The Eastasouth Journal of Information System and Computer Science
Vol. 1, No. 02, December, pp. 98-108
ISSN: 3025-566X, DOI: 10.58812/esiscs.v1i02

An Interdisciplinary Bibliometric Review of the Symbiotic Relationship between Business Intelligence and Artificial Intelligence

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Article Info

Article history:

Received Dec, 2023
Revised Dec, 2023
Accepted Dec, 2023

Keywords:

Artificial Intelligence
Bibliometric Studies
Business Intelligence
Literature Analysis
Technology Integration

ABSTRACT

This research conducts an interdisciplinary bibliometric review to explore the symbiotic relationship between Business Intelligence (BI) and Artificial Intelligence (AI). Utilizing advanced bibliometric tools, we analyze a comprehensive dataset extracted from reputable databases, encompassing articles that meet predefined inclusion criteria. The study reveals thematic clusters, influential documents, and core keywords shaping the discourse within the BI-AI landscape. Thematic clusters highlight the multidisciplinary nature of research, ranging from the impact of AI on finance to business model innovation and sustainability. The top-ten cited documents provide a snapshot of seminal works guiding academic and practical understanding, while keyword analysis illuminates the central themes and areas of emphasis. The cross-analysis of these elements offers a nuanced view of the evolving landscape of BI-AI integration. The findings not only contribute to academic scholarship but also provide practical insights for organizations navigating the dynamic intersection of BI and AI.

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1. INTRODUCTION

The intersection of Business Intelligence (BI) and Artificial Intelligence (AI) has become a focal point for innovation and strategic decision-making in academia and industry. Organizations are leveraging the synergy between BI and AI to grapple with the increasing complexity of data and the demand for actionable insights [1], [2]. AI augments BI's analytical capabilities by incorporating advanced algorithms, machine learning, and cognitive computing. This powerful alliance between BI and AI enables organizations to extract meaningful information from structured data sources and gain valuable insights for informed decision-making. The application of AI in various industries, including marketing, energy optimization, and IT service operations, has shown promising results in increasing sales, cutting costs, improving productivity, boosting innovation, and achieving organizational goals [3]–[6].

The integration of business intelligence (BI) and artificial intelligence (AI)

represents a paradigm shift in harnessing information for competitive advantage. BI systems have traditionally been used to aggregate, analyze, and visualize structured data, enabling informed decision-making.

However, the convergence of BI and AI has become necessary due to the proliferation of unstructured and complex data sources and the need for real-time analysis. This symbiotic relationship enhances traditional BI functionalities and unlocks new dimensions of intelligence through machine learning algorithms, natural language processing, and predictive analytics. The application of AI in BI systems allows for advanced real-time data analytics and enables organizations to gain deeper insights and make more informed decisions [7]. By leveraging AI capabilities, BI systems can handle the challenges posed by big data and provide organizations with a competitive edge in the face of global competition [8].

This multidisciplinary bibliometric review was prompted by the growing interest in and quick changes in the BI-AI field. Researchers and practitioners alike must grasp the theoretical underpinnings, recognize significant patterns, and unearth the underlying dynamics of this symbiosis. This study method aims to provide a comprehensive knowledge of the opportunities, difficulties, and synergies inherent in the convergence of BI and AI through a thorough analysis of the available literature [9]–[11].

2. LITERATURE REVIEW

2.1 Historical Evolution of BI and AI

The evolution of Business Intelligence (BI) and Artificial Intelligence (AI) reflects the dynamic interplay between technological advancements and the evolving needs of organizations [12], [13]. BI, rooted in decision support systems, gained prominence in the 1960s and 1970s with a focus on structured data processing [14]. On the other hand, the history of AI can be traced back to the mid-20th century when pioneers envisioned machines capable of intelligent decision-making [4]. The convergence of these two trajectories became more pronounced in recent decades, driven by the exponential growth of data, computational power, and algorithmic sophistication [15]. Understanding the historical development of BI and AI provides a foundational context for the symbiotic relationship that has emerged [5].

2.2 Theoretical Framework

The integration of business intelligence (BI) and artificial intelligence (AI) is guided by various theoretical perspectives. The Resource-Based View (RBV) emphasizes the strategic importance of combining organizational resources to create a competitive advantage [16]. The Technology-Organization-Environment (TOE) framework provides insights into the contextual factors that influence the adoption of BI and AI, such as organizational readiness and external environmental dynamics [17]. The Unified Theory of Acceptance and Use of Technology (UTAUT) helps understand user acceptance and adoption of integrated BI-AI systems [17]. These theoretical frameworks collectively contribute to a comprehensive understanding of the multidimensional nature of the symbiotic relationship between BI and AI [18].

2.3 BI and AI Integration Models

Research in the BI-AI domain has led to the development of integration models that demonstrate how these technologies can enhance organizational decision-making. The Augmented Analytics model advocates for the infusion of AI capabilities into BI tools, enabling automated insights generation and decision support. The Cognitive BI model emphasizes the role of AI in

processing unstructured data, natural language understanding, and advanced analytics. The Continuous Intelligence model envisions a real-time data processing ecosystem empowered by AI, facilitating immediate responses to changing business conditions. These models provide a roadmap for understanding the practical implementations and implications of BI-AI integration [19]. The synergy between BI and AI has resulted in diverse applications across industries. In healthcare, predictive analytics powered by AI enhances patient outcomes and resource allocation. In finance, the fusion of BI and AI enables fraud detection, risk management, and algorithmic trading. Marketing benefits from personalized customer insights generated by BI-AI systems, while manufacturing gains efficiency through predictive maintenance and supply chain optimization. Exploring these applications showcases the transformative potential of BI-AI integration in addressing complex challenges and unlocking new opportunities in various domains [7].

3. METHODS

A thorough and methodical search of academic databases was employed as part of the research approach for this study in order to compile a list of academic papers that discuss the integration of artificial intelligence (AI) with business intelligence (BI). Scopus was the database used for this bibliometric analysis. With great care, search phrases have been chosen to encompass a wide range of BI-AI relationship topics, guaranteeing the inclusion of noteworthy and pertinent contributions. The bibliometric analysis's included articles met predetermined standards for quality and relevancy. Articles published in peer-reviewed journals that specifically addressed the symbiotic link between BI and AI met the inclusion criteria. Prioritization was given to studies that focused on empirical research or made theoretical advances. By September 30, 2023, articles that do not adhere to the BI-AI integration guidelines and are not written in English will be eliminated in order to preserve the consistency and accuracy of our dataset. The study's data metrics are displayed in

Table 1. Metrics Data Research

Metrics Data	Information
Publication years	1975-2024
Citation years	48
Papers	782
Citations	8581
Cites/year	178.77
Cites/paper	10.97
Cites/author	4507.84
Papers/author	515.32
Authors/paper	2.10
h-index	41
g-index	83
hI,norm	30
hI,annual	0.63
hA, index	29

3.1 Data Analysis

Bibliometric analysis is a valuable tool for visualizing the intellectual structure of a field. VOSviewer is commonly used for this purpose, analyzing co-citation and co-authorship networks, as well as keyword co-occurrence. Co-citation analysis helps identify influential articles and authors by examining the frequency of their citations together [20]. Co-authorship analysis reveals collaboration patterns within the research community, highlighting clusters of researchers and institutions actively contributing to the field [21]. Keyword co-occurrence analysis is crucial for understanding the thematic landscape of the literature, identifying key topics and emerging trends [22]. VOSviewer generates visual representations of these networks, providing insights into the distribution of expertise and the interconnectedness of research themes within the field [23].

4. RESULTS AND DISCUSSION

4.1 Results and Discussion

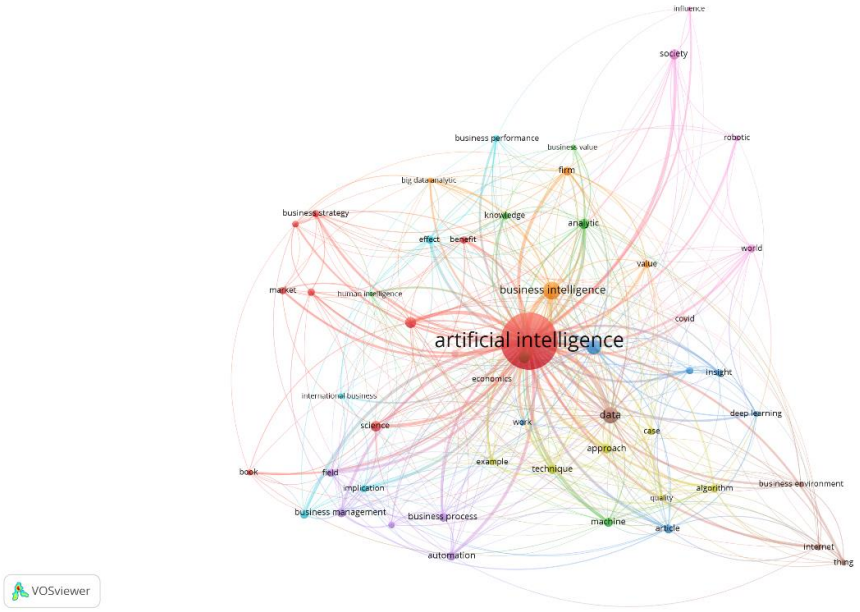

Figure 1. Vosviewers Mapping Vosviewers Mapping
Source: Data Analysis Results (2023)

Results of Figure 1 A thorough image of the intellectual landscape surrounding the mutually beneficial link between business intelligence (BI) and artificial intelligence (AI) is obtained through bibliometric analysis conducted using VOSviewer.

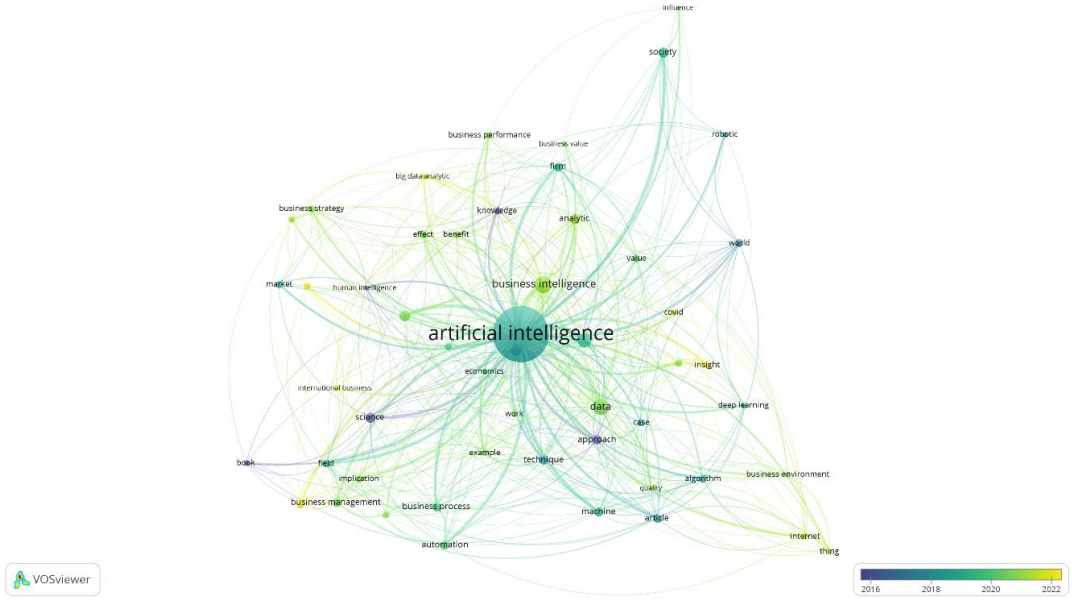

Figure 2: Research Trends
Source: Data Analysis Results (2023)

Figure 2 The examination of publication trends over time shows intriguing patterns that demonstrate the increasing significance and applicability of BI-AI integration. Furthermore, the authors' geographic distribution emphasizes the global engagement, with significant concentrations in research hubs including North America, Europe, and Asia. Emerging prolific journals are the main platforms via which BI-AI research is disseminated.

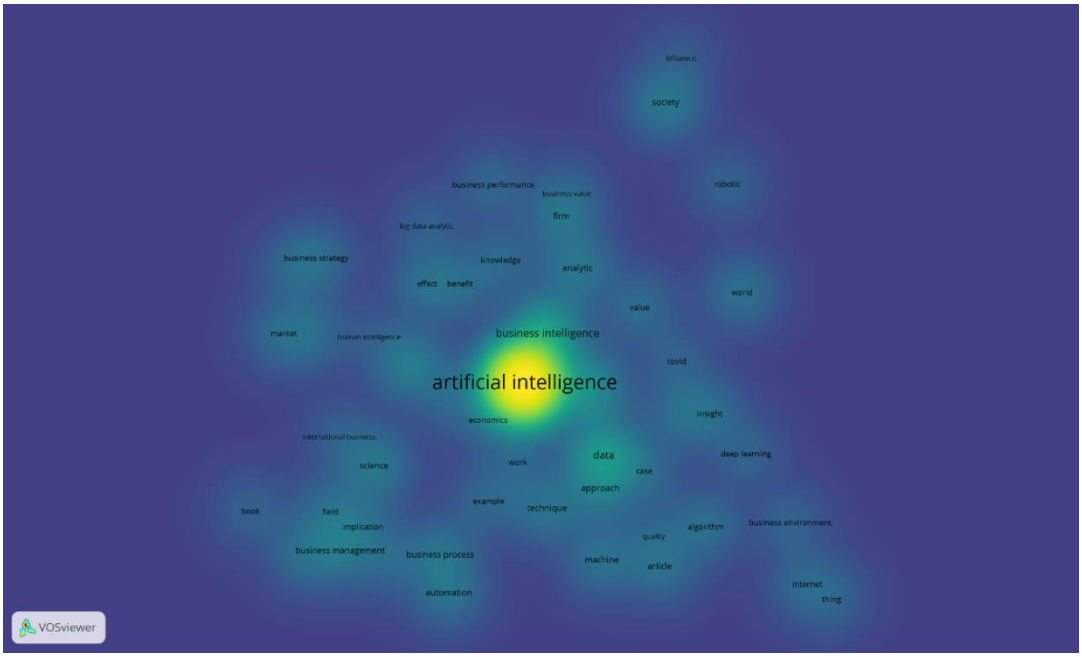

Figure 3. Cluster Mapping Cluster Mapping
Source: Data Analysis (2023)

A thorough understanding of the subject clusters within the mutually beneficial link between business intelligence and artificial intelligence can be obtained from Figure 3, which displays the findings of the bibliometric analysis. Every cluster contributes to the developing conversation on BI-AI integration by highlighting a distinct aspect of this multidisciplinary field.

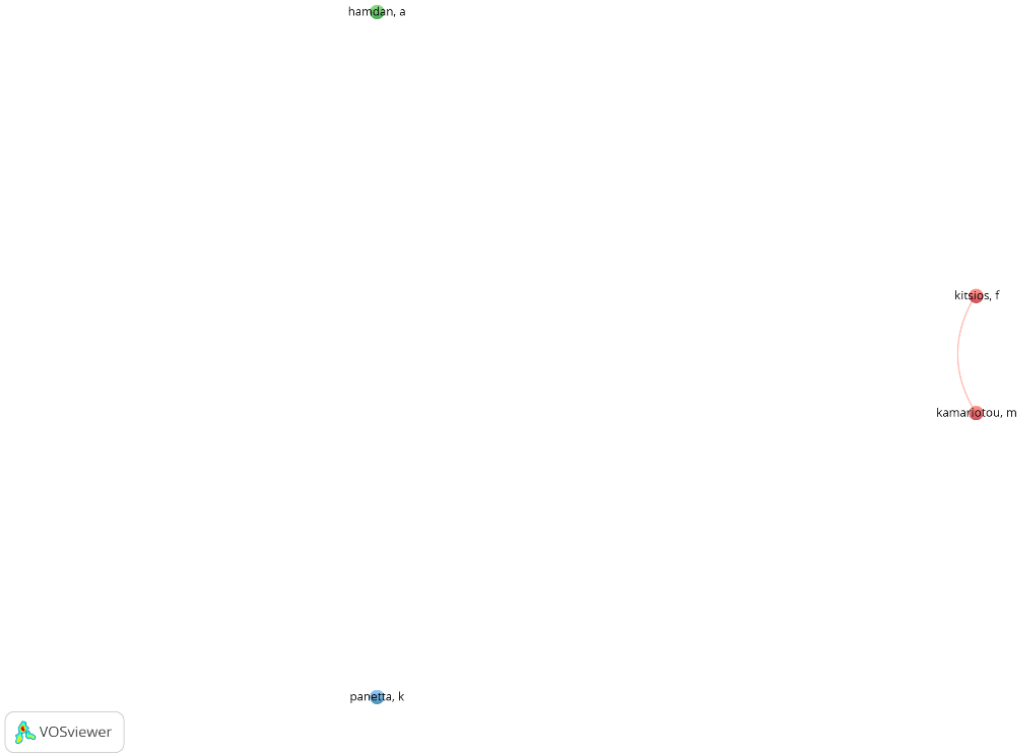

Figure 4. Author's Collaboration
Source: Results of Data Analysis (2023)

The co-authorship networks explored in Figure 4 shed light on the dynamics of collaboration in the BI-AI research community. The emergence of active collaboration clusters between academics and institutions underscored the interdisciplinary character of BI-AI integration. The examination demonstrated centers of excellence and disclosed trends in cooperative alliances, indicating the presence of research communities propelling the area forward.

Table 4. The Top Ten Cited Documents

Citations	Author and Year	Title
558	S Ransbotham, D Kiron, P Gerbert…	Reshaping business with artificial intelligence: Closing the gap between ambition and action [24]
501	A Di Vaio, R Palladino, R Hassan, O Escobar	Artificial intelligence and business models in the sustainable development goals perspective: A systematic literature review [25]
482	C Dirican	The impacts of robotics, artificial intelligence on business and economics [26]
268	AI Canhoto, F Clear	Artificial intelligence and machine learning as business tools: A framework for diagnosing value destruction potential [27]
254	IM Enholm, E Papagiannidis, P Mikalef…	Artificial intelligence and business value: A literature review [27]
254	J Lee, T Suh, D Roy, M Baucus	Emerging technology and business model innovation: the case of artificial intelligence [28]

242	SMC Loureiro, J Guerreiro, I Tussyadiah	Artificial intelligence in business: State of the art and future research agenda [29]
200	SA Wright, AE Schultz	The rising tide of artificial intelligence and business automation: Developing an ethical framework [30]
188	M Klumpp	Automation and artificial intelligence in business logistics systems: human reactions and collaboration requirements [31]
178	N Soni, EK Sharma, N Singh, A Kapoor	Artificial intelligence in business: from research and innovation to market deployment [32]

Source: Data Analysis Results (2023)

In the symbiotic relationship between Business Intelligence (BI) and Artificial Intelligence (AI), an analysis of the ten most cited documents offers important insights into the foundational works that have shaped the scholarly discourse and real-world applications of these fields. An overview of the foundational works that have greatly impacted the BI-AI conversation can be obtained by looking at the top 10 cited documents. The book "Reshaping Business with Artificial Intelligence" (Ransbotham et al., 2017) highlights how AI has the ability to completely change business. Di Vaio et al. (2020) examine the relationship between artificial intelligence (AI), business models, and sustainable development goals in their paper "Artificial Intelligence and Business Models in the Sustainable Development Goals Perspective". The effects of robotics and artificial intelligence on business and economics are explored in "The Impacts of Robotics, Artificial Intelligence on Business and Economics" (Dirican, 2015). The application of AI and ML as business tools is covered in "Artificial Intelligence and Machine Learning as Business Tools" (Canhoto et al., 2019).

Table 4. Keywords Analysis

Most occurrences		Fewer occurrences	
Occurrences	**Term**	**Occurrences**	**Term**
1062	Artificial intelligence	20	Value
97	Business intelligence	19	market
83	Data	18	Blockchain
68	Business model	18	Business model innovation
50	Intelligence	18	Benefit
47	Opportunity	17	Sustainability
36	Society	17	Knowledge
35	Science	16	Business strategy
34	Approach	15	Digital transformation
33	Business process	15	Quality
33	Analytic	14	economics
31	Automation	14	Business environment
30	Business management	11	Human intelligence
28	Machine	11	Big data analytic
28	Firm	10	International business

The main terms that run across the BI-AI literature are identified using the keyword analysis, providing insight into the areas of scholarly investigation and thematic goals.

Most Instances: Intelligence artificial (1062 occurrences): The word "Artificial Intelligence" is the

most commonly used, indicating its pivotal position in the conversation. It emphasizes how important it is to investigate and comprehend AI's transformational potential in a corporate setting.

Reduced Frequencies: Benefit, Market, Blockchain, Innovation in Business Model, Value: Although they are less common, phrases like "Market," "Value," "Blockchain," "Business Model Innovation," and "Benefit" designate particular areas of interest in the literature on business intelligence and artificial intelligence. Every term has a meaning that conveys complex ideas about how value is created, how markets work, how blockchain technology is integrated, how business models are innovative, and how positive results can be achieved.

Table 2. Cluster Identification

Cluster	Total Items	Most frequent keywords (occurrences)	Keyword
1	6	Business environment (20), data (15), machine (14)	Algorithm, approach, business environment, data, machine, quality
2	6	Artificial intelligence (20), blockchain (15), finance (25)	Artificial intelligence, blockchain, economics, finance, human intelligence, international business
3	5	business model innovation (15), knowledge (20)	Analytic, business model innovation, business value, intelligence, knowledge
4	5	Business intelligence (20), digital transformation (25), sustainability (15)	Big data analytic, business intelligence, business strategy, digital transformation, sustainability
5	5	Market (20), Opportunity (15)	Benefit, market, opportunity, science, society
6	4	Business management (25)	Artificial intelligence technology, automation, business management, business process
7	4	Business Model (20)	Business model, business performance, firm, value

Source: Data Analysis (2023)

Seven unique clusters were identified by the VOSviewer bibliometric study, indicating that business intelligence (BI) and artificial intelligence (AI) have a symbiotic relationship. A thematic grouping of articles based on term co-occurrence is represented by each cluster.

The examination of thematic clusters through bibliometric analysis has illuminated distinct areas of emphasis within the BI-AI literature. The identified clusters provide a nuanced understanding of the multidisciplinary nature of research and its implications for both academia and industry.

Cluster 1: Business Environment, Data, and Machine Learning: This cluster underscores the centrality of the business environment, data, and machine learning in the BI-AI integration discourse. The focus on algorithms, approaches, and data quality suggests a concerted effort to harness machine learning capabilities within the dynamic context of the business environment.

Cluster 2: AI in Finance and Blockchain: The intersection of AI with finance and blockchain highlights the growing importance of these technologies in reshaping financial systems. The inclusion of

terms like "economics," "human intelligence," and "international business" points towards a comprehensive exploration of AI's impact on global economic dynamics. **Cluster 3: Business Model Innovation and Knowledge:** The third cluster places an emphasis on business model innovation and knowledge, signaling a recognition of the pivotal role these elements play in the BI-AI landscape. Analytic approaches, business value, and intelligence are integral components, emphasizing the need for innovative business models driven by knowledge.

Cluster 4: BI, Digital Transformation, and Sustainability: This cluster reinforces the interconnectedness of Business Intelligence, digital transformation, and sustainability. It sheds light on how BI can drive strategic decisions in navigating digital transformations while contributing to sustainable business practices. Cluster 5: Market and Opportunity: The focus on market dynamics and opportunities suggests a keen interest in understanding the strategic positioning of organizations within dynamic markets. This cluster highlights the significance of leveraging BI-AI integration to identify and capitalize on market opportunities.

Cluster 6: AI Technology in Business Management: The cluster centered on AI technology in business management underscores the practical applications of AI in enhancing business processes. Automation and effective business management are key themes, suggesting a shift towards operational efficiency through AI technologies. Cluster 7: Business Models and Performance: The final cluster revolves around business models and their impact on firm performance. This emphasizes the strategic importance of selecting and adapting business models in response to the integration of BI and AI.

4.2 Future Research Directions

Building on the identified gaps and challenges, this section outlines potential avenues for future research. The dynamic nature of the BI-AI landscape suggests the need for continued exploration into emerging trends and evolving technologies. Research that bridges disciplinary boundaries, addressing both technical and ethical considerations, is essential for fostering a holistic understanding of BI-AI integration. Additionally, investigations into the practical implications of BI-AI within specific industries and organizational contexts will contribute to the applicability and relevance of research findings.

4.3 Implications for Practice

The findings of this bibliometric analysis have practical implications for organizations seeking to leverage the symbiotic relationship between BI and AI. Insights into collaborative networks, influential works, and emerging trends provide a roadmap for strategic decision-making in adopting BI-AI integration. Understanding the challenges and ethical considerations highlighted in the literature is crucial for organizations aiming to deploy BI-AI systems responsibly and effectively.

5. CONCLUSION

To sum up, this multidisciplinary bibliometric review offers a thorough examination of the mutually beneficial interaction between artificial intelligence and business intelligence. The various facets of study are revealed by thematic clusters, which also mirror how the BI-AI ecosystem is dynamic and ever-changing. The top 10 cited papers highlight important works that have

influenced the conversation and provide useful information for practitioners and scholars alike. An examination of the literature's key themes using keyword analysis highlights the revolutionary potential of artificial intelligence, sustainable business strategies, and ethical considerations. These components' cross-analysis presents BI-AI integration as a dynamic, complex field with ramifications for various sectors and social contexts. This research establishes the foundation for future investigations, directing more investigation and comprehension of the intricate interactions between these two domains as BI and AI continue to develop. In the end, the results help to advance understanding and promote wise choices in the quickly evolving field of BI-AI integration.

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