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DECENTRALIZED BUSINESS IN THE BLOCKCHAIN ERA: MAPPING RESEARCH TRENDS AND IDENTIFYING FUTURE RESEARCH DIRECTIONS

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Abstract

The evolution of decentralized business models (DBMs) has transformed the global economic landscape, shifting from cryptocurrency-centric origins to diverse industrial applications. This study aims to map research trends and identify critical gaps in decentralized business during the blockchain era. Using a Systematic Literature Review (SLR) and bibliometric analysis through the PRISMA framework, 142 eligible documents from the Scopus database (2017–2023) were analyzed. Findings reveal three evolutionary phases: initiation (2017–2018), stable development (2019–2021), and acceleration (2022–2023). Keyword clustering identifies Decentralized Finance (DeFi), Smart Contracts, and Decentralized Autonomous Organizations (DAOs) as dominant themes. Geographically, a "triad" of leaders China, the United States, and India dominates the discourse. Despite rapid growth, significant gaps persist in scalability, regulatory frameworks, and domain-specific security. This study provides a strategic roadmap for future research, emphasizing the convergence of blockchain with IoT and AI to foster automated and secure industrial ecosystems.

Keywords: *Blockchain, Decentralized Business, Business Models, Bibliometric Analysis, DeFi, Smart Contracts*,.

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1. Introduction

The evolution of decentralized business models (DBMs) in the blockchain era represents a fundamental paradigm shift in organizational structures. Initially rooted in the theoretical foundations of cryptocurrencies like Bitcoin and Ethereum, the discourse has matured significantly over the past decade. What began as a security mechanism for peer-to-peer financial transactions has now expanded into a sophisticated digital architecture capable of transforming entire industrial value chains [1]. This transition marks the movement from "Blockchain 1.0" (cryptocurrency) to "Blockchain 3.0," where decentralization is applied to broader organizational governance and complex business ecosystems.

The primary drivers of this digital transformation are multifaceted, blending technological innovation with economic necessity. The convergence of blockchain with emerging technologies such as the Internet of Things (IoT) and Artificial Intelligence (AI) has provided the technical scalability required for real-world deployment [2]. Economically, the shift is driven by the demand for operational efficiency and the elimination of costly intermediaries. By leveraging smart contracts and automated consensus, businesses can achieve unprecedented levels of transparency and trust, which are essential in the modern, globalized economy.

Academic discourse has concurrently shifted from purely technical explorations of ledger security to the practical implementation of decentralization in sectors like supply chain and governance. Early research was heavily concentrated on the centralization-decentralization taxonomy within public blockchains [3]. However, contemporary scholars are now focusing on the "value proposition" of blockchain as a disruptive force in digital platforms, exploring how decentralized autonomous organizations (DAOs) can replace traditional corporate hierarchies [4]. This scholarly evolution reflects a growing interest in the socio-technical impacts of blockchain on society and industry.

The current global research landscape is characterized by its interdisciplinary nature, with a strong emphasis on practical frameworks for specific industries. In supply chain management, research highlights how blockchain enhances traceability and decentralized coordination [5]. Similarly, the "Decentralized Finance" (DeFi) movement has become a focal point, illustrating how borderless and permissionless services can democratize financial access. Geographically, the discourse is propelled by a competitive global network of researchers, particularly from the United States, China, and India, who are collectively refining the scalability and security of these decentralized frameworks.

Despite the rapid progress, the decentralized business era still faces significant hurdles, including regulatory uncertainty and integration complexities [6]. This study aims to map these research trends and identify the critical gaps that persist in the current body of knowledge. By synthesizing the trajectory of decentralized business models, this paper provides a roadmap for both academic inquiry and practical application, ensuring that the transformative potential of blockchain technology is harnessed effectively across diverse global sectors.

2. Method and Analysis

A Systematic Literature Review (SLR) combined with a bibliometric approach is employed to quantitatively assess the literature, identifying key trends, patterns, and research actors within the discipline of Blockchain and Decentralized Business. By applying established frameworks such as PRISMA (Preferred Reporting Items for Systematic Reviews and Meta Analyses), this methodology ensures a comprehensive and replicable literature assessment, resulting in a clear and transparent overview of the research topic. The PRISMA flow diagram guarantees that the review process is transparent and complete, allowing readers to understand the core procedures used in the review and to examine the reduction (or screening) of irrelevant records [7]. The established inclusion criteria are: (1) articles published up to December 31, 2023, (2) publications in the English language, and (3) a focus on the theme of Blockchain and Decentralized Business Models.

Bibliometric Analysis is a powerful tool for assessing the impact and trends in scientific research. By systematically analyzing large volumes of bibliographic data, this analysis provides valuable insights that can guide the direction of research and policy making across various academic fields [8][9]. The bibliometric analysis is conducted using software such as VOSViewer to visualize bibliographic data, including citation networks, author collaborations, and keyword co occurrence, thereby uncovering the intellectual structure and dynamics within the field of study. The integration of these two approaches SLR and Bibliometrics offers a holistic understanding of the evolution, historical trajectory, and future directions of the research domain.

The initial stage in this academic study begins with keyword selection, which can be performed through a macro (top down) approach from broad search paths to a narrower focus on more specific studies and topics. Therefore, after considering the limitations of prior research, the main focus is set on using the keywords "Blockchain & Decentralized Business" followed by a more specific refinement using "Blockchain" AND "Decentralised" AND "Business Models" in the article title, abstract, and keywords sections. Subsequently, the Scopus database is utilized by the researchers for conducting extensive literature reviews and monitoring current research trends.

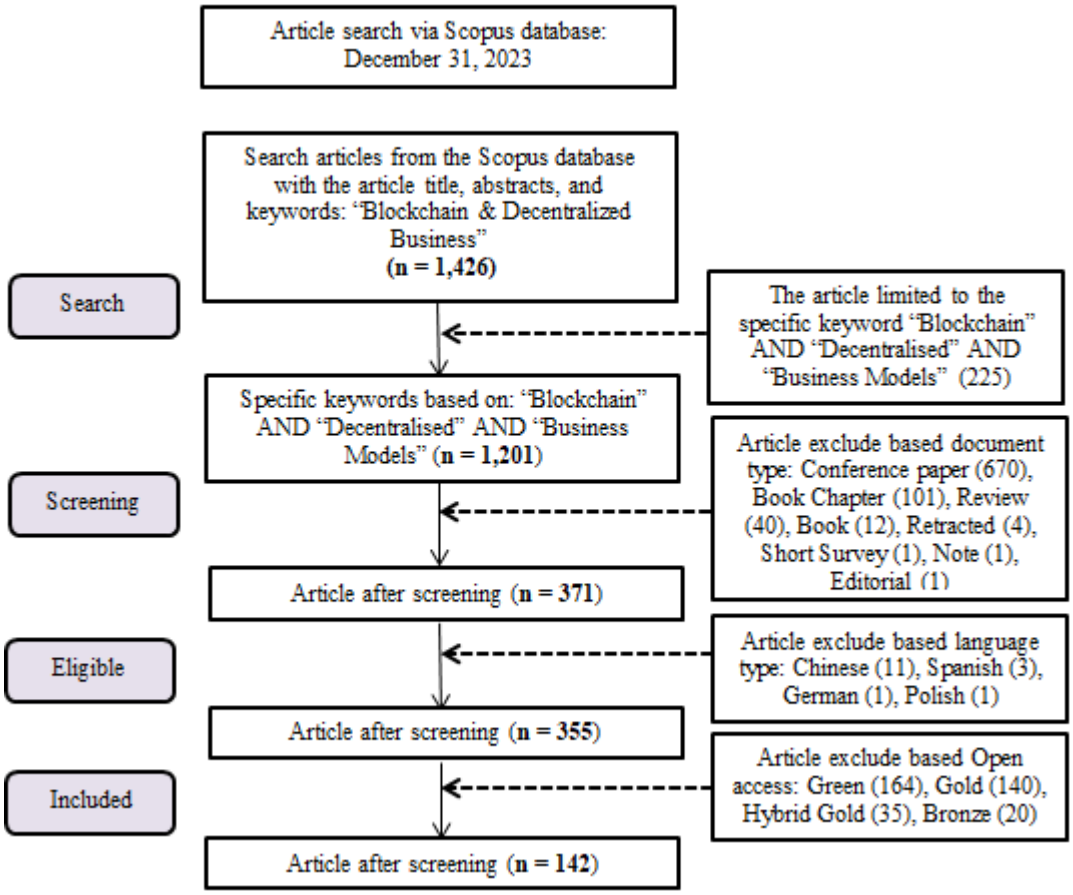


Figure 1. Systematic Literatur Review Information Flow Using PRISMA

Based on the initial search results retrieved from the Scopus database on December 31, 2023, a total of 1,426 documents related to Blockchain & Decentralized Business were identified (See Figure 1). This initial set was compiled using the keyword string applied across the articles' titles, abstracts, and keywords. To narrow the focus, the search was limited to specific keywords: "Blockchain" AND "Decentralised" AND "Business Models", which refined the initial pool to 1,201 documents.

The identified documents subsequently underwent a screening process to categorize and exclude non relevant records based on document type and language. Several document types were excluded at this stage, including Conference Papers (670), Book Chapters (101), Reviews (40), Books (12), Retracted (4), Short Surveys (1), Notes (1), and Editorials (1), which reduced the total number of documents after screening to 371. A further refinement was performed by excluding articles not written in the English language, specifically excluding Chinese (11), Spanish (3), German (1), and Polish (1), narrowing the set to 355 eligible articles.

The final filtering step involved excluding documents based on specific Open Access categories, including Green (164), Gold (140), Hybrid Gold (35), and Bronze (20), resulting in a final analytical set of 142 documents. These final 142 articles were then subjected to in depth analysis within this study to address the relevant research questions concerning the intellectual structure and emerging trends in Blockchain based business models.

These final 142 articles were then subjected to in depth analysis within this study to provide a comprehensive landscape of the field and to address the following Research Questions (RQs):

RQ1: What are the primary intellectual structures and thematic trends within the literature on decentralized business in the current blockchain era?

RQ2: Who are the key research actors including influential authors, institutions, and countries contributing to the development of decentralized business research, and what does their collaboration network look like?

RQ3: What research gaps and future directions can be synthesized from the current body of knowledge to guide both academic inquiry and practical application in the blockchain era?

3. Result and Discussion

This study's findings are based on the 142 articles identified from the Scopus database that specifically address Decentralized Business in the Blockchain Era. The data derived from these articles were meticulously analyzed by examining the total number of publications, annual publication trends, and the key journal sources. Furthermore, the study highlights the most influential elements within the literature on this topic, including the contributing authors, their institutional affiliations, and the countries involved in the research collaboration networks.

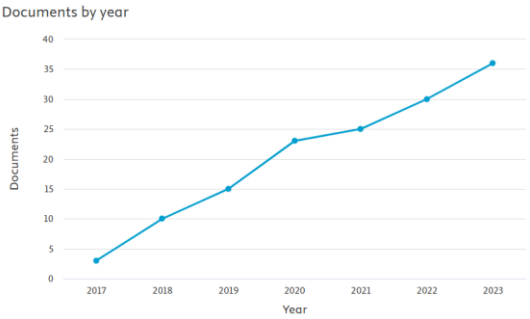
RQ1: What are the primary intellectual structures and thematic trends within the literature on decentralized business in the current blockchain era?

The literature on decentralized business in the blockchain era consistently highlights several primary keyword clusters that define the transformation of modern business models. The first cluster focuses on the Core Concepts of Decentralization, where the utilization of Distributed Ledger Technology (DLT) serves as the foundation for transparent authority and data distribution without reliance on central entities [10]. This has given rise to Decentralized Autonomous Organizations (DAOs), which enable organizations to operate autonomously through consensus mechanisms and digital code [11].

The second cluster pertains to Innovations and Practical Applications, dominated by the terms Decentralized Finance (DeFi) and Smart Contracts. DeFi has emerged as a solution to eliminate intermediaries within the financial sector [12], while smart contracts facilitate the automation of business agreements securely and efficiently [13]. Furthermore, Peer to Peer (P2P) transaction systems are frequently linked to enhanced trust and transparency, particularly within supply chain management and the renewable energy sector [14][15].

The final cluster addresses Strategic Challenges and Oversight. Researchers emphasize the critical importance of Governance in managing interactions within decentralized systems, especially considering the complexities arising in hybrid business models [16]. Additionally, aspects of security and scalability remain crucial themes that must be addressed to ensure the sustainability of blockchain technology across broader industrial scales [17][15]. Overall, the integration of these keywords signifies a major shift toward a more autonomous, transparent, and efficient business ecosystem.

The literature on decentralized business in the blockchain era primarily revolves around the transformative impact of Decentralized Finance (DeFi) and Decentralized Autonomous Organizations (DAOs), which leverage smart contracts to eliminate traditional intermediaries and foster financial inclusion [12][1][11]. Beyond finance, research frequently explores diverse blockchain applications in supply chain management, e commerce, and distributed energy markets, emphasizing the technology's ability to enhance transparency and traceability [18][19]. Furthermore, a significant portion of the discourse is dedicated to the technical and regulatory challenges hindering widespread adoption, specifically regarding scalability bottlenecks, smart contract vulnerabilities, and the legal uncertainties of decentralized ledgers [20][21]. Emerging themes also highlight the convergence of blockchain with AI and IoT to create smarter, decentralized coordination systems, as well as the integration of green technologies for sustainable business models like carbon credit trading [22][23].



Source: Scopus database

Figure 2. Number of Decentralized Business In The Blockchain Era Publication

The evolution of literature concerning decentralized business demonstrates a consistent positive growth trend, which can be categorized into three distinct phases:

a. Initiation Phase (2017–2018):

In 2017, research in this field was in its infancy with only 3 documents. However, a significant surge occurred in 2018, reaching 10 documents (an increase of over 200%). This reflects the initial momentum when blockchain technology began to be viewed not merely as a cryptocurrency instrument, but as a new foundation for business models.

b. Stable Development Phase (2019–2021):

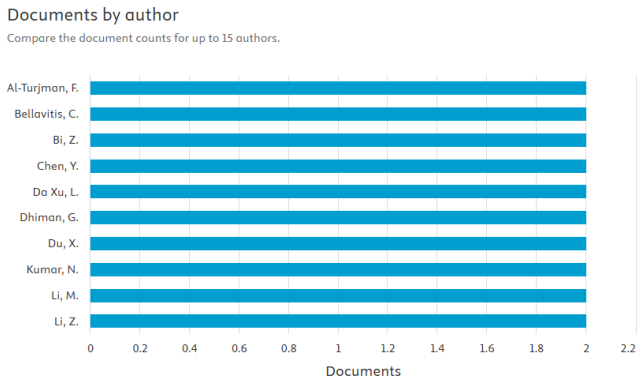
During this period, the number of publications grew organically from 15 documents (2019) to 25 documents (2021). Bibliometrically, this growth indicates that academic interest shifted from basic conceptual introductions toward deeper explorations, such as governance mechanisms in Decentralized Autonomous Organizations (DAOs) and the emergence of Decentralized Finance (DeFi) ecosystems.

c. Acceleration and Maturity Phase (2022–2023):

The peak of this growth is evident in the last two years, where publications reached 30 documents in 2022 and hit an all time high of 36 documents in 2023. This sustained increase in volume signifies that decentralized business has become a "mature research subject," continuously evolving alongside the integration of emerging technologies like AI and IoT.

RQ2: Who are the key research actors including influential authors, institutions, and countries contributing to the development of decentralized business research, and what does their collaboration network look like?

The analysis of authorship in decentralized business research reveals a highly balanced and emerging intellectual landscape, where no single researcher dominates the discourse. Based on the bibliometric data, the top contributing authors including Al-Turjman, F., Bellavitis, C., Chen, Y., Da Xu, L., and Kumar, N. each have a consistent output of 2 articles. This uniform distribution suggests that the field is currently shaped by a diverse collective of experts specializing in different niches, from the financial disruption of decentralized models to the technical integration of blockchain in industrial systems.

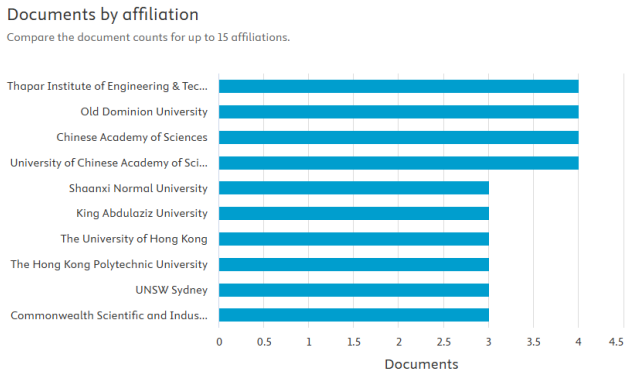


Source: Scopus database

Figure 3. Number of Decentralized Business In The Blockchain Era by Author (Top 10)

Following this distribution, the collaboration networks among these authors indicate an interdisciplinary approach that bridges computer science, economics, and strategic management. Since each key author contributes an equal number of publications, the intellectual structure of the "Blockchain Era" in business is characterized as fragmented yet burgeoning. This network reflects a global effort to address complex decentralized challenges, where authors like Bi, Z. and Li, M. collaborate across institutional borders to refine the practical implementation of smart contracts and decentralized governance.

The institutional analysis of decentralized business research highlights a strong concentration of academic output within prominent technical and research-heavy universities. Leading the global contribution are Thapar Institute of Engineering & Technology, Old Dominion University, and the Chinese Academy of Sciences, each with 4 core publications. This distribution underscores the critical role of institutions that bridge engineering prowess with digital business transformation. Furthermore, the presence of the University of Chinese Academy of Sciences alongside its parent academy indicates a significant research cluster within Asia, focusing on the systemic integration of blockchain into decentralized frameworks.

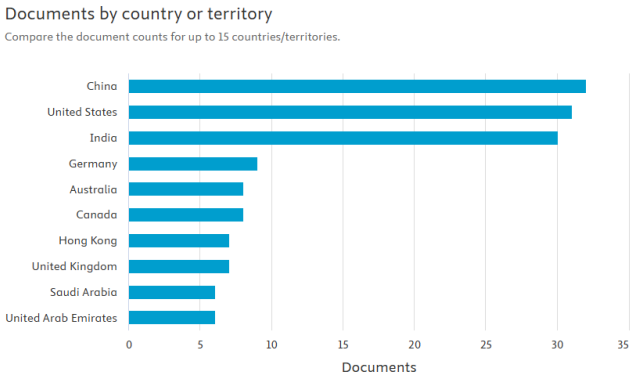


Source: Scopus database

Figure 4. Number of Decentralized Business In The Blockchain Era by Affiliation (Top 10)

Supporting this top tier, a secondary group of institutions including Shaanxi Normal University, King Abdulaziz University, The University of Hong Kong, and UNSW Sydney each contributes 3 articles. The involvement of high-ranking universities from Australia, Hong Kong, and Saudi Arabia demonstrates that the "Blockchain Era" in business has gained widespread global interest, transcending regional boundaries. This institutional network suggests a robust collaborative environment where academic entities are increasingly focusing on the socio-technical challenges of decentralization, such as governance, security, and the development of sustainable decentralized business models.

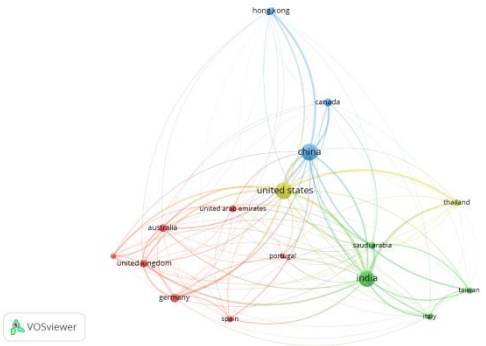
The geographical distribution of decentralized business research reveals a dominant "triad" of global leaders driving the discourse in the blockchain era. China, the United States, and India emerge as the most prolific contributors, with 32, 31, and 30 documents respectively. This narrow margin between the top three nations indicates an intense academic competition and a shared strategic interest in mastering decentralized technologies. These countries serve as the primary hubs for blockchain innovation, where large-scale digital infrastructures and a high density of tech-focused institutions provide a fertile ground for extensive scholarly publication.



Source: Scopus database

Figure 5. Number of Decentralized Business In The Blockchain Era by Country (Top 10)

Beyond the leading trio, the research landscape is supported by a significant secondary cluster comprising Germany (9), Australia (8), and Canada (8), followed closely by Hong Kong, the United Kingdom, Saudi Arabia, and the United Arab Emirates. The inclusion of major financial and technological centers such as Hong Kong and the UAE highlights the global shift toward integrating blockchain into international trade and financial hubs. This distribution reflects a broad international collaboration network, suggesting that while the volume of research is concentrated in a few powerhouse nations, the practical implications and interest in decentralized business models are truly global, spanning across Europe, the Middle East, and the Asia-Pacific region.



Source: VOSviewer software output

Figure 6. Visualization of countries in the network

Table 1. Top Countries/Territories in Decentralized Business Research

Country	Documents	Citations	Total link strength
United States	31	2556	2195
India	30	1677	1953
China	32	1899	1897
United Kingdom	7	697	758
Saudia Arabia	6	612	717
Thailand	5	68	681
Australia	8	1351	601
Germany	9	609	594
France	4	277	472
Taiwan	5	217	461

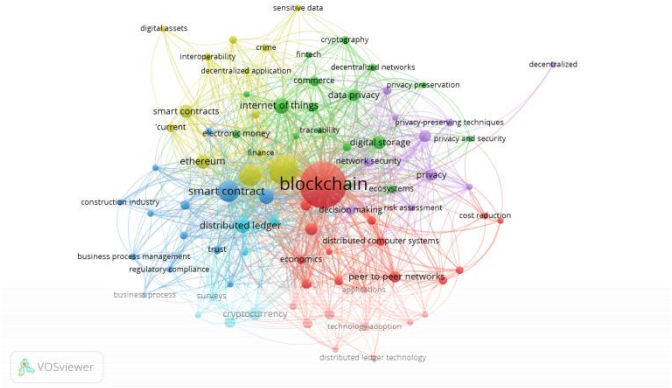
Source: VOSviewer software output

Following the geographical distribution analysis, the significant focus from these leading nations underscores a global strategic race to master the decentralized economy. The high citation counts and strong collaboration links, particularly from the United States and India, suggest that research in the blockchain era is not merely a regional interest but a highly integrated international effort to redefine business governance and financial systems. This interconnectedness across diverse economic hubs like China, Australia, and the Middle East reflects a collective drive to address technical bottlenecks and regulatory frameworks, ensuring that decentralized business models can be scaled effectively across global markets.

RQ3: What research gaps and future directions can be synthesized from the current body of knowledge to guide both academic inquiry and practical application in the blockchain era?

Based on the keyword co-occurrence analysis, several research gaps and future directions can be synthesized to guide academic and practical inquiry in the blockchain era. While core technologies such as Blockchain (140 occurrences) and Smart Contracts (29 occurrences) are well-established, there is a clear shift toward integrating these with broader digital ecosystems. A significant future direction lies in the convergence of blockchain with the Internet of Things (IoT) and Information Management, suggesting a move away from purely financial applications toward secure, automated industrial data systems and Digital Storage solutions. The relatively lower occurrence of specific platforms like Ethereum (13) compared to general terms indicates a gap in comparative studies between different decentralized infrastructures and their specific efficiencies in various business sectors.

Furthermore, the data highlights Security (10 occurrences) as a persistent concern that requires deeper exploration, particularly in the context of Distributed Ledgers and decentralized governance. Future research should prioritize addressing the scalability of smart contracts and the regulatory implications of cross-border decentralized transactions. There is also a notable opportunity for practical applications to explore "hybrid" models that combine decentralized trust with existing enterprise information management systems. By bridging these technical gaps with organizational strategy, future academic inquiry can provide a more robust framework for the widespread adoption of decentralized business models in a post-digital transformation landscape.



Source: VOSviewer software output

Figure 7. Co-occurrence framework and representation of key terms.

Table 2. Key Terms and Research Foci in Decentralized Business

Keywords	Occurrences	Total Link Strength
Blockchain	140	533
Block-chain	57	323
Decentralised	32	176
Smart contract	29	160
Distributed ledger	13	91
Information management	15	90
Internet of things	16	88
Digital storage	12	69
Ethereum	13	63
Security	10	63

Source: VOSviewer software output

Research Gaps and Future Directions in the Blockchain Era

Synthesizing the body of knowledge available up to 2023 reveals several critical research gaps and future directions essential for guiding academic inquiry and practical applications. These findings are systematically categorized into technical, regulatory, and domain-specific implementation challenges.

1. Technical Scalability and Performance Hurdles

   A primary gap identified in existing literature is the issue of scalability, low performance in large-scale applications, and high energy consumption. While blockchain offers unprecedented transparency, its operational efficiency for real-time applications remains significantly hindered (Kumar et al., 2023; Samanta & Chaki, 2022). Future research must prioritize the development of lightweight algorithms and hybrid models that integrate on-chain and off-chain solutions to enhance transaction speeds without compromising data privacy (Huang et al., 2023).

2. Regulatory Frameworks and Governance Challenges

   The absence of robust regulatory frameworks and standardized protocols continues to be a major barrier to blockchain adoption in sensitive sectors such as accounting and auditing. Literature through 2023 indicates that most solutions remain experimental and often fail to meet global legal compliance standards. Future studies need to design resilient governance frameworks that facilitate the seamless integration of blockchain into governmental and high-stakes financial ecosystems (Zhao et al., 2021).

3. Domain-Specific Implementation and Security Vulnerabilities

   There is a notable disconnect between theoretical models and practical implementation, particularly in healthcare and education. In healthcare, there is a lack of concrete architectural design patterns for decentralized data exchange (Zhang et al., 2023). From a security perspective, vulnerabilities in smart contracts and risk management protocols remain highly exposed. Future focus should be directed toward creating comprehensive risk assessment frameworks and formal verification tools to mitigate the exploitation of smart contract code.

Table 3. Summary of Key Gaps and Future Research Directions

Research Area	Future Focus & Directions	Authors	Reference
Scalability & Performance	Development of hybrid models and lightweight protocols for real-time efficiency.	Kumar et al; Huang et al.	[24][25]
Regulatory & Governance	Design of robust legal frameworks and standardized compliance protocols.	Zhao et al.	[26]
Domain-Specific Gaps	Tailored architectural designs for healthcare and digital credentialing in education.	Zhang et al.; Srivastava et al.	[27][28]
Security Vulnerabilities	Advanced risk assessment frameworks and formal verification for smart contracts.	Samanta & Chaki	[29]
Emerging Tech Synergy	Exploration of Blockchain-AI and IoT integration for automated decision-making.	Kumar et al.	[24]

4. Conclusion

This study concludes that decentralized business research has transitioned from a theoretical niche into a mature academic subject characterized by rapid annual growth and global collaborative efforts. The primary intellectual structure of the field is anchored in Decentralized Finance (DeFi) and Decentralized Autonomous Organizations (DAOs), driven by technological innovations such as smart contracts and IoT integration. While China, the United States, and India lead in publication volume, the United States maintains the highest scholarly impact through extensive citation networks.

However, the "Blockchain Era" still faces substantial hurdles that prevent total industrial adoption. The synthesis of existing knowledge reveals critical gaps in technical scalability, the absence of standardized global regulatory frameworks, and security vulnerabilities in automated code execution. Future research must bridge these gaps by shifting focus toward interdisciplinary inquiries that combine technical robustness with legal compliance and organizational strategy. Ultimately, the future of decentralized business lies in creating smarter, energy-efficient, and highly integrated systems that can operate seamlessly across international borders.

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