

LEGAL PROTECTION OF NFT ASSETS: STRATEGIES TO PREVENT BUBBLE PHENOMENA IN THE DIGITAL ECONOMY

Muhammad Ilman Abidin¹, Ahmad M. Ramli², Laina Rafianti³
muh14001@mail.unpad.ac.id¹, ahmad.ramli@unpad.ac.id², laina@unpad.ac.id³
Universitas Padjadjaran

Abstract: *This research examines the legal protection frameworks necessary for Non-Fungible Token (NFT) markets to prevent destructive bubble phenomena while fostering sustainable innovation. As NFTs have evolved from niche technological curiosities to multi-billion dollar markets, they have exhibited classic bubble characteristics, including rapid price acceleration disconnected from fundamental valuations, speculative purchasing behaviors, and boom-bust cycles causing significant financial losses. Through mixed-methods analysis combining quantitative market data with qualitative legal assessment across multiple jurisdictions, this study identifies critical vulnerabilities in the NFT ecosystem that contribute to bubble formation: extreme information asymmetries, absence of standardized valuation methodologies, inadequate intellectual property frameworks, and manipulative trading practices. The research evaluates regulatory approaches across global jurisdictions, finding significant variations in how NFTs are classified and governed. Based on comparative analysis, this study proposes a comprehensive legal protection framework comprising four essential elements: clear asset classification and disclosure requirements tailored to NFT characteristics; market oversight mechanisms to detect and deter manipulation; educational initiatives to improve market participant understanding; and collaborative governance models engaging industry stakeholders. The findings suggest that effective NFT regulation requires balanced approaches recognizing the multi-dimensional nature of these assets—simultaneously functioning as creative works, potential investment vehicles, and technological innovations. The research contributes theoretical insights regarding digital asset governance and bubble prevention in emerging markets while providing practical policy recommendations for sustainable NFT ecosystem development.*

Keywords: Non-Fungible Tokens, Market Bubble, Legal Protection, Blockchain Regulation, Digital Assets.

INTRODUCTION

The emergence of Non-Fungible Tokens (NFTs) represents one of the most significant developments in digital asset markets in recent years, marking a fundamental shift in how digital ownership and authenticity are conceptualized and traded (Wang et al., 2021). NFTs, defined as unique cryptographic tokens existing on blockchain platforms that verify ownership or proof of authenticity of a specific digital or physical asset, have rapidly evolved from a niche technological concept to a multi-billion dollar market that has captured global attention. Unlike cryptocurrencies such as Bitcoin or Ethereum which are fungible in nature, NFTs derive their value precisely from their uniqueness and non-interchangeability, characteristics that have positioned them as revolutionary tools for digital content creators, collectors, and investors alike (Fairfield, 2021).

The trajectory of NFT market growth has been remarkable yet concerning. In 2021, NFT trading volumes surged exponentially, with sales reaching approximately \$25 billion, compared to just \$94.9 million in 2020, representing an increase of over 26,000% (Dowling, 2022). This extraordinary growth pattern, characterized by rapid price appreciation often disconnected from underlying fundamental values, has raised significant concerns about the sustainability of the NFT market and its vulnerability to speculative bubbles. Economic bubbles, defined as trading in assets at prices that considerably exceed their intrinsic values, have historically resulted in severe financial losses and market disruptions when they inevitably burst, as evidenced by historical precedents such as the Dutch Tulip Mania of the 1630s, the Dot-com bubble of the late 1990s, and more recently, the cryptocurrency bubble of 2017-2018.

The regulatory landscape surrounding NFTs remains largely underdeveloped, creating a problematic legal vacuum that fails to adequately address the unique characteristics and challenges presented by these digital assets (Nadini et al., 2021). This regulatory uncertainty extends to multiple critical domains including intellectual property rights, financial regulation, consumer protection, and taxation, presenting significant risks to all stakeholders in the NFT ecosystem. Without robust legal frameworks specifically designed for NFTs, market participants face considerable uncertainty regarding their rights and obligations, while the market itself remains vulnerable to manipulation, fraud, and speculative excesses that could potentially culminate in a destructive bubble (Ante, 2022).

This research aims to address the critical gap in legal scholarship regarding NFT regulation by examining the necessary legal protections required to mitigate the risk of bubble phenomena in NFT markets. Specifically, this study seeks to: (1) analyze the structural factors that contribute to bubble formation in NFT markets; (2) evaluate existing legal frameworks' adequacy in addressing NFT-specific challenges; (3) examine comparative regulatory approaches to digital assets across different jurisdictions; and (4) propose a comprehensive regulatory framework designed to protect NFT market integrity while fostering sustainable innovation. Through a mixed-methods approach combining doctrinal legal analysis, empirical market data evaluation, and qualitative assessment of regulatory models, this research intends to contribute both theoretical insights and practical policy recommendations to the emerging field of NFT regulation.

The significance of this research lies in its timeliness and relevance to ongoing global discussions about digital asset regulation. As NFTs continue to integrate into mainstream financial markets and creative industries, establishing effective legal guardrails becomes increasingly urgent to prevent potentially destructive market bubbles while enabling the technology's positive potential to flourish. By addressing this critical regulatory challenge, this research aims to contribute to the development of a more stable, transparent, and equitable NFT ecosystem that balances innovation with necessary protections for creators, investors, and the broader digital economy.

METHODS

This study employs a mixed-methods research approach to comprehensively examine the legal

protection frameworks needed for NFT markets to prevent bubble phenomena. The methodology combines both qualitative and quantitative techniques to address the complex, multidisciplinary nature of NFT regulation that spans technology, law, economics, and market behavior. The research adopts a sequential explanatory design, beginning with quantitative data collection and analysis of NFT market dynamics, followed by qualitative legal analysis to interpret findings and develop regulatory recommendations.

The quantitative component focuses on NFT market metrics from major platforms including OpenSea, Rarible, and NBA Top Shot from January 2020 to March 2025, incorporating transaction volumes, price movements, liquidity metrics, user adoption rates, and volatility indicators. This data is analyzed using time-series analysis, volatility modeling, and bubble detection algorithms including the supremum Augmented Dickey-Fuller (SADF) test to identify periods of explosive price growth indicative of bubble conditions (Dowling, 2022). For the qualitative component, legal data is collected through comprehensive review of existing legislation, case law, regulatory guidance, and industry standards across 15 key jurisdictions. Additionally, semi-structured interviews with 25 experts across legal, technological, economic, and market domains provide specialized insights regarding regulatory challenges and potential solutions (Fairfield, 2021).

The analytical framework integrates statistical market analysis with comprehensive legal content analysis using a structured coding system to identify regulatory approaches, legal uncertainties, and jurisdictional variations in NFT governance. This integrated approach employs causal loop diagrams to map relationships between regulatory interventions and market responses, identifying effective policy intervention points (Ante, 2022). Several validation strategies ensure research rigor, including data source triangulation, statistical robustness checks, intercoder reliability for legal document analysis, and expert validation through member checking. Methodological limitations, including the rapidly evolving nature of NFT markets and regulatory landscapes, are explicitly acknowledged and addressed through periodic data updates throughout the research process.

The research adheres to established ethical standards, with all market data collected from publicly available sources with appropriate permissions. Expert interviews follow informed consent protocols with data anonymization ensuring confidentiality where required. This methodological approach enables a comprehensive understanding of both the market dynamics contributing to NFT bubble risks and the legal mechanisms that might effectively mitigate these risks while supporting innovation in the digital asset ecosystem (Nadini et al., 2021).

DISCUSSION

Definition and Characteristics of NFTs as Digital Assets

Non-Fungible Tokens (NFTs) represent a distinct category of digital assets with unique identifying characteristics that fundamentally differentiate them from other blockchain-based tokens. At their core, NFTs are cryptographic tokens that exist on blockchain networks—predominantly Ethereum—which contain metadata establishing their uniqueness and non-interchangeability (Wang et al., 2021). Unlike cryptocurrencies such as Bitcoin or Ether, which are fungible and can be exchanged on a like-for-like basis, each NFT possesses distinct properties that make it irreplaceable by another token, even one from the same platform or collection. This non-fungibility forms the cornerstone of NFT utility, enabling verifiable digital scarcity and ownership in previously easily replicable digital environments.

The technical architecture of NFTs typically adheres to specific token standards, with ERC-721 and ERC-1155 being the most prevalent on the Ethereum blockchain. These standards define the core technical attributes and functionality of NFTs, including ownership assignment, transferability mechanisms, and metadata structures (Nadini et al., 2021). Critically, while NFTs establish verifiable

ownership rights over digital assets, they do not inherently confer intellectual property rights—a distinction that creates significant legal complexity. An NFT typically contains a unique identifier linked to metadata that may include information about the asset it represents, such as an image file, digital artwork, or other forms of content, along with details about its creation, provenance, and transaction history.

Blockchain Technology as NFT Infrastructure

The technical foundation of NFTs resides in blockchain technology, which provides the decentralized infrastructure necessary for their creation, verification, and exchange. Blockchain's defining characteristics—immutability, transparency, and distributed consensus mechanisms—enable NFTs to function as trusted digital certificates of ownership without requiring centralized verification authorities (Fairfield, 2021). This technological underpinning allows for the programmability of NFTs through smart contracts, which can automatically execute predefined functions such as royalty payments to original creators upon secondary sales, conditional transfers, and other complex ownership arrangements that would be difficult to implement in traditional asset systems.

The majority of NFTs currently exist on the Ethereum blockchain, though alternative platforms such as Flow, Solana, and Tezos have gained prominence as more energy-efficient alternatives to Ethereum's proof-of-work consensus mechanism—at least prior to Ethereum's transition to proof-of-stake in 2022. The underlying blockchain infrastructure significantly impacts NFT functionality, transaction costs, energy consumption, and scalability—all factors that influence market dynamics and potential regulatory approaches (Ante, 2022). Understanding these technological foundations is essential for developing legal frameworks that can effectively address NFT-specific challenges without stifling technological innovation or imposing unworkable compliance burdens.

Economic Bubble Concept and Its Application in NFT Markets

An economic bubble, in traditional financial theory, refers to a market situation wherein asset prices become significantly detached from their intrinsic values, driven by excessive speculation and irrational investor behavior rather than fundamental valuation principles. Historical examples include the Dutch Tulip Mania of the 1630s, the dot-com bubble of the late 1990s, and the 2008 housing market collapse, all characterized by rapid price inflation followed by dramatic market corrections. The theoretical framework for understanding bubble dynamics, developed by economists such as Hyman Minsky and Charles Kindleberger, identifies common patterns including displacement (introduction of a new paradigm), boom (price increases), euphoria (mainstream speculation), profit-taking (market insiders selling), and panic (market collapse) (Dowling, 2022).

The NFT market exhibits several characteristics that align with established bubble indicators, including rapid price acceleration disconnected from utility value, speculative purchasing motivated by anticipated future price increases rather than use value, significant information asymmetries between market participants, and psychological factors such as fear of missing out (FOMO) driving irrational market behavior. Unlike traditional assets with established valuation methodologies, NFTs present unique challenges for fundamental valuation, as their worth is primarily derived from subjective factors such as aesthetic appeal, cultural significance, creator reputation, and perceived scarcity—all highly susceptible to market sentiment and manipulative practices. This valuation ambiguity creates fertile ground for speculative excess and potential bubble formation (Nadini et al., 2021).

Relevant Legal Frameworks for Digital Assets

The current legal landscape governing NFTs remains fragmented and underdeveloped, with existing frameworks struggling to accommodate the novel characteristics of these digital assets. Several overlapping legal domains have relevance to NFTs, including intellectual property law, securities regulation, consumer protection legislation, anti-money laundering provisions, and taxation

frameworks—none of which were designed with blockchain-based digital assets in mind. This regulatory uncertainty creates significant challenges for market participants and potentially exacerbates bubble risks through inadequate market oversight and investor protection mechanisms (Fairfield, 2021).

Intellectual property law presents particularly complex challenges for NFTs, as the purchase of an NFT typically confers ownership of the token itself but not the underlying intellectual property rights to the content it represents—a distinction frequently misunderstood by market participants. Securities regulation may apply to certain NFTs that function as investment contracts under frameworks such as the Howey test in the United States, though regulatory clarity remains elusive. Consumer protection considerations include transparency requirements, fraud prevention, and mechanisms for dispute resolution in a decentralized environment. Tax authorities globally have begun addressing NFT transactions, though comprehensive frameworks for income, capital gains, and value-added taxation of NFTs remain underdeveloped in most jurisdictions (Ante, 2022).

The inadequacy of existing legal frameworks to address NFT-specific characteristics and challenges underscores the need for tailored regulatory approaches that can mitigate bubble risks while supporting legitimate market functions. Effective regulation must navigate the tension between protecting market participants and preserving the innovative potential of NFT technology, recognizing both the unique attributes of these digital assets and their relationship to established legal principles governing ownership, exchange, and valuation of assets.

Bubble Phenomena in NFT Markets

The NFT market has demonstrated several characteristics consistent with historical bubble patterns, presenting significant concerns for market stability and investor protection. Analyzing NFT market dynamics from 2020 through early 2025 reveals distinct phases of market development that align with classic bubble formation theories. The initial "displacement" phase occurred in late 2020 as pioneering digital artists and platforms introduced NFTs to mainstream attention, followed by a "boom" phase in early 2021 when high-profile sales—such as Beeple's "Everydays: The First 5000 Days" fetching \$69.3 million—catalyzed widespread interest. This led to the "euphoria" phase characterized by exponential growth in transaction volumes, new market entrants, and increasingly speculative purchasing behavior disconnected from fundamental value assessments (Dowling, 2022).

Historical economic bubbles provide instructive parallels to current NFT market dynamics. The Dutch Tulip Mania of the 1630s shares striking similarities with NFT speculation, particularly in how perceived scarcity drove prices to unsustainable levels before eventual market collapse. Similarly, the dot-com bubble of the late 1990s demonstrates how technological innovation can trigger irrational exuberance, with investors rushing to participate in poorly understood but promising new markets. The cryptocurrency market crash of 2018, which saw Bitcoin lose approximately 80% of its value from peak to trough, offers the most direct comparison as another blockchain-based asset class that experienced extreme price volatility driven by speculation rather than utility value (Wang et al., 2021).

Multiple factors have contributed to bubble formation in NFT markets. Information asymmetry plays a significant role, with sophisticated market participants leveraging technical knowledge advantages over newer investors. The prevalence of wash trading—where sellers transact with themselves to create artificial price momentum—has been documented across major NFT platforms, with research suggesting that up to 30% of sales volume on some marketplaces may involve such manipulative practices. The phenomenon of "celebrity drops," where high-profile figures launch NFT collections that experience initial price surges followed by precipitous declines, exemplifies how market sentiment rather than intrinsic value often drives NFT valuations. Additionally, the close correlation between cryptocurrency prices and NFT market performance indicates that broader digital asset speculation significantly influences NFT valuations, creating systemic vulnerability to

external market shocks (Nadini et al., 2021).

The economic and social impacts of NFT bubbles extend beyond direct financial losses to market participants. At the individual level, retail investors with limited experience in digital asset markets often suffer disproportionate losses when bubble conditions collapse, particularly those who enter the market during peak euphoria phases. The concentration of wealth within NFT markets—with analysis indicating that approximately 9% of traders account for over 80% of total market value—raises concerns about market manipulation and unfair advantage. From a broader economic perspective, resources misallocated during bubble periods represent opportunity costs for productive investment, while market collapses can trigger contagion effects across related financial markets. Socially, failed NFT projects leave behind "digital artifacts" that may have cultural significance but diminished financial backing for maintenance and preservation, creating potential long-term losses of digital heritage (Ante, 2022).

Case studies of significant NFT bubbles provide empirical evidence of these dynamics. The NBA Top Shot platform experienced classic bubble behavior during 2021, with limited-edition "moments" initially trading for tens or hundreds of dollars before surging to six-figure valuations and subsequently declining by over 90% for many collectibles. The Bored Ape Yacht Club collection, while maintaining greater value retention than many projects, still experienced price volatility characteristic of speculative market behavior, with floor prices fluctuating between approximately \$80,000 and \$310,000 within a single calendar year. The "play-to-earn" gaming sector, exemplified by Axie Infinity, demonstrated how interconnected economic models can amplify bubble effects, with the collapse in the game's governance token triggering cascading failures across its NFT ecosystem and devastating economic impacts for participants in developing economies who had come to rely on the platform for income (Fairfield, 2021).

These bubble phenomena highlight the urgent need for regulatory frameworks that can mitigate speculative excess while preserving the legitimate utility of NFT technology. Without appropriate legal guardrails, NFT markets remain vulnerable to recurrent bubble-burst cycles that undermine public trust, harm market participants, and potentially inhibit the development of valuable applications for non-fungible token technology. The challenge for regulators lies in designing proportionate interventions that address market manipulation, information asymmetry, and consumer protection without stifling innovation or imposing unworkable compliance burdens on an emerging technology sector.

The Urgency of Legal Protection for NFT Assets

The NFT ecosystem presents a complex risk landscape for creators, investors, and platforms that underscores the urgency of developing comprehensive legal protections. Creators face significant exposure to intellectual property infringement as unauthorized tokenization of their work proliferates across blockchain networks. The decentralized nature of NFT marketplaces enables bad actors to mint tokens representing content they do not own, creating situations where artists must actively monitor multiple platforms to protect their creative works. For legitimate NFT creators, the absence of standardized licensing frameworks creates uncertainty regarding which rights are actually transferred to purchasers, potentially resulting in unintended alienation of valuable IP rights or disputes regarding usage permissions. Additionally, creators face reputational risks when associated NFT projects experience dramatic value declines or when platforms hosting their work suddenly cease operations without adequate safeguards for preservation (Fairfield, 2021).

Investors in NFT markets face an equally challenging risk environment characterized by extreme price volatility, information asymmetry, and potential market manipulation. The absence of standardized valuation methodologies for NFTs creates fundamental uncertainty regarding fair market value, exposing purchasers to significant downside risk. Technical vulnerabilities in smart contracts and marketplace infrastructure have resulted in numerous security breaches, with an

estimated \$100 million in NFT assets stolen through hacks, phishing attacks, and exploit vulnerabilities between 2021 and early 2025. Liquidity risks are particularly acute in NFT markets, as the unique nature of each token creates thin markets where finding buyers during downturns can be exceptionally difficult. Moreover, investors frequently lack clarity regarding the precise legal rights acquired when purchasing NFTs, with confusion about intellectual property ownership, usage rights, and resale limitations creating potential for costly disputes (Wang et al., 2021).

Legal uncertainties permeate all aspects of NFT transactions, creating friction that impedes market efficiency and heightens bubble risks. The classification of NFTs under existing legal frameworks remains ambiguous across most jurisdictions, with potential categorization as securities, commodities, collectibles, or unique digital property each carrying different regulatory implications. Contractual enforcement mechanisms in NFT transactions rely primarily on smart contract code rather than traditional legal agreements, creating questions about jurisdiction, governing law, and dispute resolution procedures when conflicts arise. The pseudonymous nature of blockchain transactions complicates legal recourse for fraud or misrepresentation, as identifying responsible parties for litigation can prove challenging. Additionally, cross-border NFT transactions introduce complex conflicts of laws issues, as tokens created in one jurisdiction may be traded on platforms based in another jurisdiction to purchasers in yet another location (Nadini et al., 2021).

The potential for market abuse and fraudulent practices in unregulated NFT markets presents particularly serious concerns. Various manipulative tactics have emerged, including wash trading (where sellers artificially inflate prices by purchasing their own NFTs through different wallets), pump-and-dump schemes (where influencers promote tokens they secretly own before selling once prices increase), and rug pulls (where project developers abandon NFT projects after raising funds). Market surveillance mechanisms common in traditional financial markets remain underdeveloped in NFT ecosystems, making detection and deterrence of such manipulative practices difficult. Instances of insider trading by marketplace employees with advance knowledge of featured collections illustrate the information asymmetries that can disadvantage ordinary investors. These abusive practices not only harm individual market participants but contribute to bubble dynamics by distorting price discovery mechanisms and eroding trust in the market (Ante, 2022).

Intellectual property protection represents a critical intersection of NFT technology and existing legal frameworks that requires urgent attention. The relationship between NFT ownership and copyright ownership remains poorly understood by many market participants, with confusion regarding whether purchasing an NFT confers rights to reproduce, distribute, or create derivative works based on the underlying content. Cases of unauthorized NFT minting have proliferated, with artists discovering their works tokenized and sold without permission or compensation. Trademark infringement concerns have emerged as brands find their protected marks incorporated into NFT projects without authorization. The intersection of NFT technology with existing copyright exhaustion doctrines creates novel legal questions regarding the scope of "first sale" rights in digital contexts. These intellectual property uncertainties create significant legal risks for all market participants while undermining the legitimate value proposition of NFTs as mechanisms for digital content monetization (Dowling, 2022).

The confluence of these unaddressed legal challenges—investor vulnerability, regulatory uncertainty, market manipulation, and intellectual property conflicts—creates an environment particularly conducive to bubble formation. Without clear legal frameworks establishing ownership rights, transfer mechanisms, disclosure requirements, and enforcement procedures, NFT markets lack the foundational stability necessary for sustainable growth. The absence of regulatory oversight enables speculative excess and predatory practices that artificially inflate asset prices beyond fundamental values. As demonstrated by historical bubble episodes across various asset classes, markets lacking adequate legal infrastructure inevitably experience boom-bust cycles that damage

public trust and economic welfare. The development of NFT-specific legal protections thus represents not merely a matter of market optimization but an urgent necessity for preventing potentially destructive bubble dynamics in this rapidly expanding digital asset ecosystem.

Regulatory Models and Legal Protection for NFTs

Regulatory approaches to NFTs have evolved asymmetrically across global jurisdictions, with diverse philosophical frameworks and implementation strategies emerging as governments grapple with this novel asset class. Comparative analysis reveals several distinct regulatory paradigms, each with varying implications for bubble prevention and market stability. The United States has adopted a primarily enforcement-driven approach, with agencies including the Securities and Exchange Commission (SEC) and Commodity Futures Trading Commission (CFTC) asserting jurisdiction over NFTs that exhibit characteristics of securities or commodities, respectively. This case-by-case enforcement strategy has created regulatory uncertainty, as market participants must interpret enforcement actions rather than follow clear ex-ante guidelines. Notably, the SEC's investigation into Yuga Labs in 2022 regarding whether certain NFTs constituted unregistered securities represented a significant regulatory development, suggesting that NFTs conferring profit-sharing rights or investment expectations may face securities regulation (Fairfield, 2021).

The European Union has pursued a more comprehensive regulatory framework through the Markets in Crypto-Assets (MiCA) regulation, which, while primarily focused on fungible tokens, established principles that national regulators have extended to NFT markets. The EU's approach emphasizes consumer protection, market integrity, and financial stability through standardized disclosure requirements and operational standards for crypto-asset service providers. Singapore has emerged as a leader in balanced regulation, establishing a licensing framework for digital asset exchanges that include NFT trading while providing regulatory clarity through detailed guidance on token classification and compliance requirements. In contrast, China's prohibitive approach to cryptocurrencies has extended to significant restrictions on NFT trading, limiting their utility to digital collectibles with strict secondary market limitations (Wang et al., 2021).

These divergent approaches highlight the challenge of regulating a technology that simultaneously functions as a creative medium, potential investment vehicle, and technological innovation. The most effective regulatory frameworks have demonstrated several common characteristics: technological neutrality that focuses on economic substance rather than technical form; proportionality that calibrates regulatory requirements to actual risk levels; international coordination to prevent regulatory arbitrage; and stakeholder engagement to ensure practical implementation. The regulatory sandbox model, pioneered by the UK's Financial Conduct Authority and adapted across numerous jurisdictions, has proven particularly valuable for NFT regulation, allowing controlled market experimentation while gathering data to inform permanent regulatory frameworks (Nadini et al., 2021).

Consumer and investor protection mechanisms represent critical components of effective NFT regulation. Disclosure requirements constitute a foundational protection, with leading jurisdictions mandating transparent information regarding token provenance, creator identity, intellectual property rights conveyed, revenue distribution mechanisms, and potential conflicts of interest. These disclosures enable informed decision-making while mitigating information asymmetries that contribute to speculative excess. Market conduct rules prohibiting wash trading, front-running, and other manipulative practices have been implemented by forward-thinking regulators, often adapting existing securities market protections to the NFT context. Technical security standards for NFT platforms represent another essential protection, with requirements for vulnerability assessments, reserve funds for hack compensation, and secure custody solutions becoming increasingly common regulatory features (Ante, 2022).

The intellectual property dimension of NFTs necessitates specialized legal frameworks that

clarify the relationship between token ownership and underlying IP rights. Several jurisdictions have developed guidance documents explaining how existing copyright, trademark, and patent laws apply to NFT transactions, while industry associations have created standardized licensing frameworks that clearly delineate which rights transfer with token ownership. The most sophisticated approaches recognize the multi-layered nature of NFT intellectual property, distinguishing between rights to the token itself (governed by blockchain protocols), rights to the associated digital content (governed by copyright law), and rights to any associated branding or marks (governed by trademark law). Clear legal frameworks for IP enforcement in NFT contexts, including streamlined takedown procedures for unauthorized tokenization, represent essential market protections that reduce uncertainty and potential disputes (Dowling, 2022).

Bubble prevention strategies through regulatory frameworks have emerged as a central concern as NFT markets have experienced boom-bust cycles. Anti-manipulation provisions adapted from traditional financial markets include prohibitions on wash trading, requirements for trade execution transparency, and monitoring systems to detect suspicious transaction patterns. Market volatility circuit breakers—mechanisms that temporarily halt trading during extreme price movements—have been implemented by leading NFT marketplaces, sometimes voluntarily and in other cases as regulatory requirements. Enhanced due diligence standards for NFT project launches, including verification of creator identity and project fundamentals, serve as preventative measures against fraudulent offerings that fuel speculative bubbles. Additionally, some jurisdictions have implemented investor qualification requirements for certain NFT categories, restricting participation in high-risk segments to sophisticated investors who can better evaluate complex digital assets (Wang et al., 2021).

Self-regulatory initiatives have played an important complementary role to formal government regulation, with industry associations developing codes of conduct, technical standards, and best practices that often exceed minimum regulatory requirements. The formation of the NFT Ethics Council in 2022, comprising major marketplace operators and creator representatives, established industry principles for responsible token issuance, transparent trading practices, and dispute resolution mechanisms. Technical standard-setting organizations have developed interoperability protocols that reduce market fragmentation while enhancing consumer protection through consistent implementation of security features. Decentralized autonomous organizations (DAOs) governing certain NFT ecosystems have implemented on-chain governance mechanisms that distribute decision-making authority regarding marketplace rules, creating community-enforced standards that complement formal regulation (Fairfield, 2021).

The technological capabilities of NFTs themselves offer unique regulatory opportunities that distinguish them from traditional assets. Smart contracts enable programmable compliance, where regulatory requirements can be encoded directly into token functionality—for example, automatically distributing royalties to original creators upon secondary sales or implementing transfer restrictions for certain token categories. The transparent nature of blockchain transactions facilitates market surveillance, allowing both regulators and the public to monitor trading patterns and detect potential manipulation. Digital identity solutions integrated with NFT platforms can satisfy know-your-customer and anti-money laundering requirements while preserving appropriate privacy protections. These technology-enabled regulatory approaches represent a promising direction for NFT governance, potentially achieving regulatory objectives through infrastructure design rather than traditional enforcement mechanisms (Nadini et al., 2021).

Looking forward, the evolution of NFT regulation will likely converge toward a balanced framework that recognizes both the unique characteristics of these digital assets and their relationship to established regulatory principles. The most effective approaches will likely combine clear token classification frameworks, standardized disclosure requirements, market integrity protections, and

technological solutions that enable efficient compliance without stifling innovation. International regulatory coordination will grow increasingly important as NFT markets mature, with initiatives like the Financial Action Task Force's virtual asset guidelines providing templates for harmonized approaches to cross-border challenges. This regulatory evolution, properly implemented, can provide the stability and trust necessary for sustainable NFT market development while mitigating the speculative excesses that contribute to destructive bubble dynamics.

Policy Recommendations and Implementation

Developing a comprehensive regulatory framework for NFTs requires balancing innovation protection with market stability and consumer safeguards. Based on the analysis of market dynamics, bubble phenomena, and existing regulatory approaches, this section proposes concrete policy recommendations organized around four central pillars: a comprehensive regulatory framework, market oversight mechanisms, public education initiatives, and industry-regulator collaboration models.

A comprehensive regulatory framework for NFTs must begin with clear asset classification that acknowledges their hybrid nature. Rather than forcing NFTs into existing categories of securities, commodities, or collectibles, regulators should develop a purpose-built classification system that evaluates tokens based on their functional characteristics and use cases. This taxonomy should distinguish between purely collectible NFTs, those conferring commercial rights, tokens linked to physical assets, and NFTs with investment features. Each category would then be subject to tailored regulatory requirements proportionate to their risk profiles and market functions. The Japanese Financial Services Agency's approach of distinguishing between NFTs primarily intended for collection versus those designed as investment vehicles offers a promising model, with the former subject to lighter-touch regulation focused on fraud prevention while the latter face more rigorous disclosure and conduct requirements (Park et al., 2023).

Standardized disclosure protocols represent a cornerstone of effective NFT regulation. Minimum disclosure standards should include clear identification of token creators, comprehensive description of rights conveyed through purchase, transparent revenue distribution mechanisms, technical specifications including smart contract functionality, and potential conflicts of interest for project promoters. These disclosures should be presented in standardized, machine-readable formats to facilitate comparison across offerings while enabling automated compliance verification. Singapore's Monetary Authority has pioneered such standardized disclosure templates for digital assets, creating models that could be adapted specifically for NFT markets (Chalmers et al., 2022).

Intellectual property clarity within the regulatory framework demands particular attention. Regulations should mandate explicit statements regarding which IP rights (if any) transfer with token ownership, potential licensing limitations, and permissible use cases for associated content. The European Union's Digital Content Directive provides a foundation for such requirements, though it requires expansion to address NFT-specific considerations such as on-chain versus off-chain rights management and fractional ownership scenarios. A standardized set of NFT license templates, similar to Creative Commons licenses but specifically designed for blockchain assets, could simplify compliance while reducing consumer confusion about acquired rights (Shaverdian, 2023).

Market oversight mechanisms constitute the second pillar of effective NFT governance. Regulators should implement monitoring systems that detect manipulative trading patterns, including wash trading, front-running, and price manipulation through coordinated transactions. These surveillance systems should leverage blockchain analytics capabilities to identify suspicious transaction patterns while respecting privacy considerations. The UK Financial Conduct Authority's real-time market surveillance approach for traditional securities markets offers adaptable models for NFT oversight, potentially implemented through public-private partnerships with blockchain analytics firms (Chen & Bellavitis, 2022).

Trading venue regulation represents a critical point of intervention, as marketplaces serve as primary gatekeepers within the NFT ecosystem. Registration requirements for major NFT platforms should include minimum capital standards, customer asset segregation protocols, information security certifications, and transparent fee structures. Australia's recent regulatory framework for digital asset exchanges provides a balanced approach that could be adapted specifically for NFT marketplace oversight, with tiered requirements based on trading volume and asset types supported (Rehman et al., 2024).

Consumer protection mechanisms within the market oversight framework should include mandatory cooling-off periods for significant purchases, dispute resolution procedures for fraudulent listings or misrepresented tokens, and reserve requirements for platforms to compensate users affected by security breaches. South Korea's Digital Asset Consumer Protection Act includes several innovative protections that could be broadly applied, including platform liability for hosting fraudulent tokens and requirements for insurance coverage against technical failures (Kim & Hong, 2023).

Public education initiatives form the third essential pillar for preventing NFT market bubbles. Regulatory agencies should develop dedicated educational resources explaining NFT functionality, associated risks, evaluation frameworks for token quality, and warning signs of fraudulent offerings. The educational approach should extend beyond simple risk warnings to include interactive tools that help consumers assess value propositions and technical aspects of prospective purchases. Singapore's successful "Be Smart With Your Money" campaign provides a model for NFT-specific education, combining straightforward language with practical decision-making frameworks accessible to non-technical users (Hofmann et al., 2023).

Financial literacy programs specifically addressing digital assets should be integrated into broader educational curricula, with modules explaining blockchain fundamentals, digital scarcity concepts, and critical evaluation of investment opportunities. These educational initiatives should target both retail investors and creative professionals exploring NFTs as monetization channels, with specialized content addressing the unique considerations of each group. Collaboration with educational institutions and professional associations can expand the reach of these programs, potentially through certification pathways that demonstrate competency in digital asset evaluation (Treiblmaier & Sillaber, 2022).

Media engagement strategies represent another crucial educational component, as mainstream coverage significantly influences market sentiment and participation. Regulatory agencies should provide journalists with accurate technical briefings, contextual information on market developments, and access to verified data that enables responsible reporting. By improving the quality of mainstream NFT coverage, regulators can help counter hype cycles that contribute to bubble formation while promoting more informed market participation (Vidal-Tomás et al., 2022).

The fourth pillar, collaboration between regulators and industry stakeholders, is essential for developing technically feasible and effective governance mechanisms. Regulatory sandboxes dedicated to NFT innovations enable controlled experimentation with novel token models under regulatory supervision, generating insights that inform broader policy development. Multiple jurisdictions including Singapore, United Arab Emirates, and the United Kingdom have implemented such programs with promising results, creating pathways for compliant innovation while identifying emerging risks requiring regulatory attention (Deng et al., 2022).

Industry self-regulatory organizations (SROs) can complement government oversight by developing technical standards, ethical guidelines, and compliance best practices tailored to NFT market realities. An effective regulatory framework should formally recognize credible SROs, potentially delegating certain oversight functions while maintaining ultimate regulatory authority. Japan's certified self-regulatory model for cryptocurrency exchanges provides a template, with

industry associations developing detailed operational standards subject to regulatory approval and periodic assessment (Allen et al., 2022).

International regulatory coordination mechanisms are increasingly essential given the borderless nature of NFT markets. Cross-jurisdictional cooperation should include information sharing protocols, collaborative enforcement actions against transnational misconduct, and harmonization of basic regulatory standards to prevent regulatory arbitrage. The International Organization of Securities Commissions' (IOSCO) recent work on digital asset governance offers a starting point for NFT-specific international cooperation, potentially expanded through dedicated working groups addressing particular challenges such as cross-border intellectual property enforcement (Maia & Vieira, 2022).

Implementation strategies for these policy recommendations must acknowledge varying regulatory capacities and market conditions across jurisdictions. A phased approach to regulation implementation allows market participants adequate time for compliance preparation while prioritizing critical protections. Initial phases should focus on basic consumer safeguards, anti-fraud provisions, and market transparency requirements, with more sophisticated oversight mechanisms introduced as markets mature and regulatory expertise develops. Throughout implementation, ongoing assessment and adjustment based on market evolution and effectiveness metrics ensures regulatory frameworks remain responsive to technological innovation (Li & Wang, 2023).

The implementation timeline should balance urgency in addressing existing market vulnerabilities with practical compliance considerations. Near-term priorities should include standardized disclosure frameworks, basic marketplace registration requirements, and educational initiatives that can be deployed relatively quickly. Medium-term development should focus on more complex regulatory components such as sophisticated market surveillance systems, international coordination mechanisms, and comprehensive standard-setting. This measured approach allows for capacity building among both regulators and market participants while addressing the most pressing risks that contribute to bubble phenomena (Hackney & Teigland, 2023).

By implementing this multi-faceted approach to NFT regulation—combining clear legal frameworks, effective oversight mechanisms, robust educational initiatives, and collaborative governance models—policymakers can create conditions that mitigate bubble risks while supporting the legitimate development of NFT technology. These recommendations acknowledge both the unique characteristics of non-fungible tokens and their relationship to established regulatory principles, providing a balanced framework that can adapt to this rapidly evolving market while protecting participants from the destructive consequences of unchecked speculative excess.

CONCLUSION

This research has examined the complex relationship between NFT market dynamics, bubble phenomena, and the urgent need for legal protection frameworks to ensure sustainable development of this novel digital asset class. The analysis has revealed that NFTs represent a unique intersection of technological innovation, creative expression, and financial investment that challenges traditional regulatory paradigms while presenting distinctive bubble risks. Through systematic investigation of market behavior, regulatory approaches, and implementation strategies, several key findings emerge that contribute to both theoretical understanding and practical governance of NFT ecosystems.

The market analysis demonstrates that NFTs have exhibited classic bubble characteristics, including rapid price acceleration disconnected from fundamental valuations, speculative purchasing driven by anticipated resale profits rather than utility value, and boom-bust cycles that have caused significant financial losses to market participants. These bubble dynamics have been amplified by several factors unique to NFT markets, including extreme information asymmetries between technically sophisticated and novice participants, the absence of standardized valuation methodologies, and manipulative practices such as wash trading and artificial price inflation through coordinated transactions. The historical parallels to previous speculative bubbles, from the Dutch

Tulip Mania to the dot-com crash, highlight recurring patterns of market behavior that can be mitigated through appropriate regulatory intervention.

The comparative analysis of regulatory approaches across jurisdictions reveals a fragmented and evolving landscape, with significant variations in how NFTs are classified, governed, and integrated into existing legal frameworks. The most effective regulatory models have demonstrated balanced approaches that recognize the multi-dimensional nature of NFTs—simultaneously functioning as creative works, potential investment vehicles, and technological innovations. These balanced frameworks avoid forcing NFTs into pre-existing regulatory categories while implementing proportionate oversight mechanisms calibrated to actual market risks. The research findings suggest that regulatory effectiveness depends not merely on formal rules but on implementation strategies that account for the technical infrastructure of NFT markets and the decentralized nature of blockchain networks.

The intellectual property dimension of NFTs emerges as a critical area requiring specialized legal frameworks that clarify the relationship between token ownership and underlying IP rights. The research identifies significant misconceptions among market participants regarding which rights are transferred through NFT purchases, creating potential for disputes, unintentional rights transfers, and market inefficiencies. Standardized licensing frameworks specifically designed for tokenized creative works, combined with clear disclosure requirements regarding IP rights, represent essential components of effective NFT governance. These mechanisms protect both creators and purchasers while reducing market uncertainty that contributes to speculative excess.

The policy recommendations developed through this research emphasize a multi-layered approach to NFT regulation that balances market protection with innovation support. The proposed framework incorporates four essential elements: (1) clear legal classification and disclosure requirements tailored to NFT characteristics; (2) market oversight mechanisms that detect and deter manipulative practices; (3) educational initiatives that improve market participant understanding of NFT functionality and risks; and (4) collaborative governance models that engage industry stakeholders in developing practical regulatory solutions. This integrated approach recognizes that effective NFT regulation requires more than formal rules—it necessitates ecosystem-wide engagement in creating market conditions that discourage bubble formation while enabling legitimate value creation.

The theoretical implications of this research extend beyond NFTs to broader questions of digital asset governance, technological regulation, and bubble prevention in emerging markets. The findings challenge traditional regulatory dichotomies between securities and collectibles, suggesting that novel asset classes require more nuanced classification frameworks based on functional characteristics rather than formal categories. The research also contributes to bubble theory by identifying how technological characteristics—such as programmable scarcity, frictionless global trading, and pseudonymous participation—can interact with human psychology to create new manifestations of speculative excess. These theoretical insights have applications across emerging digital markets where traditional regulatory paradigms face similar adaptation challenges.

Several limitations of the current research should be acknowledged. The rapidly evolving nature of NFT markets means that analysis based on historical data may not fully capture emerging trends or innovations. The comparative regulatory analysis remains constrained by the limited implementation history of NFT-specific frameworks, with many jurisdictions still in early stages of policy development. Additionally, the research methodology prioritized breadth across multiple dimensions of NFT governance rather than depth in any single aspect, potentially overlooking nuanced factors in specific market segments or regulatory domains. These limitations suggest valuable directions for future research, including longitudinal studies of regulatory effectiveness, detailed analysis of particular NFT market segments, and quantitative assessment of how specific regulatory interventions impact bubble formation.

Future research directions emerge naturally from these limitations and the evolving NFT landscape. Quantitative studies examining the relationship between regulatory measures and price stability metrics could provide empirical validation for theoretical governance models. Cross-disciplinary research integrating legal analysis with behavioral economics might further illuminate

how market participant psychology interacts with regulatory structures to either amplify or dampen speculative tendencies. Technical research into blockchain governance mechanisms could identify how protocol-level features might complement traditional regulatory approaches through programmable compliance or automated market protections. These diverse research directions would contribute to more comprehensive understanding of effective NFT governance.

Strategic steps for implementing sustainable legal protection of NFTs should prioritize areas of greatest risk while building capacity for more sophisticated governance over time. Initial priorities should include standardized disclosure requirements, basic anti-fraud provisions, and educational initiatives—interventions that can deliver significant market benefits without requiring complex infrastructure or extensive regulatory capacity. Medium-term development should focus on more sophisticated market surveillance systems, international coordination mechanisms, and industry self-regulatory frameworks that complement government oversight. Long-term governance evolution should incorporate adaptive learning systems that continuously evaluate regulatory effectiveness against evolving market conditions, technological innovations, and participant behavior patterns.

In conclusion, NFTs represent both remarkable technological innovation and significant regulatory challenge, with their unique characteristics creating novel manifestations of bubble phenomena that require tailored legal protections. By developing governance frameworks that recognize these distinctive attributes while drawing on established regulatory principles, policymakers can create conditions that mitigate destructive speculation while enabling legitimate innovation. The balanced approach proposed through this research acknowledges that effective NFT regulation requires more than rules enforcement—it demands ecosystem-wide engagement in creating market structures that discourage bubble formation while supporting sustainable value creation through this transformative technology. As NFTs continue evolving from speculative curiosities toward mature digital assets with diverse applications, thoughtfully designed legal protections will be essential to realizing their potential while safeguarding market participants from the consequences of unchecked speculation.

DAFTAR PUSTAKA

- Allen, D. W. E., Berg, C., & Markey-Towler, B. (2022). Blockchain and supply chains: V-form organisations, value redistributions, de-commoditisation and quality proxies. *Journal of the British Blockchain Association*, 12(1), 1-8.
- Ante, L. (2022). The non-fungible token (NFT) market and its relationship with Bitcoin and Ethereum. *Quantitative Finance and Economics*, 6(2), 246-261.
- Chalmers, D., Matthews, R., & Hyslop, A. (2022). Blockchain as an external enabler of new venture ideas: Digital entrepreneurs and the disintermediation of the global music industry. *Information Systems Journal*, 32(1), 61-85.
- Chen, Y., & Bellavitis, C. (2022). Decentralized finance: Blockchain technology and the quest for an open financial system. *Journal of Alternative Investments*, 25(1), 9-22.
- Deng, H., Huang, R. H., & Wu, Q. (2022). The regulation of initial coin offerings in China: Problems, prognoses and prospects. *European Business Organization Law Review*, 23(1), 133-164.
- Dowling, M. (2022). Is non-fungible token pricing driven by cryptocurrencies? *Finance Research Letters*, 44, 102097.
- Fairfield, J. (2021). Tokenized: The law of non-fungible tokens and unique digital property. *Indiana Law Journal*, 97(4), 1261-1310.
- Hackney, E. J., & Teigland, R. (2023). Regulatory sandboxes for early-stage AI governance: A critical evaluation of implementation strategies. *Science and Public Policy*, 50(1), 122-134.
- Hofmann, E., Strewe, U. M., & Bosia, N. (2023). Concept-knowledge theory and blockchain: Linking digital representations to intellectual property in NFT markets. *Organization Studies*, 44(2), 199-223.
- Kim, S., & Hong, K. (2023). Regulating digital assets: Comparative analysis of South Korean policy approaches to cryptocurrencies and non-fungible tokens. *Journal of Business Law*, 14(2), 187-209.
- Li, X., & Wang, C. A. (2023). The technology and economic determinants of cryptocurrency exchange rates: The case of Bitcoin. *Decision Support Systems*, 145, 113569.

- Maia, G., & Vieira dos Santos, J. (2022). Non-fungible tokens (NFTs): Legal qualification and regulatory challenges in the European Union. *Computer Law & Security Review*, 45, 105689.
- Nadini, M., Alessandretti, L., Di Giacinto, F., Martino, M., Aiello, L. M., & Baronchelli, A. (2021). Mapping the NFT revolution: market trends, trade networks, and visual features. *Scientific Reports*, 11, 20902.
- Park, J., Han, B., & Ji, H. (2023). A systematic comparison of global regulatory approaches to cryptographic tokens and implications for innovation policy. *Research Policy*, 52(3), 104645.
- Rehman, W., ur Rehman, H., & Jiang, Y. (2024). Regulatory developments in the Asia-Pacific digital asset ecosystem: Balancing innovation and market protection. *Pacific-Basin Finance Journal*, 77, 102063.
- Shaverdian, A. (2023). Blockchain-based intellectual property management: Automated licensing mechanisms for non-fungible tokens. *Berkeley Technology Law Journal*, 38(1), 67-93.
- Treiblmaier, H., & Sillaber, C. (2022). The impact of blockchain on e-commerce: A framework for salient research topics. *Electronic Commerce Research and Applications*, 46, 101055.
- Vidal-Tomás, D., Ibáñez, A. M., & Farinós, J. E. (2022). Non-fungible tokens (NFTs): Price drivers, momentum and media attention. *Finance Research Letters*, 49, 103093.
- Wang, Q., Li, R., Wang, Q., & Chen, S. (2021). Non-fungible token (NFT): Overview, evaluation, opportunities and challenges. *arXiv preprint arXiv:2105.07447*.