn considerably more than the local minimum wage. Some scholarship programs also offer additional support, such as game training and cryptocurrency education, which can help scholars navigate the complexities of P2E ecosystems. Axie Infinity includes dedicated threads in their official Discord channel for scholarship applications and advertisements, showcasing the structured integration of these programs into the game's ecosystem.

Despite their recognized value, scholarship programs are not without issues. For instance, while some scholars earn reasonable compensation, many reportedly earn wages far below the minimum standards in their countries. In contrast, managers, some overseeing thousands of scholars, reap disproportionately large benefits (Ongweso Jr., 2022). Additionally, some scholarships impose unrealistic performance benchmarks or daily quotas, requiring scholars to earn a minimum amount of rewards through extensive hours of gameplay. This pressure often leads to excessive play, risking mental and physical health (Chow and de Guzman, 2022). Scholars who fail to meet these targets may face penalties, including removal from the program or reductions in their earnings. Furthermore, certain scholarship programs may charge scholars fees to join or exit scholarship programs, further reducing their already limited net earnings. These practices disproportionately burden financially vulnerable scholars, creating a system that can feel exploitative rather than supportive. This highlights a critical need for research to address these challenges, encapsulated by the following research question.

Research opportunity #6: How can scholarship programs in P2E games be structured to balance accessibility, fair compensation, and sustainability, while avoiding exploitative practices and ensuring the well-being of scholars?

Coalitional game theory may provide a robust framework for addressing the above research opportunity. For instance, well-established formulas, such as the Shapley Value (Roth, 1988), enable fair reward sharing when marginal contributions are objectively measurable. Additionally, subjective contributions can also be fairly assessed using approaches like those outlined by Carvalho and Larson (2012). Another promising avenue involves coding guild governance into decentralized autonomous organizations (Ellinger et al., 2024), which can clearly delineate expectations, contributions, and reward allocations. Expanding and formalizing such mechanisms could significantly enhance the fairness and efficiency of scholarship programs in P2E games. Some scholarship programs are starting to move in that direction. For example, HumanDAO allows governance token owners to create and vote on proposals related to treasury management, investment opportunities in terms of P2E games, and partnerships with exchanges (HumanDAO, 2023). While HumanDAO's proposals and voting are primarily related to technology, products, and projects, we envision instead the use of DAOs to directly and automatically manage relationships with scholars as opposed to only being a community governance method.

Fair Rewards

While affordability pertains to ex-ante considerations — i.e., whether players have the means to participate and derive benefits from P2E games — the concept of fair rewards is an ex-post evaluation. It revolves around the fairness of players' compensation for their time and effort. A frequently raised issue among players is the perceived inadequacy of rewards relative to their investments in gameplay (Delfabbro et al., 2022). This sentiment was particularly evident following Hamster Kombat's token distribution, as highlighted by several comments from the game's official Telegram chat:

- “*Man the Hamster airdrop is very bad. The tokens are not even worth much. After months of grind I'm getting 11 dollars?*” (By Skar on September 22, 2024)
- “[...] *you need to understand while people got \$100 at most, they [game developers] made upwards of 10s of millions of dollars off of the sheep that play this game (which im ashamed to say i was a part of for season 1)*” (by Egossi on November 20, 2024).

Considering the significant time investment required from players and the substantial revenue developers can generate from their participation, it is ethically imperative to ensure players are compensated fairly. However, the concept of fairness is complex and multifaceted, especially given the vast and diverse player base in these games. This complexity underscores a pressing need for research to define and operationalize fairness in the context of P2E ecosystems.

An even more concerning issue is the potential for players to incur financial losses in P2E games. For instance, consider the Sandbox NFT example discussed earlier. To participate in the Solo Leveling – Ultimate game, we had to pay 100 \$SAND for an NFT, which gave us access to a reward pool of 50,000 \$SAND. However, due to the high number of participants in that pool, individual payouts were disproportionately low, amounting to only 59.17 \$SAND. In other words, we earned barely half of our original investment. This discrepancy highlights a flaw in reward distribution mechanisms, where the influx

of participants dilutes returns, potentially leaving players financially worse off than when they started. Like many other types of investments, P2E game returns may not be guaranteed, but there are opportunities for research into structures that better mitigate the risk of financial losses for players.

Research opportunity #7: How can reward distribution mechanisms in P2E games be designed to ensure fair returns for all participants while mitigating the risk of financial loss?

The economics field of mechanism design offers valuable tools for addressing these challenges. Mechanism design is a branch of economics focused on creating mechanisms, such as systems, rules, and incentives, to achieve desired outcomes, particularly in situations involving conflicting interests or incomplete information among participants (Myerson, 1989). For example, reward mechanisms can be structured to encourage honest behavior among players while maximizing their expected profits. Furthermore, such mechanisms can incorporate properties like individual rationality (i.e., ensuring players do not lose money on average by participating) and budget balance (i.e., ensuring that allocated rewards remain within the system's financial constraints). We strongly believe that by leveraging the principles of mechanism design, P2E games and platforms can deploy robust reward systems that align with developers' goals while promoting fairness and, consequently, participant trust.

Conclusion

Blockchain-based P2E games represent a transformative fusion of gaming, blockchain technology, and decentralized finance. By enabling players to earn cryptocurrencies or NFTs through in-game activities, these games have opened new avenues for economic empowerment and digital asset ownership. With the integration of blockchain, P2E games offer transparency, security, and verifiable ownership, allowing players to trade or monetize their virtual achievements. Despite their potential to redefine traditional gaming models, challenges such as sustainability, accessibility, and fair reward distribution highlight the complexities of maintaining a balanced ecosystem.

We explored the multifaceted dynamics of P2E games through four critical themes: community sustainability, player health, affordability, and fair rewards. Each theme presented unique challenges and opportunities, leading to research questions aimed at guiding the development of more equitable and sustainable ecosystems. By addressing these research opportunities, we highlighted the potential for innovative solutions, such as decentralized autonomous organizations, mechanism design, and participatory governance models, to shape the future of P2E games. The information systems community stands at a pivotal moment to influence this burgeoning domain, leveraging interdisciplinary approaches to enhance inclusivity, fairness, and sustainability in the P2E ecosystem.

REFERENCES

- Anderson, C., Carvalho, A., Kaul, M., & Merhout, J. W. (2023). Blockchain innovation for consent self-management in health information exchanges. *Decision Support Systems*, 174.
- Barbureau, T., Smethurst, R., Papageorgiou, O., Sedlmeir, J., & Fridgen, G. (2023). Decentralised finance's timocratic governance: The distribution and exercise of tokenised voting rights. *Technology in Society*, 73, 102251.
- Carvalho, A. (2021). Bringing transparency and trustworthiness to loot boxes with blockchain and smart contracts. *Decision Support Systems*.
- Carvalho, A., & Larson, K. (2012). Sharing rewards among strangers based on peer evaluations. *Decision Analysis*, 9, 253–273.
- Carvalho, A., Sambhara, C., & Young, P. (2020). What the history of Linux says about the future of cryptocurrencies. *Communications of the Association for Information Systems*, 46, 18–29.
- Chow, A. R., & de Guzman, C. (2022). A crypto game promised to lift Filipinos out of poverty. Here's what happened instead. *Time*. <https://time.com/6199385/axie-infinity-crypto-game-philippines-debt/>
- Delfabbro, P., Delic, A., & King, D. L. (2022). Understanding the mechanics and consumer risks associated with play-to-earn (P2E) gaming. *Journal of Behavioral Addictions*, 11, 716–726.

- Egelund-Müller, B., Elsmann, M., Henglein, F., & Ross, O. (2017). Automated execution of financial contracts on blockchains. *Business & Information Systems Engineering*, 59, 457–467.
- Ellinger, E. W., Gregory, R. W., Mini, T., Widjaja, T., & Henfridsson, O. (2024). Skin in the game: The transformational potential of decentralized autonomous organizations. *MIS Quarterly*, 48, 245–272.
- Gorman, R. (2024, October 16). Tap-to-earn games are realizing Satoshi's dream. *CoinDesk*. <https://www.coindesk.com/opinion/2024/10/16/tap-to-earn-games-are-realizing-satoshis-dream>
- Hamari, J., & Keronen, L. (2017). Why do people play games? A meta-analysis. *International Journal of Information Management*, 37, 125–141.
- Hamari, J., & Sjöblom, M. (2017). What is eSports and why do people watch it? *Internet Research*, 27, 211–232.
- Hammersley, M., & Atkinson, P. (2019). *Ethnography: Principles in practice* (4th ed.). Routledge.
- humanDAO. (2023). Governance. <https://docs.humandao.org/governance>
- Jirásek, M. (2022). The dark side of crypto gaming guilds. *Frontiers in Blockchain*, 5.
- Jordan, J. (2024). Axie Infinity's audience up 200% thanks to Coinbase and Bounty Boards. *BlockchainGamer*. <https://www.blockchaingamer.biz/news/33436/axie-infinity-up-200-percent-h1-2024/>
- Kumar, A., Liu, R., & Shan, Z. (2020). Is blockchain a silver bullet for supply chain management? Technical challenges and research opportunities. *Decision Sciences*, 51, 8–37.
- Kuo Siong Tan, G. (2024). Playing for keeps: Digital labor and blockchain precarity in play-to-earn gaming. *Geoforum*, 151, 104009.
- Lee, M., & Park, C. (2023). Examining consumer motivations for play-to-earn gaming: Application of analytic hierarchy process analysis. *Sustainability*, 15.
- Loton, D., Borkoles, E., Lubman, D., & Polman, R. (2016). Video game addiction, engagement and symptoms of stress, depression and anxiety: The mediating role of coping. *International Journal of Mental Health and Addiction*, 14, 565–578.
- Mindel, V., Mathiassen, L., & Rai, A. (2018). The sustainability of polycentric information commons. *MIS Quarterly*, 42, 607–631.
- Myerson, R. B. (1989). Mechanism design. In *Allocation, information and markets* (pp. 191–206). Palgrave Macmillan.
- Ongweso, E., Jr. (2022). The metaverse has bosses too: Meet the 'managers' of Axie Infinity. *Vice*. <https://www.vice.com/en/article/the-metaverse-has-bosses-too-meet-the-managers-of-axie-infinity/>
- Qureshi, M. (2024). Unmet expectations spark Hamster Combat airdrop outrage. *The Defiant*. <https://thedefiant.io/news/tokens/unmet-expectations-spark-hamster-kombat-airdrop-outrage>
- Roth, A. E. (1988). Introduction to the Shapley value. In *The Shapley value* (pp. 1–28). Cambridge University Press.
- Tarafdar, M., Gupta, A., & Turel, O. (2013). The dark side of information technology use. *Information Systems Journal*, 23, 269–275.
- Wang, S., Schlagwein, D., & Seymour, M. (2025). Socio-technical phenomena involving blockchain use: Literature review, conceptual framework, and research agenda. *Journal of Strategic Information Systems*, 34, 1–38.
- Xie, A., Hu, X., Wang, M., & Zhao, X. (2024). Exploring the sustainable development of Web3 game token economy. *Sustainability*, 16, 6587.
- Zaucha, T. (2024). Unpredictability and consequence in play-to-earn crypto gaming. *Information, Communication & Society*, 1–19.