THE TRANSITION FROM WEB 2.0 TO WEB 3.0 ECOSYSTEMS: A SYSTEMATIC LITERATURE REVIEW

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The Transition from Web 2.0 to Web 3.0 Ecosystems: A Systematic Literature Review

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Abstract

The internet has evolved from basic static websites into dynamic, interactive platforms that handle large amounts of data, creating remarkable global connections yet also raising concerns about privacy violations, concentrated power, and the commercialization of personal information. Web 3.0 has emerged as a new approach that emphasizes decentralized systems, empowers users to control their own data, and establishes trust through cryptographic methods. This research uses a systematic qualitative review of the existing literature, following PRISMA 2020 guidelines, to analyze how Web 3.0 is understood relative to Web 2.0 across six key areas: technology, economics, social impact, privacy protection, governance structures, and trust mechanisms. The study reviews publications from 2015 to 2025. Findings indicate Web 3.0 signifies a fundamental shift in power structures and decision-making processes rather than just a technological innovation. This change depends on blockchain technology, smart contracts, semantic web systems, and artificial intelligence capabilities. Although AI might enhance user experience and promote broader adoption, researchers have not yet fully examined how large language models fit into this landscape. The success of Web 3.0 will depend on more than just technological advances—it must also address significant challenges related to regulation, economic sustainability, system compatibility, and building user trust.

*Keywords***:** Web 3.0, decentralization, blockchain, governance, privacy

Introduction

The development of the World Wide Web has been shaped by ongoing technological and cultural changes, evolving from static information sharing to interactive, data-driven systems. Web 1.0 was the initial phase of the internet, characterized by static pages and limited user interaction. Its successor, Web 2.0, introduced dynamic content, social networking, and user-generated media, fundamentally transforming communication and commerce. These advancements led to centralized data control, increased privacy concerns, and the exploitation of users through the monetization of personal information (Martin, 2018; McClain et al., 2023; Voramontri & Klieb, 2019). Recent research (Ray, 2023; Gan et al., 2023; Rathor et al., 2023) indicates that the internet must continue to evolve, with Web 3.0 representing the next stage. Web 3.0 emphasizes user control and decentralization. It aims to empower users by giving them ownership of their data and digital identities through blockchain technology, smart contracts, and token-based economic systems (Yaga & Mell, 2025). Unlike earlier versions, Web 3.0 seeks to offer users greater transparency and self-governance while improving semantic understanding and interoperability across platforms. This decentralized web not only pushes technological advancements but also aims to reshape economic incentives, governance structures, and trust systems. Still, the question remains whether the motives behind Web 2.0—profit, accessibility, and social engagement—can thrive within a decentralized, privacy-focused environment. Analyzing how these previous influences shaped the early development of the web provides valuable insights into the potential evolution and global growth of Web 3.0.

The growth of web technologies has enhanced connectivity but also raised concerns about privacy and data misuse (Cong et al., 2025). Web 2.0 business models rely heavily on monetizing user data through targeted ads and behavioral tracking (Zuboff, 2019), despite widespread awareness of privacy risks and the ongoing ‘privacy paradox’ (Jha et al., 2022). Although Web 3.0 aims to create a decentralized, user-controlled ecosystem, there is no universally accepted definition or standardized implementation framework

(Murray et al., 2023). Moreover, the profit-driven motives underpinning Web 2.0 may be less effective in decentralized systems. This raises an important question: which incentives will motivate businesses and users to adopt Web 3.0 if traditional data-driven revenue models decline?

This study reviews existing research on factors influencing Web 3.0 adoption, covering definitions, technological foundations, and motivating factors across academia, industry, and government. It explores whether lessons from Web 2.0—particularly regarding privacy, user engagement, and economic models—can inform the implementation of Web 3.0. The study also examines how Web 3.0 addresses decentralization, trust, governance, and economic sustainability at its current stage of development.

RQ1: What are the emerging themes in the literature on the perceptions of Web 2.0 influence Web 3.0 design across technological, economic, social interaction, privacy, governance, and trust mechanisms?

How do stakeholders conceptualize and evaluate Web 3.0 design relative to Web 2.0 across technological, economic, social, privacy, governance, and trust dimensions?

This study aims to systematically analyze how Web 3.0 is defined and perceived relative to Web 2.0 across technological, economic, social, privacy, governance, and trust dimensions. It integrates perspectives from academia, industry, and government to:

1. Clarify the conceptual boundaries of Web 3.0 and identify its primary enabling technologies, including blockchain, smart contracts, semantic web frameworks, and artificial intelligence (AI).

2. Examine how these technologies support decentralization, automation, interoperability, and user sovereignty, and assess the extent to which they address core limitations of Web 2.0, such as centralized control, data monetization, and privacy risks.

3. Investigate the emerging role of AI—particularly large language models (LLMs)—in shaping user interactions, trust mechanisms, and adoption patterns within decentralized environments.

4. Develop an integrated view of the technological, economic, and governance factors that shape the adoption, deployment, and long-term sustainability of Web 3.0 ecosystems.

Review of the Literature

Evolution from Web 2.0 to Web 3.0

Web 2.0 marks a participatory, interactive phase of the internet defined by user-generated content, social networking, and collaborative platforms (Zhao, 2022; Ziegler, 2022). Advances in broadband infrastructure, mobile connectivity, and platform design enabled widespread engagement, real-time communication, and large-scale knowledge sharing (van Deursen & van Dijk, 2019; Shao, 2017). These developments significantly lowered barriers to participation and facilitated peer-to-peer interaction across social, commercial, and informational domains. However, the same infrastructure that enabled participation also led to increased centralization. Large platforms consolidated control over data, digital interactions, and algorithmic visibility, enabling business models based on data commodification and targeted advertising (Baruh et al., 2017; McClain et al., 2023). As a result, Web 2.0 created a paradox in which increased accessibility and participation coexisted with growing concerns over privacy, surveillance, and platform dominance (Sim et al., 2024; Johnson et al., 2023). In response to these limitations, Web 3.0 has emerged as a proposed evolution of the internet that emphasizes decentralization, user sovereignty, and cryptographic trust mechanisms. Rather than relying on centralized intermediaries, Web 3.0 seeks to redistribute control through blockchain technologies, smart contracts, and distributed infrastructures (Cheng, 2024; Zubaydi et al., 2023). This shift reflects not only technological change but also a broader reconfiguration of governance, economic structures, and trust systems.

Definitional Ambiguity of Web 3.0

Despite growing interest, Web 3.0 lacks a universally accepted definition. Scholars conceptualize it in multiple ways, including as a decentralized internet architecture, a semantic and intelligent web, and a blockchain-based economic ecosystem (Murray et al., 2023; Fensel et al., 2020; Cheng, 2024). These interpretations reflect differing emphases on infrastructure, data processing, and economic organization.
Gan et al. (2023) describe Web 3.0 as a broad, evolving concept that extends beyond any single technological framework, while Cheng (2024) notes that current definitions often conflate decentralization, token-based economies, and intelligent data processing. This conceptual fragmentation complicates empirical research, policy development, and cross-sector adoption, as stakeholders lack a shared understanding of the term. The absence of definitional clarity suggests that Web 3.0 is best understood as a multi-dimensional construct that integrates technological, economic, and governance transformations rather than as a singular innovation. This ambiguity represents a foundational challenge for both research and implementation.

Technological Convergence and Infrastructure

Web 3.0 is driven by the convergence of several enabling technologies, including blockchain, artificial intelligence (AI), semantic web frameworks, and smart contracts (Zubaydi et al., 2023; Zhang et al., 2022; Zhu et al., 2024). Blockchain technologies provide decentralized data storage, immutability, and trustless transaction mechanisms, while semantic web systems enable machine-readable data and improved interoperability across platforms (Fensel et al., 2020). Artificial intelligence plays a critical role in enhancing automation, personalization, and semantic understanding. AI-powered systems can process large volumes of data, generate insights, and support adaptive user experiences (Dwivedi et al., 2021). However, the role of large language models (LLMs) within Web 3.0 ecosystems remains underexplored. While LLMs have the potential to facilitate more intuitive human–system interactions and reduce technical barriers to entry, their influence on governance, trust formation, and economic coordination in decentralized environments remains poorly understood. In addition, emerging infrastructures such as edge computing, Internet of Things (IoT) integration, and decentralized identity systems contribute to the development of Web 3.0 ecosystems (Zhang et al., 2022). Together, these technologies support a shift toward more autonomous, interoperable, and user-controlled digital environments.

Table 1
Potential Web 3.0 enabling technologies

Technology	Role in Web 3.0 implementation	Common use cases	Supporting literature
Artificial intelligence (AI)	Powers intelligent automation, semantic analysis, and personalization	Recommendation systems, chatbots, and autonomous agents	Fensel et al. (2020); Zhang et al. (2022)
Blockchain / Distributed Ledger Technologies	Enables decentralization, trustless transactions, and immutable data storage	Cryptocurrencies, NFTs, smart contracts, and decentralized identity	Zubaydi et al. (2023); Zhang et al. (2022)

Internet of Things (IoT) and Edge Computing	Connects physical devices to digital networks, allowing real-time data transfer	Smart homes, wearables, and industrial automation	Zhang et al. (2022); Zhu et al. (2024)
Non-fungible tokens (NFTs)	Store verifiable digital assets and credentials on a blockchain	Identity and credentials (e.g., certificates), digital ownership	Alshater et al. (2024); Taherdoost (2023); Yaga & Mell (2024)
Semantic web	Enables machine-readable data and platform interoperability	Linked data, ontologies, metadata tagging	Cheng (2024); Fensel et al. (2020)

Note. This table was generated with the assistance of an AI language model and aligned with the peer-reviewed sources cited in the "Supporting literature" column.

Governance Restructuring and Power Dynamics

A central theme in the literature is the transition from centralized to decentralized governance models. Web 2.0 platforms concentrate authority in corporate entities that control data, algorithms, and digital interactions (Sivarajah et al., 2020; Johnson et al., 2023). In contrast, Web 3.0 aims to distribute governance through decentralized networks, enabling users to participate in decision-making and reducing reliance on centralized intermediaries (Calzada, 2024). Blockchain-based governance models, including decentralized autonomous organizations (DAOs), exemplify this shift by enabling collective decision-making through token-based voting. However, research indicates that these systems face significant challenges, including low participation rates and the concentration of influence among large token holders, which can lead to governance capture (Beck et al., 2018; De Filippi & Loveluck, 2016). From a policy perspective, governments and regulators recognize both the potential and the risks of decentralized governance. While Web 3.0 technologies may improve transparency and efficiency in areas such as digital identity and cross-border transactions, they also pose regulatory challenges related to accountability, jurisdiction, and compliance (Organisation for Economic Co-operation and Development [OECD], 2020; European Securities and Markets Authority [ESMA], 2023). These findings suggest that effective governance in Web 3.0 will require balancing decentralization with institutional oversight and regulatory coordination. A central theme in the literature is the governmental interest in reducing financial crime and systemic risks in decentralized systems, emphasizing compliance with anti-money laundering and counterterrorism financing standards for virtual asset service providers (ESMA, 2023; Financial Action Task Force [FATF], 2024).

Economic Transformation and Value Creation

Web 2.0's economic model is primarily based on data monetization, in which platforms generate revenue through targeted advertising and the exploitation of user data (Zuboff, 2019; Goldfarb & Tucker, 2019). In contrast, Web 3.0 proposes alternative economic structures centered on token-based systems and decentralized finance (DeFi), enabling users to participate directly in value creation and exchange (Cheng, 2024; Zhang et al., 2022). These decentralized economic models aim to reduce dependence on intermediaries and redistribute economic power to users. However, their long-term sustainability remains uncertain. Unlike Web 2.0 platforms, which benefit from established revenue streams and economies of scale, Web 3.0 ecosystems face challenges related to volatility, scalability, and adoption (Zubaydi et al., 2023). The literature highlights a critical tension between decentralization and profitability, raising questions about whether token-based systems can provide stable, scalable economic incentives comparable to those of traditional platform-based models.

Privacy, Trust, and Regulatory Tensions

Privacy concerns are a defining feature of Web 2.0, where extensive data collection and behavioral tracking have raised issues of surveillance and user exploitation (Baruh et al., 2017; McClain et al., 2023). Although users express concern about privacy risks, they often continue to engage with platforms, reflecting the well-documented "privacy paradox" (Jha et al., 2022). Web 3.0 seeks to address these issues through privacy-by-design principles, cryptographic security mechanisms, and decentralized identity systems, all of which aim to give users greater control over their data (Fensel et al., 2020). However, decentralized architectures introduce new risks. Public blockchains enable transaction traceability and behavioral analysis, thereby exposing users to re-identification and surveillance (Casino et al., 2019; Conti et al., 2018). At the same time, regulatory frameworks such as the General Data Protection Regulation (GDPR) create tensions between privacy protection, innovation, and data accessibility (GDPR; Jia et al., 2021). These competing priorities highlight the complexity of designing systems that ensure both user privacy and regulatory compliance. Trust in Web 3.0 is also being reconfigured. Rather than relying on centralized institutions, trust is increasingly embedded in code, protocols, and decentralized networks. However, the effectiveness of this shift depends on users' ability to understand and engage with these systems, as well as on the reliability and security of the underlying technologies.

Interoperability and Transition Challenges

A critical but underexplored issue in the literature is interoperability between Web 2.0 and Web 3.0 systems. While Web 2.0 relies on centralized infrastructures, Web 3.0 introduces decentralized architectures that are not inherently compatible with existing platforms. Research suggests that hybrid models—combining centralized and decentralized elements—may enable a gradual transition, allowing users and organizations to adopt Web 3.0 technologies. Integration will be essential for facilitating adoption and minimizing disruption of established systems (Zhang et al., 2022). Ensuring backward compatibility, standardization, and seamless.

Synthesis of Key Themes

Collectively, the literature reveals recurring patterns across definitions, technologies, governance structures, economic models, and privacy considerations. These insights converge into five core analytical dimensions: definitional ambiguity, technological convergence, governance restructuring, economic transformation, and privacy–regulatory tension, with interoperability and artificial intelligence serving as cross-cutting factors. These themes provide the conceptual foundation for the analysis in the Results section.

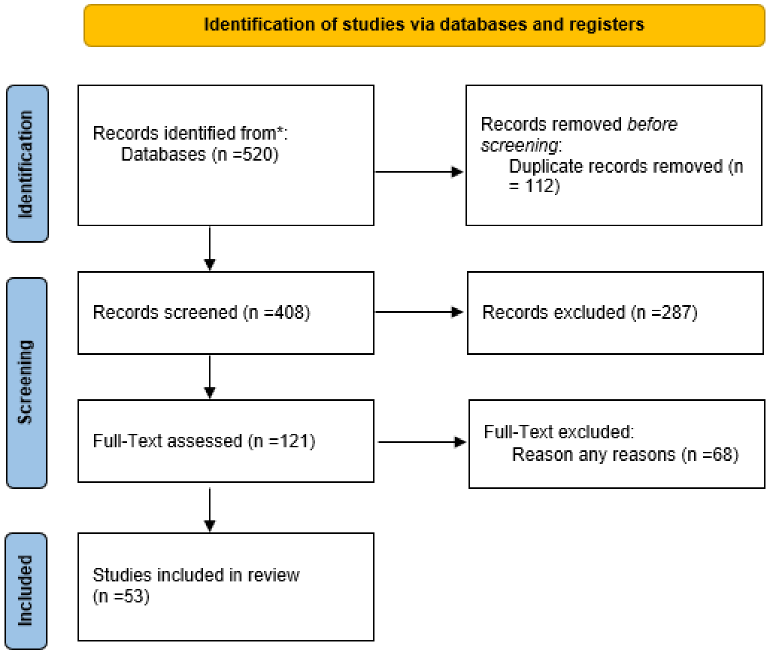
Research Methodology

Review Design

This study was conducted in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA 2020) guidelines (Page et al., 2021). The PRISMA framework ensured transparency, reproducibility, and methodological rigor in identifying, screening, and synthesizing relevant literature. The study selection followed PRISMA 2020 guidelines, ensuring a systematic process. A flow diagram (see Figure 1) shows the progression from identification to final inclusion, enhancing transparency by explaining the filtering based on inclusion/exclusion criteria. Counts were reconstructed from the search strategy, database coverage, and the included studies as an approximation, not an exact audit trail, because numerical tracking was not recorded during the initial review.

Figure 1

PRISMA Flow Diagram



Source: Page MJ, et al. BMJ 2021; 372:n71. doi: 10.1136/bmj.n71.

Note. PRISMA counts were reconstructed based on documented search procedures, database coverage, and final included studies, as numerical tracking was not recorded during the original review process.

A systematic review approach was chosen because Web 3.0 is an evolving concept without a universally accepted definition, making empirical measurement challenging. This method provides a structured approach to synthesizing interdisciplinary evidence from academic, industry, and government sources (Muka et al., 2020).

Information Sources

A comprehensive literature search was conducted across multiple electronic databases to identify relevant peer-reviewed studies. The databases included Galileo, Google Scholar, IEEE Xplore, LITMAP, ProQuest, RefSeek, ScienceDirect, and Semantic Scholar. Additionally, gray literature sources—such as government reports, industry publications, and institutional papers—were found through targeted Google Scholar searches to ensure inclusion of emerging and practice-based insights.

Search Strategy

A structured keyword and Boolean search strategy was used across all databases. Search terms included combinations of “Web 3.0,” “decentralization,” “blockchain,” “semantic web,” “artificial intelligence,” “privacy,” “governance,” and “trust.” Search strings were tailored to each database’s indexing system. The search was limited to publications from January 2015 to November 2025 to ensure relevance to current technological developments.

Eligibility Criteria

Studies were selected based on predefined inclusion and exclusion criteria to ensure consistency and relevance. Inclusion criteria included peer-reviewed articles and high-quality gray literature published between January 1, 2015, and November 1, 2025, focusing on Web 3.0 technologies, adoption factors, governance, or socio-economic implications, and available in full text in English. Exclusion criteria included publications published before 2015, editorials, opinion pieces, blog posts, abstracts, any works shorter than 6 pages, and non–peer–reviewed sources that did not meet established quality standards for gray literature.

Study Selection Process

The study selection process followed PRISMA 2020 guidelines and comprised four stages: (1) identification of records through database and gray literature searches; (2) screening of titles and abstracts after duplicate removal; (3) eligibility assessment through full-text review; and (4) final inclusion of studies that met all criteria.

Quality Appraisal

To evaluate the methodological quality of the included studies, this review used the Critical Appraisal Skills Programme (CASP, 2017) checklist for qualitative studies. This tool assessed credibility, rigor, and relevance across qualitative research sources. Gray literature sources were assessed using the AACODS (Authority, Accuracy, Coverage, Objectivity, Date, and Significance) checklist (Tyndall, 2010), which evaluates the quality and reliability of non–peer-reviewed materials.

Data Extraction and Synthesis

Relevant data were extracted from each selected study, including definitions and conceptualizations of Web 3.0, key enabling technologies, governance and economic models, privacy and trust considerations, and adoption challenges and opportunities. A thematic analysis was used to synthesize findings across studies. Recurring patterns and themes were identified and grouped into key categories, including definitional ambiguity, technological convergence, governance restructuring, economic uncertainty, and privacy–regulatory tensions.

Role of Gray Literature

Gray literature was included to ensure comprehensive coverage of this rapidly evolving field. Because traditional peer-reviewed publication processes can delay the dissemination of emerging findings, gray literature provides timely insights into technological developments, regulatory perspectives, and industry practices. Including gray literature reduces publication bias and enhances the inclusiveness and rigor of systematic reviews (Adams et al., 2021; Booth et al., 2022; Paez, 2017; Benzies et al., 2020). This approach supports a more balanced and up-to-date understanding of Web 3.0 across multiple domains.

Results

The literature review identifies five critical dimensions essential to understanding Web 3.0: conceptual ambiguity, technological integration, governance transformation, economic viability concerns, and privacy-regulatory conflicts. Web 3.0 lacks a consensus definition, with researchers proposing diverse conceptualizations, including decentralized infrastructure (Murray et al., 2023), semantic and intelligent web systems (Fensel et al., 2020), and blockchain-enabled tokenized ecosystems (Cheng, 2024). This conceptual fragmentation impedes systematic evaluation and standardized policy development, creating barriers for stakeholders seeking to formulate coherent Web 3.0 implementation strategies (Gan et al., 2023). Consequently, scholarly efforts must prioritize establishing a consolidated framework that synthesizes these perspectives.

Technological Convergence

Web 3.0 is defined by the integration of blockchain, artificial intelligence (AI), semantic web technologies, and smart contracts, which together enable decentralized, transparent, and user-centric systems (Zubaydi et al., 2023; Zhang et al., 2022). These technologies enhance automation, interoperability, and data sovereignty while reducing reliance on centralized intermediaries. Although AI is widely recognized for enabling personalization and semantic processing, its role in governance and trust—particularly through large language models (LLMs)—remains underexplored. Emerging research suggests that LLMs may improve accessibility, facilitate user interaction, and support decision-making in decentralized environments, yet empirical evidence of their broader socio-economic impact remains limited (Dwivedi et al., 2021).

Governance Restructuring

A defining feature of Web 3.0 is the shift from centralized platform governance to decentralized, user-driven systems (Calzada, 2024). While Web 2.0 platforms consolidated control over data, algorithms, and digital interactions, Web 3.0 aims to redistribute authority through blockchain-based governance. However, decentralized governance introduces new challenges, including low participation and the concentration of influence among large token holders, which may undermine democratic decision-making (Beck et al., 2018; De Filippi & Loveluck, 2016). These limitations underscore the need for governance models that balance decentralization, accountability, and efficiency.

Economic Viability Concerns

Web 3.0 advocates moving away from Web 2.0's data-centric revenue models, including advertising and data commercialization. Alternative approaches emphasize token-based economies and decentralized financial systems, enabling users to own and trade digital assets without centralized intermediaries (Cheng, 2024). Although this approach aligns with Web 3.0's decentralization philosophy, its long-term economic sustainability remains questionable. In contrast to Web 2.0 platforms that exploit personal data, Web 3.0 has not yet demonstrated that tokenization and decentralized finance can yield comparable economic returns or profitability (Zhang et al., 2022). Additional investigation is required to determine how Web 3.0 can develop financially sustainable business frameworks, particularly relative to Web 2.0's established revenue mechanisms.

Privacy–Regulatory Tension

Web 3.0 aims to address privacy concerns through cryptographic mechanisms and privacy-by-design principles, enabling greater user control over data and identity (Fensel et al., 2020). However, decentralized systems introduce new risks, including transaction traceability, behavioral profiling, and the potential re-identification of users on public ledgers (Casino et al., 2019). Additionally, regulatory frameworks such as the General Data Protection Regulation (GDPR) create tensions among privacy protection, innovation, and data accessibility (Jia et al., 2021). These challenges highlight the need for regulatory approaches that accommodate decentralized architectures while ensuring user protection and compliance. Addressing these privacy and regulatory complexities is fundamental to the mainstream acceptance of Web 3.0 and requires a careful balance between user privacy rights and regulatory compliance obligations (Alotaibi, 2025).

Interoperability between Web 2.0 and Web 3.0

A key challenge in the transition to Web 3.0 is interoperability with existing Web 2.0 systems. While Web 2.0 relies on centralized infrastructure, Web 3.0 introduces decentralized architectures that are not inherently compatible with legacy platforms. Research suggests that hybrid models, including backward compatibility and dual-participation frameworks, may enable gradual migration and reduce disruption during this transition (Zhang et al., 2022). Ensuring interoperability will be essential for the widespread adoption and practical implementation of Web 3.0 technologies.

Discussion

The web continuum

While much of the literature on Web 2.0 highlights its positive impacts—especially how it democratizes information by enabling individuals and communities to share knowledge, express opinions, and collaborate globally without relying on traditional gatekeepers such as publishers and broadcasters (Martin, 2018)—the concept of Web 2.0 has also faced ongoing scholarly criticism. Proferes (2016) argues that there is no clear technological or architectural breakthrough directly linked to Web 2.0; instead, he suggests that the term primarily serves as a strategic rebranding within the tech industry following the dot-com bubble, rather than representing an actual technological or economic shift. From this viewpoint, Web 2.0 functions more as an industry narrative than as a specific stage in the web's technical evolution. Similarly, Sýkora (2017) states that describing it as a "second" version of the web is inherently misleading, as no fundamental update to the web's underlying infrastructure occurred with the emergence of Web 2.0 platforms. If Web 2.0 is viewed not as a separate technological era but as a continuation and reconfiguration of the original web—mainly driven by new business models, social practices, and platform architectures—the implications for Web 3.0 are significant. Rather than representing a clear technological break, Web 3.0 should be seen as another stage in the evolution of governance, control, and economic arrangements, rather than a totally new set of core networking technologies. Scholars argue that what is often referred to as Web 2.0 largely reflects shifts in platform ownership, participatory practices, and data-driven business models, rather than a new technical infrastructure (Ziegler, 2022). From this view of continuity, Web 3.0 is less a distinct "next web" and more a normative and architectural shift toward decentralization, cryptographic trust, and user-controlled data ecosystems. This perspective also recommends caution when assessing claims about the transformative potential of Web 3.0. Just as Web 2.0 did not replace fundamental web protocols but reorganized power, user interaction, and monetization around centralized platforms, Web 3.0 may primarily redesign governance models and economic coordination rather than building a completely new internet (Murray et al., 2023; Cheng, 2024). In this context, Web 3.0 signifies a socio-technical change in how digital services are owned, governed, and trusted, rather than an entirely new technological era. Finally, because Web 2.0 is not clearly distinguishable from earlier versions, the ambiguity surrounding Web 3.0 is even greater. The absence of a clear historical or technical boundary supports the view that Web 3.0 is best understood as a debated, evolving concept that combines decentralization, semantic technologies, and token-based economic models under one label (Fensel et al., 2020; Gan et al., 2023). Therefore, the future success of Web 3.0 will probably depend less on technological advances and more on whether its proposed governance and incentive systems can effectively challenge and replace the centralized, platform-centered models that emerged during the Web 2.0 era. The literature often cites AI as enabling personalization, semantic processing, and automation in Web 3.0. However, few studies view AI—especially large language models—as central to governance, trust, or economic coordination. Most see AI tools as peripherals rather than as actors influencing user behavior, incentives, or decision-making. This gap reflects an empirical shortcoming: while AI and ML are spreading across digital infrastructures, their role in mediating interactions, redistributing value, and reconfiguring trust in decentralized systems remains largely unexplored.

Profit motive and the Privacy Paradox

Regarding economic incentives versus privacy rights, Baruh et al. (2017) and McClain et al. (2023) agree that users dislike data monetization and prefer privacy. Ziegler (2022) and Zuboff (2019) show that data is key to profitable models, often prioritizing profit over privacy. Aguirre et al. (2016) and Martin (2018) show that increasing personalization and data monetization intensify privacy concerns and reduce user trust in digital platforms, while Jha et al. (2022) and Voramontri & Klieb (2019) highlight the privacy paradox—users remain active despite privacy worries.

Key challenges of Web 3.0

Web 3.0 focuses on decentralization and user empowerment as core principles, but it faces several structural challenges that hinder widespread adoption. Scalability and performance issues are key concerns because distributed consensus systems introduce delays and reduce transaction capacity, thereby preventing decentralized networks from effectively supporting real-time or high-volume applications (Zheng et al., 2017; Xu et al., 2019). Additionally, decentralized governance structures often see low participation and a tendency for large token holders to dominate voting power, leading to governance capture that conflicts with the principles of fair and distributed authority (Beck et al., 2018; De Filippi & Loveluck, 2016). Regulatory and legal uncertainty presents another obstacle to organizational adoption, especially for enterprises and government agencies, as decentralized platforms operate across various jurisdictions without clear responsibility (Howell et al., 2020; Kshetri, 2018). Blockchain systems present security and design challenges due to their immutability. Vulnerabilities in smart contracts and protocol design can expose decentralized applications to exploitation, while irreversible on-chain transactions magnify the consequences of technical failures and user errors (Atzei et al., 2017; Zheng et al., 2017). Web 3.0 likewise faces an ongoing privacy paradox, where publicly accessible, immutable ledgers enable transaction tracking and behavior analysis, making pseudonymous systems vulnerable to user identification and mass surveillance (Conti et al., 2018; Casino et al., 2019). These obstacles indicate that the proposed Web 3.0 design has not yet been resolved and may instead shift the fundamental issues of power concentration, trust, and data control that characterize Web 2.0 to the protocol, infrastructure, and community governance levels. These findings collectively highlight that the evolution toward decentralized systems is not purely technological but fundamentally structural and socio-economic.

Conclusion

This study compares how academic, industry, and governmental sources conceptualize Web 3.0 relative to Web 2.0 across technological, economic, social, privacy, governance, and trust factors (RQ1). The identified themes show that Web 3.0 is not defined by a single technological breakthrough but by a fundamental shift in core architecture and socio-economic systems. Unlike Web 2.0's centralized, platform-based approach, Web 3.0 is consistently described as a decentralized ecosystem that emphasizes user sovereignty, cryptographic trust, and distributed governance. Technologically, this shift is driven by the adoption of blockchain, smart contracts, semantic web frameworks, and artificial intelligence (AI), which together foster more autonomous, interoperable, and intelligent digital environments. From an economic perspective, the literature shows a clear shift away from data-driven monetization toward token-based and decentralized value systems. However, the sustainability of these models in the long run remains uncertain, especially given the high profitability of Web 2.0 platforms. On the social side, Web 3.0 offers the possibility for more user-controlled interactions and identity management. However, how much this will affect participation and engagement is unknown. Regarding privacy and governance, Web 3.0 aims to address long-standing issues of centralized data control by implementing privacy-by-design principles and decentralized decision-making processes. However, these innovations also pose new challenges for regulation, accountability, and oversight. As a result, trust is being reshaped rather than established, shifting from reliance on centralized intermediaries to dependence on code, protocols, and distributed networks. AI plays an essential role in driving these changes by enabling intelligent automation, semantic data processing, personalization, and autonomous agents, all of which enhance usability and promote adoption. In this context, emerging technologies such as large language models (LLMs) have the potential to reduce barriers to entry by enabling more natural, intuitive language interactions with decentralized systems. However, the current peer-reviewed literature provides limited real-world evidence on how AI and LLMs specifically influence Web 3.0 adoption, highlighting a significant gap in understanding their impact on user behavior, economic incentives, and trust dynamics. Overall, the comparison between Web 2.0 and Web 3.0 shows that the evolution of the web is less about a clear technological shift and more about a reorganization of control, value creation, and governance structures. While Web 3.0 presents a compelling vision of a more transparent, user-centered, and decentralized internet, its widespread adoption will depend not only on technological advances but also on overcoming key challenges related to economic viability, regulatory consistency, interoperability, and trust. Future research should therefore focus on empirically examining these areas, especially the role of AI and LLMs in shaping interactions, governance, and value creation within decentralized ecosystems.

Research Gaps

Although much has been written about privacy, transparency, and the economic effects of Web 2.0, there is limited empirical research on how artificial intelligence (AI) and machine learning (ML) will alter user interactions and reshape economic models in Web 3.0. This gap is critical because AI and ML are being integrated across the internet—from personalized content to autonomous decision-making—yet their broader social and economic consequences remain poorly understood. Existing studies often focus on technical possibilities or theoretical frameworks rather than examining who will benefit from Web 3.0's decentralized promises, including whether gains will accrue primarily to individual users, firms, or government actors. In the domain of privacy, many studies explore solutions for data protection and transparency, including regulatory interventions (Bartol et al., 2024; Calzada, 2024). Blockchain applications span multiple sectors, including strengthening web ecosystem security, building tamper-resistant medical records, and tracking pharmaceuticals to verify authenticity and prevent counterfeiting (Zubaydi et al., 2023). However, an important question remains: how will AI and ML, which now underpin much of the technological landscape, shape future iterations of the web? At present, there is little published research on how AI- and ML-driven systems will change routine web use or affect the revenue models that sustain Web 2.0 (Bartol et al., 2024; Gan et al., 2023). As concerns about data privacy, misinformation, and transparency grow, public agencies and businesses must adopt new technologies in ways that safeguard privacy and security (Cong et al., 2025; Sivarajah et al., 2020). Much of the literature suggests that these concerns make a transition to a new web architecture likely, but there remains limited evidence on who stands to benefit most. Beyond a relatively small group of influencers and content creators, most economic gains currently accrue to businesses (Bartol et al., 2024; Janssen et al., 2017). Clarifying how future web architectures might redistribute value among users, firms, and states remains a central empirical gap.

Future Research Areas

Beyond the research gaps already identified and the extensive literature on the technological, economic, and privacy aspects of Web 3.0, additional research is needed in several underexplored areas.

1. **User behavior and trust mechanisms**
   More research is needed on how shifts in trust in platforms, technologies, and decentralized systems shape the adoption of Web 3.0. In particular, it remains unclear how trust is built, maintained, and repaired in decentralized environments.

2. **Interoperability between Web 2.0 and Web 3.0**
   Existing studies often treat Web 2.0 and Web 3.0 as distinct phases, overlooking transitional or hybrid models. Research should examine interoperability, backward compatibility, and dual participation to understand how gradual migration might occur in practice.

3. **Governance and regulatory frameworks**
   While privacy and oversight are well-studied in Web 2.0, there is limited analysis of governance and regulatory models suited to decentralized ecosystems. Comparative work is needed on how different frameworks allocate responsibility, enforce compliance, and handle cross-jurisdictional disputes in Web 3.0.

4. **Equity and the digital divide in Web 3.0**
   Digital inequality is widely discussed in the context of Web 2.0, but little is known about how blockchain, AI, and token-based systems may reproduce or deepen exclusion. Future research should explore who gains or loses access, influence, and economic opportunity in Web 3.0 environments.

5. **Human-centered design and user experience**
   Human-centered design for decentralized systems remains underexplored, particularly in usability, accessibility, and interface design. Studies should examine how Web 2.0 UX principles can inform the design of fair, intuitive, and inclusive Web 3.0 applications.

6. **Civic participation and public discourse**
   Although Web 2.0's impact on civic engagement is well documented, the effects of decentralization and cryptographic identity systems on digital citizenship, activism, and public deliberation remain unclear. Research is needed to understand how Web 3.0 might reshape civic participation and democratic practices.

Future research should prioritize empirical examination of these dynamics, particularly the role of AI and LLMs in shaping governance, trust, and value creation within decentralized ecosystems.

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