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Bibliometric Content Analysis on Blockchain and Artificial Intelligence Integration in Business

Manoj Govindaraj[1*], B. Latha Lavanya[2], L. Sudha[3], G. Somasekhar[4], Jenifer Lawrence[5] and G. Chandramowleeswaran[6]

[1*]Associate Professor, Department of Management Studies, Vel Tech Rangarajan Dr. Sagunthala R&D Institute of Science and Technology, Chennai, India
[2]Associate Professor, Measi Institute of Management Royapettah, Chennai, India
[3]Assistant Professor, Faculty of Management, SRM Institute of Science and Technology, Kattankulathur Campus, Chengelpet, Tamil Nadu, India
[4]VIT-AP School of Business, VIT-AP University, Andhra Pradesh, India
[5]Associate Professor, Department of Management Studies, Woldia University, Ethiopia
[6]Associate Professor, Department of Business Administration, Vel Tech Rangarajan Dr. Sagunthala R&D Institute of Science and Technology, Chennai, India
E-mail: [1]manoj.nmcc@gmail.com, [2]latha.lavanya@measiim.edu.in, [3]sudhal1@srmist.edu.in, [4]profsomasekharg@gmail.com, [5]aljeniferalbin@gmail.com, [6]mowleehul@gmail.com
ORCID: [1]https://orcid.org/0000-0003-2830-7875, [2]https://orcid.org/0000-0002-4185-9618, [3]https://orcid.org/0000-0003-4974-7482, [4]https://orcid.org/0000-0001-6966-7020, [5]https://orcid.org/0000-0002-4115-1521, [6]http://orcid.org/0000-0002-1293-1043
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***Abstract* - The market is experiencing substantial shifts because of two crucial Fourth Industrial Revolution innovations, AI and blockchain. Customers stand to benefit from blockchain technologies powered by AI because these advanced systems provide new ways to build business models as digitization advances. Research studies about blockchain and AI integration continue to appear; however, the essential business value of such integration remains vague to many. This research strives to identify multiple vertical business aspects where integrated AI and blockchain solutions bring benefits and uses, yet no studies exist to address this shortage. The study determines significant works about this subject through bibliometric analysis, which considers publication frequency, citation data, and network-based intellectual influence. The research discovered four main theme clusters in its content analysis of the subject matter that focus on supply chains, secure transactions, healthcare provisions, finance, and accounting applications. The research identifies ten business applications that could profit from applying these techniques according to its final point.**

Keywords: **Blockchain, Artificial Intelligence, Fourth Industrial Revolution, Business, Trends, Integration**

Nomenclature

Abbreviation	Description
AI	Artificial Intelligence
IoT	Internet of Things
IR	Industrial Revolution
NO	Neural Network
CPS	Cyber-Physical Systems
DRL	Deep Reinforcement Learning
CSP	Cloud Service Provider
IIoT	Industrial Internet of Things
BCPS	Blockchain-enabled Cyber-Physical System
RNNs	Recurrent Neural Networks
LSTM	Long Short-Term Memory
DTW	Dynamic Time Warping
CNNs	Convolutional Neural Networks
RQs	Research Questions
ROI	Return On Investment

I. INTRODUCTION

AI is a technological system that exceeds human ability and completes complex tasks requiring human cognitive power (Agarwal et al., 2020; Pandl et al., 2020; Subbaiah et.al., 2024). AI functions as a leading industrial growth factor (Ghaleb et al., 2022; Goodell 2021) because it helps businesses implement advanced technologies in the Fourth IR 4.0, including cryptocurrency (Li & Whinston, 2020) and blockchain (Ehrenberg & King, 2020) along with IoT and cloud computing (Hsu, 2020). AI expansion continues to grow due to the extraordinary volume of data that social media, IoT devices and online applications produce for machine learning algorithm training (Dinh & Thai, 2018). There exist some specific issues with AI adoption (Alahakoon et al., 2023). The problem of personal information protection has become critical due to several detected data violations and privacy misuse incidents. The Facebook controversy is the most significant case of data misuse when Cambridge Analytica used improper third-party tactics on millions of users. As AI cannot speak or understand human language, it becomes impossible to establish trust or verification standards in the current environment (Dinh & Thai, 2018).

According to (Dinh and Thai 2018) and (Liu et al. 2019a), the performance of blockchain technology has become

increasingly popular across different fields. Blockchain emerged in 2008 as a revolutionary technological solution with Bitcoin (Nakamoto, 2008) to transform communication methods, track activities, process payments, and handle multiple other tasks (Goodel et al., 2021). Users now have secure encrypted methods to move their wealth directly due to blockchain innovations (Abdullah et al., 2020). The implementation of smart contracts enhances permission checks and compliance verification because blockchain functions with multiple location-synchronized databases of shared information that allow all participants to reach an agreement about mutual actions (Karafloski & Mishev, 2017; Nakamoto, 2008; Karafloski & Mishev, 2017).

1. Blockchain technology and AI developments have quickened their integration point, altering the digital landscape of the forthcoming IR 4.0-inspired generation. Blockchain enables AI-oriented applications to develop better privacy features, understandability, and trust systems (Barnett & Treleaven, 2018). However, AI addresses blockchain-oriented technology challenges related to security, scalability, personalization, and governance issues. The distinct technological nature of blockchain and AI allows them to support each other by filling in the gaps of mutual weaknesses. Digital businesses maintain blockchain as their yin and AI as their yang because blockchain delivers execution and recording alongside verification, but AI makes decisions by recognizing and understanding (Alonso et al., 2020).

2. Patient data storage within the healthcare sector has become possible due to Blockchain technology, according to (Makarius et al., 2020). After system access is granted, health practitioners can use AI-derived patterns for data analysis (Chlaihawi, 2024). The shared utilization of these systems proved beneficial for the healthcare industry during the COVID-19 crisis (Fusco et al., 2020). BurstIQ is an essential blockchain-focused company that delivers digital healthcare solutions for medical practices (Lim et al., 2020). Electronic wallets enable health practitioners to review patient records, which helps them acquire additional medical information (Daley, 2019). These platforms work together to transform financial services operations through speed and operational trust development. Similar to blockchain and AI's impacts throughout other sectors of business, supply chains now benefit from manual operation digitization, protected data transfers, and automatic payment processing (Chen et al., 2024; Liu et al., 2018). Small independent coffee and cocoa producers received improved agricultural choices and accelerated payment transfers because of IBM's food trust AI platform combined with blockchain technology (Gereffi, 2019).

3. According to published research, combining AI with blockchain (Sulfath et al., 2025).will provide many uses for many industries, including autonomous cars, smart cities, finance, and 6G networks. While proffering additional insight, Dinh and Thai (2018) offered an abstract eloquence of combining both technologies and organizing their benefits via two groups. This research question was highlighted by Pandl et al. (2020), who used a comprehensive literature analysis to provide insight into the interaction between distributed ledger technology (or blockchain) and AI while encompassing both classifications. Unfortunately, none of these assessments explored the commercial applications of combining AI with blockchain, which defines the primary activity driving an economy's growth and activity (Gandhi et al., 2024; Broadus, 1987).

4. Complex terms like dematerialization, disintermediation, engineering, and developing items on request are standard in today's corporate lingo (Kumar et al., 2023). In order to respond to these shifting requirements in the future of work and economies, organizations will need to reconfigure their business strategies so that technology becomes key to their activities to succeed in the next industrial revolution. Powerful innovations like blockchain and AI are ideally suited for this project since they can streamline and improve traditional procedures (Karafiloski & Mishev, 2017). Businesses are now seeing the promise of these technologies for various industries, such as healthcare, agriculture, manufacturing, logistics, and supply chains. (Pandl and others, 2020) However, the characteristics and prospects for blockchain and AI incorporation specifically for business have not been the subject of any investigation so far (Hui et al., 2019).

The investigation analyzed blockchain and AI merger applications within businesses to resolve this research field's gap. The paper illustrates the business sector benefits of blockchain and AI utilization during Industry 4.0 and describes the research field (Li et al., 2020; Gupta et al., 2020). The study examines field working principles using bibliometric content analysis to analyze internal research principles and publication output. This study investigates the below RQs by the methodology of prior bibliometric investigations (Donthu et al., 2021b, c; Kumar et al., 2021a, b, c; Lim et al., 2022b, c) and the objectives of the article:

RQ1. What level of productivity does the study on AI and blockchain integration in business hold? Research findings about the quantity and development of scholarly publications in this field determine the solution.

RQ2. This research presents essential publications regarding blockchain technology and AI business applications. These scholarly publications can be located due to solutions generated from this academic research, so academic researchers and business executives find them useful.

RQ3. What are popular subjects and trends regarding AI and blockchain business applications? The solution examines all

available data regarding this research problem in the academic field.

RQ4. The main commercial possibilities maintained by AI and blockchain collaboration can be identified. Business executives can utilize the response to their research question when deploying AI and blockchain technologies.

This paper delivers several important contributions. The initial section of this paper demonstrates that business applications of AI and blockchain combination have shown little results. The economic lead business justifies this knowledge's importance because companies need fundamental remodeling to survive the digital era. This essay outlines the business applications accompanied by advantages that these innovations deliver as essential teachings for both academic and commercial sectors. This paper establishes an important requirement for research scientists and practitioners to achieve scientific insights into the accumulated work within the field (Donthu et al., 2021a). Previous academic evaluations about AI and blockchain technologies exist but remain limited and accessible only in constrained ways (Alnafrah et al., 2019; Li et al., 2019). The vital approach used by (Omohundro, 2014), Karafloski and Mishev (2017), and Dinh and Thai (2018) prevents replication of their research since they lack review practices and confine their investigations to particular debate topics. (Pandl et al., 2020) present methodologically organized findings, yet their research remains limited to author-specific perceptions. The evaluation method relies on descriptive statistics of objective data, which targets the weaknesses found in past reviews (Donthu et al., 2021a). The methodology represents an important development and starts a new research phase within the discipline.

This research paper follows the organizational structure below. The author first explains the methods used for the study and then gives an exhaustive breakdown of research outcomes. Significant findings from the study are presented at the conclusion before the paper discusses identified research constraints and suggests further research recommendations.

II. METHODOLOGY

The current research utilizes bibliometric analysis to evaluate productive output (publication figures and major important articles) and research composition (subjects, application areas, and themes) in commerce. Bibliometric analysis employs quantitative tools to evaluate bibliometric data about publications and references for research overview studies as described in (Pritchard 1969), (Donthu et al. 2021a), and (Mukherjee et al. 2021). Research using this method constitutes one of the most established scientific techniques demonstrating various applications in business operations (Donthu et al., 2021b, c; Kumar et al., 2021a, b, c; Lim et al., 2022b). Among most evaluation methods (Lim et al., 2022a; Paul et al., 2021), bibliometrics stands out because it bases its evaluation on quantitative tools coupled with an evaluation framework, making it the most precise technique. Subjective assessment methods such as thematic evaluation either lack evaluation protocols (Donthu et al., 2021a; Lim et al., 2022a) or face obstacles due to the absence of unbiased thematic analysis (Shih et al.,2019) and evaluation methods. The research utilizes (Donthu et al. 2021a) proposed four-step bibliometric evaluation procedure that begins with defining study objectives and scope, then proceeds to methodology selection, followed by data collection and final analysis and presentation phases. A depiction of the research methodology overview appears in (Fig. 1).

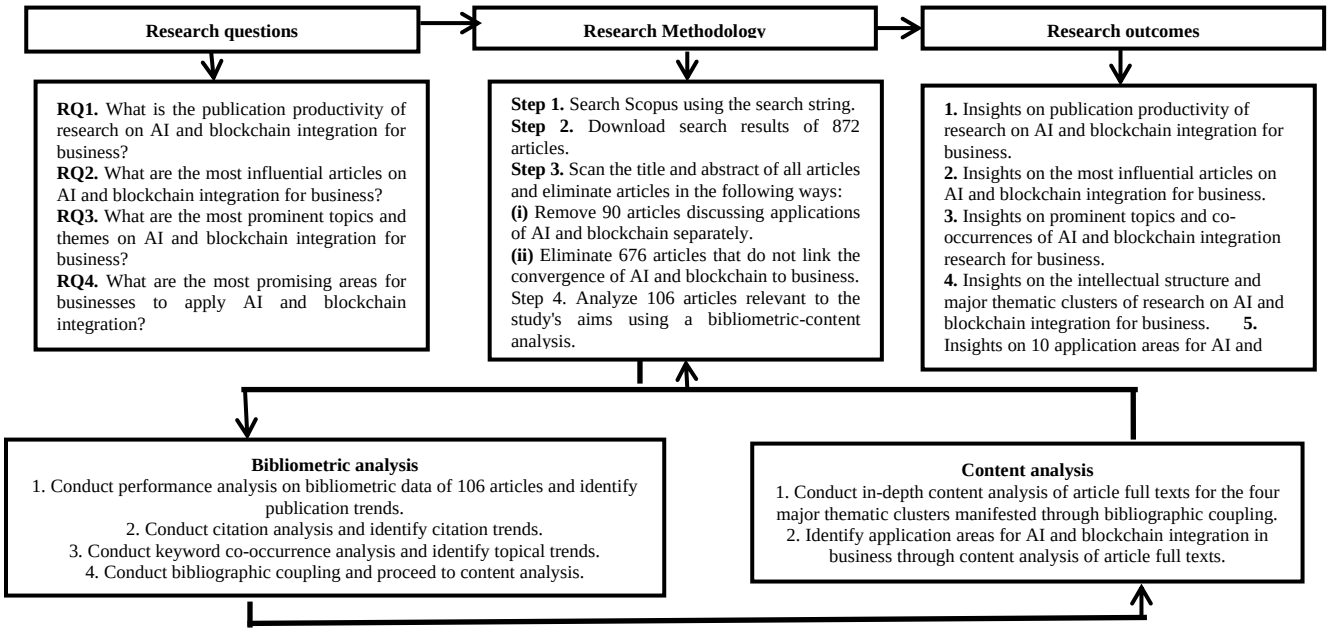

Fig. 1 Research Model and Strategy of Analysis

A. Describing the Scope and Aims of the Research

The cognitive model begins with the field of study's primary issues and themes beneath examination, while the bibliometric architecture encompasses publishing production. Since blockchain and AI are active research topics, the topic of study is rather broad.

B. Selecting the Approaches of Analysis

The report performs bibliometric metrics to unwrap the key subjects and themes in the research field, including cite score, citations, publication count, impact factor, and h-index. This analysis then notifies the authors' learning of the article bibliography.

C. Gathering the Data for the Analysis

The researchers collaborated on keyword development with domain experts in AI and blockchain to find publications and related bibliometric and bibliographic data for analysis. "AI-enabled blockchain" refers to a combination of AI and blockchain concepts. It guarantees that Google searches fully cover both of these ideas.

The First Portion of the Search

string includes AI-related phrases like "AI" and "machine learning," as well as its most popular applications like "NN" and "deep learning. " The next portion of the search string includes the phrases "distributed ledger," "blockchain," and "hyper ledger," as well as its most well-known uses, "Ethereum," "bitcoin," and "smart contract. "

The search is restricted to specific document types (such as articles and reviews), source types (such as journals), language types (such as English), and publication years. The probe was carried out in February 2021. Since Scopus is the largest scientific database for participant research articles, it was used to gather the data for the research (Bartol et al., 2014; Donthu et al., 2021a; Paul et al., 2021). 872 items were found after searching using both search phrases.

The writers use a two-step process to choose the publications pertinent to the research. After the Scopus findings were returned, two coauthors autonomously programmed the publications in the first step. These publications solely cover the various components of integrating AI with blockchain, omitting any discussion of the benefits to the enterprise in terms of cost-effectiveness, robustness, and flexibility. After 676 items were eliminated, 106 publications pertinent to the study's objectives were evaluated. The total coding consensus for the publications in the two phases was 96% among the two coauthors. According to (La Paz et al. 2020), a majority vote was used to settle disputes over adding a third coauthor.

D. Performing the Analysis and Reporting the Results

The last phase consists of performing the analysis and releasing the findings. Every paper's complete text in every significant theme cluster identified by the bibliometric analysis was reviewed and evaluated appropriately. The subsequent subsections reflect the results of the bibliometric contentbibliometric content analysis.

III. RESULTS

Based on the survey questions they answered, the analysis results analysis results are summarized. The parts are organized as follows.

A. Publication Productivity

The research assessed all of the papers published in the field by year to address RQ1—what is the publishing output of work on AI and blockchain connectivity for business? Scopus is where the bibliometric information used in the analysis was gathered. Bibliometric data describes big data that includes details on scientific publications, including publication (like abstract, title, keywords, and year) and reference (Broadus, 1987; Donthu et al., 2021a).

Fig. 2 displays the number of articles on blockchain and AI incorporation for enterprises. All papers in this field, with the majority coming in 2019 and 2020, were produced explicitly between 2017 and 2020, reflecting that it represents a new field of study that has only recently begun to gain popularity. Initially, research funding was devoted to every technology separately, but this has changed since 2019.

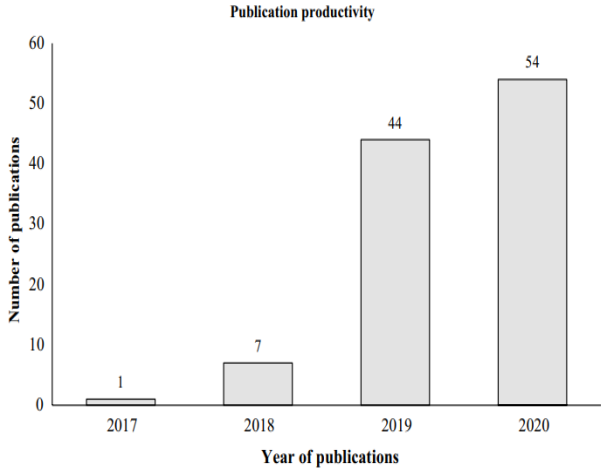

Fig. 2 Annual publication distribution on Blockchain and AI combination for business

B. Major Influential Articles

The research utilized a citation system performance analysis to examine the 106 articles beneath consideration to respond to RQ2—which is which publications are the most important for understanding how AI and blockchain connectivity may be used in commerce (Lim et al., 2022). There exists a variety of measures to gauge a paper's influence. However, the most popular one is citations (Ding & Cronin, 2011), which gauges a publication's influence by counting how often it is

referenced in various journals (Donthu et al., 2021a). The network of citations between publications is shown in Figure 3. The editorial by (Mamoshina et al., 2018) has the most citations (102), accompanied by those by (Liu et al., 2019b) and Mao et al. (2018) on a credit assessment platform model on blockchain and LSTM (47 and 44, in both).

(Mamoshina et al., 2018) provide an outline of cutting-edge approaches. The researchers describe how individualized health records will be created on a distributed ledger that individuals own and control. The authors also contend that the combination of deep learning and blockchain technology produces a decentralized marketplace for personal data that is open and safe, which can help regulators overcome their difficulties. A combination of blockchain technology and the DRL algorithm can improve IIoT applications' performance, according to (Liu et al., 2019b). Decentralization, scalability, and security are all benefits of integrating blockchain and DRL into blockchain-enabled IIoT platforms. (Mao et al., 2018) utilize a deep learning platform, LSTM, proving that a blockchain technology credit assessment process improves efficacy. The connections within the nodes describing these articles and the nodes defining other articles in the field indicate that they are also among the most important journals in the field (Lu et al., 2017).

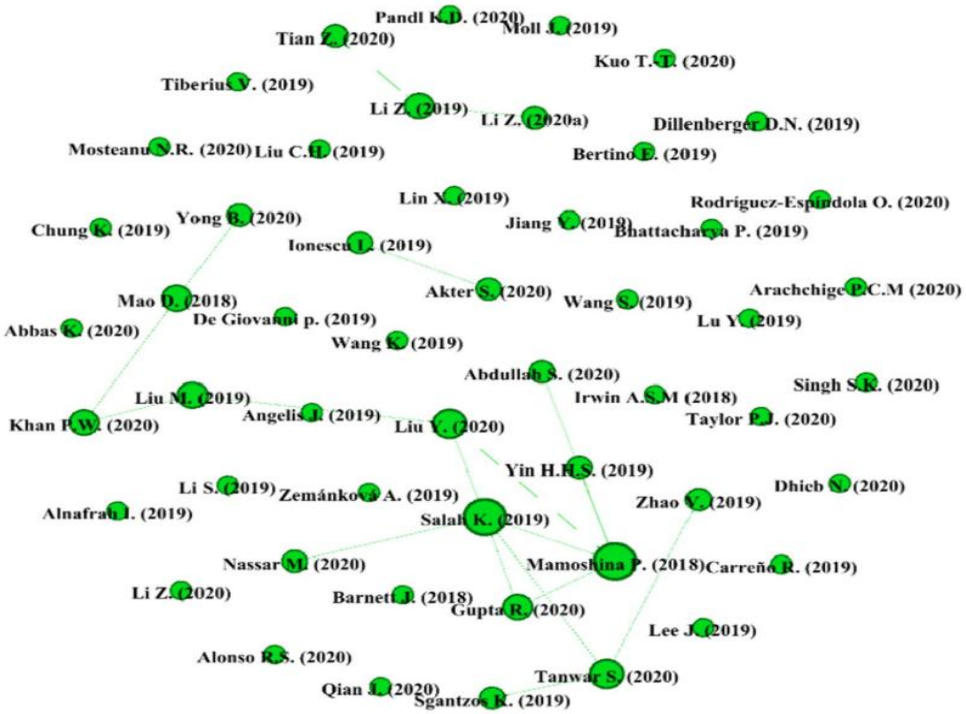

Fig. 3 Citation Network

C. Major Prominent Topics

The study does a phrase to respond to the first half of RQ3—that is, what are the major prevalent subjects and concepts on AI and blockchain connectivity for company. According to Comerio and Strozzi (2019), the keywords writers use in their works impact the topics covered, and their co-occurrence impacts the current related research. Tables 1 and 2 and Fig. 4 exhibit the keyword occurrences, co-occurrences, and network accordingly.

Table 2 lists the top 20 terms according to how frequently they appear. With 74 instances, blockchain tops the list, next by AI (31), machine learning (19), smart contracts (22), and IoT (13). All of these terms reflect the range of articles included in the dataset. Most significantly, the keywords are relevant to the main innovations that may be used and combined for the robotization of business in IR 4.0, which is compatible with the area of questioning of the latest research. The intensity or weight of correlation between the keyword pairs determines how they are ordered. "Blockchain and smart contract," "Blockchain and machine learning," and "Blockchain and security" are the three keyword pairings that are most tightly related. The dataset presented here indicates studies concentrating on the combination in which machine learning represents the primary type of AI important for business, according to the strongest correlation between machine learning and blockchain. In Fig. 4, the network of keywords is displayed. The network shows that AI, machine learning, blockchain, the IoT, and smart contracts are the most notable nodes around each other, and with various topical search terms, demonstrating the significance of these topics.

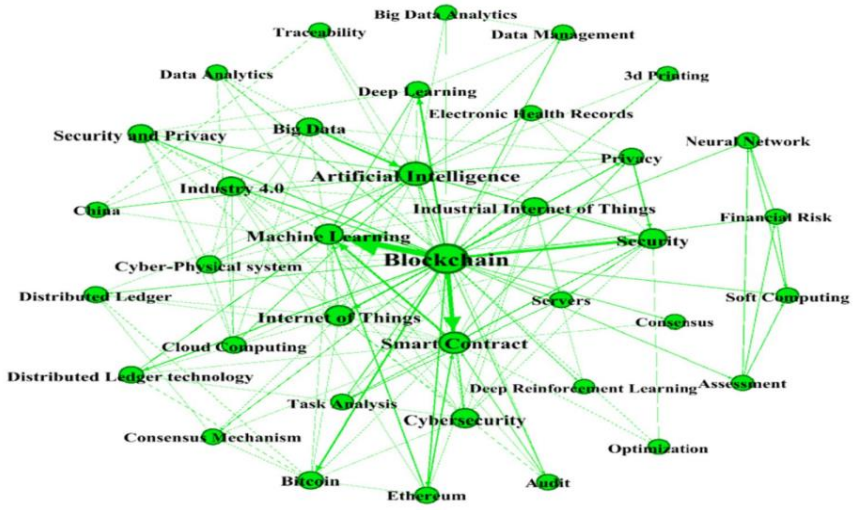

Fig. 4 Topic Network

TABLE I Top keywords concerning frequency of occurrence

Keywords	**Occurrences**
Blockchain	74
Smart contract	22
IoT	13
Big data	6
IR 4.0	5
Bitcoin	4
Ethereum	4
Privacy and security	4
Distributed ledger	3
Assessment	2
AI	31
Machine learning	19
Security	7
Cybersecurity	6
Distributed ledger technology	5
Deep learning	4
Privacy	4
IIoT	4
Cyber-physical system	2
Cloud computing	2

Table II Top keyword pairs in terms of degree of co-occurrence

Keyword 1	**Keyword 2**	**Weight**
Blockchain	Machine learning	16
Blockchain	Security	7
Smart contract	Machine learning	5
Blockchain	Deep learning	4
Blockchain	Distributed ledger technology	3
Blockchain	Industry 4.0	3
Blockchain	Privacy and security	3
Ethereum	Machine learning	3
Security	AI	3
Blockchain	Assessment	2
Blockchain	Smart contract	9
Big data	AI	5
Blockchain	Bitcoin	4
Blockchain	IoT	4
Blockchain	Ethereum	3
Blockchain	Privacy	3
Ethereum	Smart contract	3
Privacy	Security	3
3D printing	Blockchain	2
Blockchain	Audit	2

E. Major Prominent Themes

The researchers conducted bibliographic coupling and content analysis of the 106 articles beneath examination to respond to the second element of RQ3—that is, what the major prevalent subjects and issues on connectivity for businesses are. The term "bibliographic coupling" was first used by Kessler in 1963 to describe how scientific articles may be identified by their citation patterns, which group articles that quote related sources together to symbolize their conceptual relationships Kessler, 1963. Fig. 5 displays the topic groups, each highlighted in a different color. Purple and green nodes are used to emphasize groups 1 and 2, while orange and blue nodes are used to emphasize groups 3 and 4. In particular, two large topic groups are industry-specific (Groups 1 and 3), while two significant theme groups are general and crossover all sectors (Groups 2 and 4). The groups are also subjected to content analysis, and the results are given according to each group's size, which determines the count of related articles.

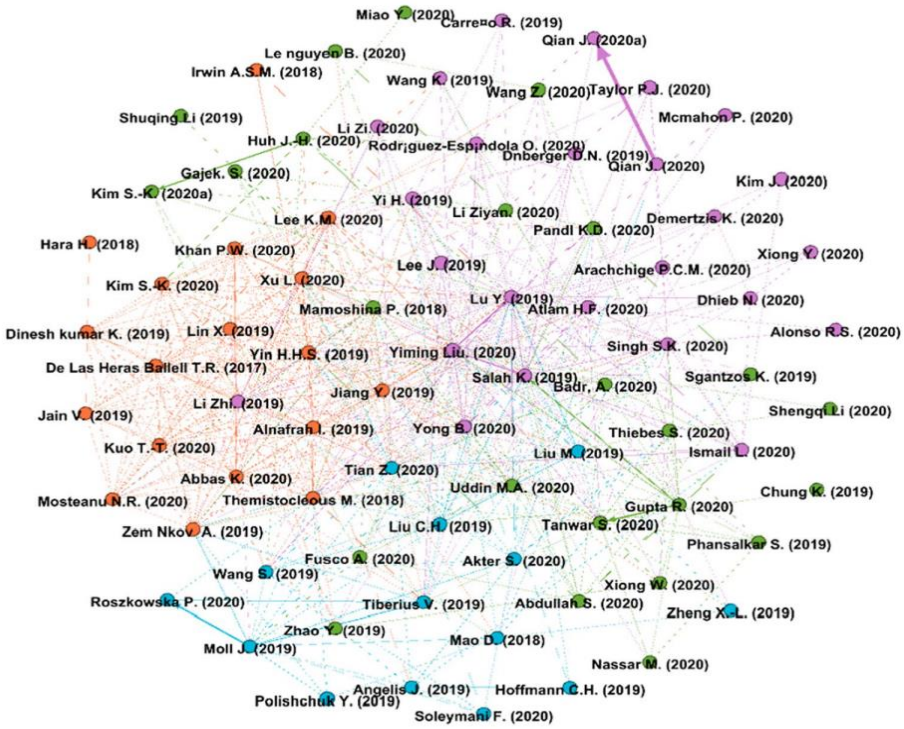

Fig. 5 Bibliographic coupling map

Group 1: ***Supply Chains and IR 4.0:*** Group 1 comprises 25 papers with 471 citations. The papers in this group describe the advances of IR 4.0, and the word clouds show that AI, supply chains, blockchain, and traceability are widely used terms. The combination of AI and blockchain, two intelligent systems that define the most recent industrialization and support the automation industry, aligns with contemporary principles. Although IR 4.0 has made it possible to enhance business in several ways (Liu et al., 2019a; Rodrguez-Espndola et al., 2020), the publications.

According to Arachchige et al. (2020), IIoT is the factor behind IR 4.0 in business. Machine learning analyses large amounts of private data generated by IIoT-oriented technologies. Machine learning methods are highly likely to expose confidential information to enemies. While smart contracts provide visibility to the suggested scheme, differential privacy is used to improve the security of the input data (Ehrenberg & King, 2020; Han et al., 2021).

Additionally, IR 4.0 has significantly increased the productivity of production processes (Lu, 2017). It causes issues with production operations' transparency, security, trustworthiness, privacy, and efficiency. In order to overcome these challenges, (Lee et al. 2019) suggest a BCPS.

A fundamentally sound assessment method may also increase the production processes' productivity efficiency. Suppliers are selected by businesses depending on their capacity for manufacturing. Nevertheless, traditional production capacity assessment programs depend on a centralized strategy with little success in data exchange. In order to provide an autonomous corporate manufacturing potential empirical observation, Li et al. (2020) offer a manufacturing ability assessment method. With transparent and decentralized data storage, blockchain enables fair and automated data trade in this case.

However, supply chains are susceptible to risks; for instance, problems like vaccination record falsification and vaccine expiry are common in the supply chains for vaccinations. These problems are highlighted, suggesting a control technology wherein machine learning techniques give details on vaccination recommendations to various users, smart

contracts identify expired vaccines, and blockchain innovation allows vaccine oversight. Parallel to this, the dairy business recognizes the value of giving consumers thorough product details to guarantee the product's safety and quality (Alonso et al., 2020). Furthermore, (Rodrguez Espndola et al. 2020) discuss how 3D printing might address issues with the flow of goods, information, and economic ability in procurement.

Group 2: ***Smart Healthcare:*** Group 2 comprises 24 papers and 259 citations. Its publications primarily focus on the healthcare sector, and the word clouds for the group notably use the terms AI, healthcare, blockchain, health, and patient.

Combining AI with blockchain in the healthcare sector can help solve concerns about medical data protection (Klinker et al., 2019; Kim and Huh 2020) described a blockchain and AI-based health information platform.

GuardHealth is a plan-sharing and storage system built on two smart contracts and a consortium blockchain. The method offers security and data privacy by employing proxy re-encryption to secure health data while transferring it to the CSP. The suggested methodology also includes a method for detecting rogue nodes using a graph convolution network, which can increase confidence and ensure data security.

The idea of intelligent health data sharing on the blockchain was introduced by (Mamoshina et al., 2018), who also describe how distributed ledger technology and AI may give patients authority over their medical records. The researchers describe how RNNs and transfer learning methods may be applied to the blockchain-enabled personal information market to produce different types of health-related prediction analyses, the findings of which can be valuable to insurance and pharmaceutical businesses. The researchers also proposed a personal data-driven market, wherein individuals retain complete data control and may set security controls to safeguard their security. Patients can receive rewards through the platform for inventing different data and providing it for usage in academics and business.

More recently, (Fusco et al., 2020) offer a prediction solution that enables the nationwide address of the threat of COVID-19. Furthermore, the forecast software may be independently upgraded with patient clinical data, which can provide big data suited for shaping mental health policy and illustrating how the industry can assist the state in moments of emergency.

Eventually, forecasting models for storage place available resources. This is due to the incredibly rapid expansion of digital health information and the boost in the types of information archives. In contrast, (Badré et al., 2020) allow the usage of integer programming, blockchain technology, and machine learning to enhance the cooperation between patients and healthcare providers.

Group 3: ***Secure Transactions:*** The 18 articles in Group 3 have 119 citations. The papers in this group summarise the dangers of online purchases and the corresponding ways to make them safe. This group notes that cryptocurrency's significant concentration of secrecy gives it a haven for illegal activity. It has proven difficult for police agencies to identify unlawful bitcoin consumers and their activities (Irwin & Turner, 2018).

A way of purposefully fraudulent purposes. The technique aids in detecting high Bitcoin users and their possible involvement in cybercrime. The article utilizes the gradient boosting technique to reveal the parties' identities.

Parallel to this, (Irwin & Turner 2018) propose an ideal approach based on a machine-learning framework with advanced analytics. This approach allows predictive monitoring by gathering and processing data from the Bitcoin blockchain. Additionally, the method promotes data exchange among law enforcement, FinTech companies, and economic planning to track down the identities of unauthorized Bitcoin users.

(Jain et al., 2019) offer a novel technique to reduce the danger of identity fraud interactions to overcome unintended unlawful activities. Their method conducts Bitcoin transactions without a private key since it combines machine learning, IoT, blockchain, and online signature verification (Rodríguez de las Heras Ballell, 2017). A continuously produced handwritten signature created using a special pen equipped with a gyroscope and accelerometer is used to verify the transactions. The DTW method is used to verify handwritten signatures.

Lastly, de las Heras Ballell (2017) highlights the flaws in developed security legal frameworks and proposes that incorporating IoT, AI, and smart contracts can address these flaws and improve precision and security. Collateral management has a significant transaction cost in smart contracts (Lu, 2017; Mayer, 2019). Creditors may cost-effectively manage restricted resources using IoT and smart contracts, immediately control and study, and quickly spot non-compliance. Furthermore, AI-enabled innovative contract systems can reduce the chance of recovering cash in the case of bankruptcy by identifying risks of commitments not being fulfilled owing to unforeseen circumstances and making it practically unbreakable agreed-upon compliance standards. The artificial technology's decision-making data and systems gathered by IoT technologies can create a complete standard documentation for genuine interactions.

Group 4: ***Accounting and Finance:*** The smallest group, Group 4, contains 14 publications with 240 citations. The papers in this group focus on the finance and accounting industries, and the word cloud for the group's articles notably features the terms auditing, accounting, business, blockchain, financial, and smart contract.

In this group, it has been shown that the combined use of blockchain together with AI may enhance business operations. Information technology may simplify financial decisions and change auditors' daily business (Moll &

Yigitbasioglu, 2019). FinTech 3.0 sheds new light on the three parts of innovation financial advancement. This results in enhanced service efficiency and lower costs. Parallel to this, DeepBreath is a web-based system for asset allocation control and implementation. Blockchain technology is utilized to decrease the resolution risk brought on by delays in the procurement of a property and its payout. CNNs are utilized to apply investment policies based on asset reallocation in the inventory to maximize ROI.

The papers in this group also go into how blockchain systems with embedded AI might assist in addressing issues like credit risk and corporate fraud. In business, frauds go undetected by auditors and make the case that FinTech offers an effective solution. She contends that combining smart contracts, blockchain, and cutting-edge AI systems can address the shortcomings of financial and other information (Mao et al., 2018). This solution employs smart contracts to gather information about credit evaluations and analyze it with LSTM. The suggested scheme illustrates how the combination of AI and blockchain might support ensuring the veracity of data regarding credit assessment and the verification of subsequent monetary operations by dealers.

F. Fields for Blockchain and AI Integration in Business

The research analyzes the evaluation text utilizing a content analysis to address RQ4: What are the major promising sectors for the industry to utilize AI and blockchain assimilation? Ten probable applications for these hallmark techniques are identified and discussed. With examples of applications and the innovations, values, and sources that go with them, IR 4.0 techniques are identified and discussed.

The research corpus's content analysis demonstrates applications for many industry sectors. A few of these uses, including planning and business, are general and can be used throughout all sectors, while others are industry-specific (e.g., healthcare, e-commerce).

The two main innovations driving the tsunami of digitalization are AI and blockchain. The combination of these two techniques has the potential to enhance present company procedures and usher in brand-new marketing strategies that can function as independent, autonomous economic actors. Blockchain may improve corporate processes' trust, transparency, privacy, and security (Mao et al., 2018), while AI can find trends in information and improve operational procedures. Since these two systems are intended to complement one another, integration is the only way to realize their promise fully.

When these are employed separately, several issues may arise. On the one hand, AI plagues transparency, trustworthiness, and modeling and analysis problems. On the other hand, blockchain has issues with sustainability and safety. By combining these two solutions, these flaws may be fixed, and organizations can benefit from safe data exchange and workflow automation.

Several commercial uses for integrating blockchain with AI have surfaced recently. When AI and blockchain are combined, an extremely reliable software decision-making process is produced, helping to build a safe environment for data transfer and payments. In particular, blockchain allows businesses to make well-informed choices by enabling seamless data exchange with AI applications.

Highly autonomous payment systems that are more flexible, agile, and cost-effective have also been established by combining blockchain with AI technology. For the industrial sector, (Lee et al., 2019) offer the CPS, which enables self-adjusting, self-optimizing, and self-configuring production units and addresses the shortcomings of current manufacturing techniques. By laying the groundwork for innovative manufacturing systems, CPS has made it possible to influence each component of the production chain, including manufacturing, design, customer service, supply chains, and support (Lu, 2017: Li et al., 2020; Li et al., 2019).

Because items can be tracked in real-time along the supply chain thanks to AI and blockchain, supply networks may also become more durable and persistent (Alonso et al., 2020). Furthermore, according to (Rodriguez-Espndola et al., 2020), these innovations can enhance the flow of goods, data, and economic ability throughout supply chains.

Blockchain in accountancy might help eliminate inaccurate assumptions made by AI methods owing to flawed data-generating methods or tampered data sources by verifying the data producers. Blockchain, AI, and IoT can assist businesses in enhancing the audit processes' performance by enhancing the credibility of financial reports, resolving inspection issues, and reducing the possibility of financial fraud.

(Irwin & Turner 2018) offer an ideal method for locating unauthorized Bitcoin transactions by analyzing large data sets obtained from the Bitcoin blockchain employing AI algorithms. In the same way, by examining the data saved on the blockchain, an aggressive gradient-boosting machine-learning model may identify problematic consumers and bogus allegations in the financial sector (Dhieb et al., 2020). It allows participants and operations on a decentralized blockchain architecture to be verified for legitimacy. Blockchain and AI combination provide a forecast solution that supports patient flow (Mamoshina et al., 2018).

Blockchain-oriented consumer data gathering in advertising can assist businesses in automating customer care. A customer support platform built on blockchain, machine learning, and IoT is proposed by (Li et al., 2019) to assist small businesses in providing excellent customer support without the assistance of outside entities. In the long run, this will increase customers' perceptions and boost business performance (Lim et al., 2022). The LSTM machine learning model on a blockchain-oriented platform may also anticipate consumer satisfaction. Machine learning techniques can identify abnormality in online communication, and blockchain's performance of the proposed consensus

mechanism can reduce the propagation of incorrect news on social media (Alagu Vignesh & Harini, 2019; Yi, 2019).

Especially noteworthy describes the possibility that blockchain technology may defend against the growing danger of incorrect information in online material (Christodoulou & Christodoulou, 2020). In particular, blockchain can rebuild confidence in the digital economy by providing more insight into the lifetime of information (Narayanan & Attili, 2021). Blockchain can trace the digital path of the information, confirm its origins, and examine any potential manipulation thanks to its distributed nature. Christodoulou and Christodoulou (2020), who battled wrong information, provide evidence for this.

In light of this, it is obvious that it can occur in a variety of contexts. When these capabilities are combined, novel services, products, and marketing strategies may be created, and industrialized enterprises can be digitally transformed to progress their operations and begin a new digital world (Makarius et al., 2020). It may be combined to enhance processes and create value (such as customer service, asset management, fraud detection, dispute resolution, production assessment, and supply chain monitoring). (Ding & Cronin, 2011; McMahon et al., 2020; Han et al., 2024). However, there exists a tonne of examples already available. Additionally, the study demonstrates that blockchain and AI (such as machine learning and edge computing) may materialize in various ways and that history's existing suggestions are exact and systems-oriented. More significantly, the analysis shows that every application instance is accompanied by factual and practical data proving its efficacy and value. As a result, the research makes a compelling argument for the beneficial potential that AI and blockchain connectivity have for business. The architecture for integrating AI and blockchain is shown in Fig 6, which also illustrates the benefits and use cases for such platforms.

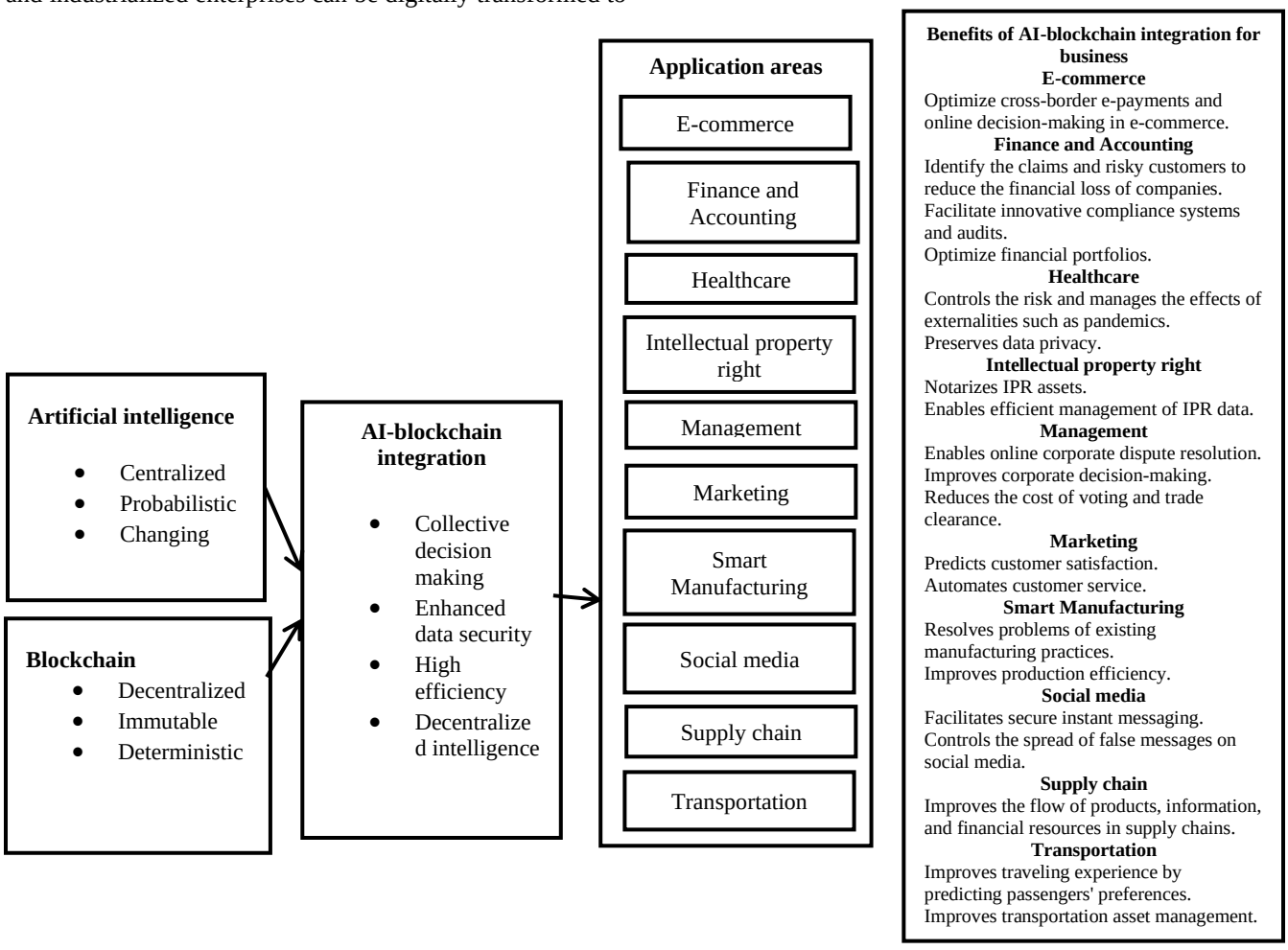

Fig 6. Framework Associated With The AI-Blockchain Combination In Business

IV. CONCLUSION

Blockchain and AI are standard features that define the innovative framework of IR 4.0. The research field requires additional studies to gather and evaluate the modern commercial applications of blockchain and AI systems in unison. A bibliometric content analysis provides this research with four main conclusions to address this knowledge gap.

The paper starts by investigating basic combinations for business applications during 2017, yet commercial adoption became widespread from 2019 onward. The article verifies

its conclusion about blockchain and AI's significant commercial possibilities through the thriving amount of research observed in this domain.

The research analyzes three reports, including (Liu et al., 2019b) on IoT systems, (Mao et al., 2018) on credit assessment systems based on blockchain and LSTM, and (Mamoshina et al., 2018) on business convergence. New research identifying the primary works in the field is essential for potential authors who wish to structure different approaches to expand existing study information.

The strongest relationship described in the text uses trilateration methods to demonstrate the research's promise and value.

The research analyzes four fundamental areas that strengthen this study's conceptual foundation. It divides its focused groups into supply chain, IR 4.0, and safe transactions spanning multiple sectors. The specific industry groups include finance and accounting and innovative healthcare. Research that supports the ongoing development of fields for better current conceptual and new frameworks receives strong support.

The literature review documented ten specific business domains where scientists propose using AI and blockchain technologies.

The goals were supported through four leading contributions outlined in this document. This paper displays the market output of AI and blockchain connectivity for companies through visualization, which confirms their current infancy and enormous future expansion possibilities. The research provides foundations for additional studies that will continue developing the crucial discoveries made in this publication. The paper presents researchers with an integrated review of up-to-date enterprise-level AI and blockchain connectivity research by presenting leading topics. The research has discovered ten applications businesses can use when integrating blockchain with artificial intelligence (Bruner, 2020). The identified business applications offer executives the possibility to utilize scientific investigations to identify upcoming opportunities when integrating the concepts of IR 4.0.

Such research material affects stakeholders, including AI personnel, corporate executives, IT service providers, blockchain researchers, and prospective academics. Business managers should use this information to initiate both approaches for developing projects that enhance organizational adaptability and increase the strength of FRMs (Fosso Wamba & Queiroz, 2023). AI and blockchain programmers will get deep insights into how the unified system delivers improved operational efficiency to companies. AI and blockchain programming sectors collaborate in their operations. IT providers have better chances to identify market opportunities and demonstrate service value after identifying strategic deployment sectors of AI and blockchain within firms. Future research in this field will build stronger knowledge through new study sources or improvements of existing research methods (Lim et al., 2022). The research includes experts and academics who stay current on integration potentials that improve business procedure development, durability, and strength.

Despite sharing some of the flaws characteristic of other academic papers, this study accepts its limitations. Bibliometric analysis was not part of Scopus design because this platform functions as a scientific database, which may contain unintentional errors. According to (Donthu et al. 2021a), the research team cleaned Scopus bibliometric data by removing repeated or inappropriate items to minimize unintended errors (2021a). The research synergy between AI and blockchain exists in a rapidly evolving scientific front that brings innovative changes to its field of application. Significant breakthroughs relating to AI incorporation and usage are expected because research programs are anticipated for fast development based on these advancements. Potential writing professionals need to use the search query provided to stay in line with current industry developments while utilizing the evaluation methods this article generates.

The research analysis identified a gap in business-based perspectives; thus, authors seeking new findings should study this particular assimilation from a business operational rather than a design framework.

This research confirms that AI integration with blockchain represents an existing substantial concern that provides new design solutions to advance the field of practice. The information within this article gives readers a complete understanding of AI and blockchain technology integration and highlights undertaking business-oriented investigations for future research.

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