The Rise of the Machines?

A Look at AI in Journalism Through Bibliometrics and Content Analysis

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This paper presents a comprehensive bibliometric review of the development of artificial intelligence (AI) in journalism based on the analysis of 331 articles indexed in the Scopus database between 2019 and 2023. This research combines bibliometric approaches and quantitative content analysis to provide an in-depth conceptual and structural overview of the field. In addition to descriptive measures, co-citation and co-word analyses are also presented to reveal patterns and trends in AI- and journalism-related research. The results show a significant increase in the number of articles published each year, with the largest contributions coming from the United States, Spain, and the United Kingdom, serving as the most productive countries. Terms such as "fake news", "algorithms", and "automated journalism" frequently appear in the reviewed articles, reflecting the main topics of concern in this field. Furthermore, ethical aspects of journalism were highlighted in every discussion, indicating a new paradigm that needs to be considered for the future development of journalism studies and professionalism.

Keywords: Artificial Intelligence; Journalism; Bibliometric; News; Scopus

1. Introduction

The role of quality journalism in providing accurate and reliable information to the public cannot be underestimated. Journalism plays an important role in democracy by acting as a watchdog and holding those in power accountable. By reporting on important issues, exposing corruption or wrongdoing, and providing analysis and context, journalists help citizens make informed decisions about their communities and the wider world. Journalists have a responsibility to report news that is based on verified facts and presents a balanced view of events (Cobley and Schulz 2013; Martínez García and Capoano 2023; Karlsson and Clerwall 2019; McQuail 2010).

Journalists must strive for accuracy, objectivity, and clarity in their

reporting. This is important to maintain media credibility and build trust with the audience. In a world where misinformation and fake news spread easily through social media and other online means, quality journalism is becoming increasingly important (Martínez García and Capoano 2023; Kovach and Rosenstiel 2021; Putri and Sonni 2023). Misinformation is generally unintentional, arising from inaccuracies or mistakes, while disinformation involves the deliberate intention to deceive by spreading false information (Di Domenico et al. 2021; Ireton and Posetti 2018). The difference between the two lies in the intention of the creator, with misinformation stemming from honest mistakes and disinformation being information that is strategically manipulated and spread to cause harm or deceive (Das and Ahmed 2022).

Responsible media organisations must ensure that their news is accurate, reliable, and unbiased (Trattner et al. 2022). To achieve this, responsible media entities can utilise advanced media technologies in a responsible manner. By leveraging these technologies, media organisations can personalise content to meet the specific needs and preferences of their audience while minimising negative effects. This approach can help traditional media organisations maintain their competitive advantage and strengthen their reputations as reliable sources of information.

Artificial intelligence is becoming an increasingly important tool in various industries, including the field of journalism. In recent years, the news media has been greatly dis- rupted by the potential of technology-based approaches to the creation, production, and distribution of news products and services. In a study conducted by de-Lima-Santos and Ceron, it was found that artificial intelligence has emerged as a very effective tool that can assist society in overcoming the challenges faced by the news industry (de-Lima-Santos and Ceron 2022).

Can a computer programme write compelling news? According to Reuters′ latest Technology Trends and Predictions report, 78% of 200 digital leaders, editors, and CEOs surveyed said that investing in artificial intelligence technology would help secure the future of journalism (Newman 2019). The survey results highlighted provide insight into the growing public awareness and adoption of AI-powered chatbots like ChatGPT in the context of journalism and publishing. The finding that 65% of UK adults have heard of at least one major chatbot points to the increasing mainstream visibility of these tools. ChatGPT′s recognition figure stands at 59%, suggesting it has emerged as the current leading platform in this space (Newman 2024). Artificial intelligence is becoming an increasingly important tool in various industries, including the field of journalism. Recent studies on artificial intelligence in journalism have highlighted its significant impact on the creation, production, and distribution of news products and services. As the world of journalism continues to evolve, technological advances have played an important role in shaping its landscape

(Horska 2020).

The media industry has undergone major changes due to technological advancements. The shift from analogue to digital media has changed the way media content is created, disseminated, and used. Digital platforms make it easier to produce, store, and share content (Küng 2024).

Likewise, the widespread use of the internet and mobile devices has changed the way people access and enjoy media. Streaming services, social media, and mobile apps are becoming popular channels for content distribution and consumption (Doyle 2013). Moreover, technology also allows media companies to collect data on user preferences and behaviour so as to provide personalized content recommendations and targeted advertising (Napoli 2011).

The increasing use of algorithms and artificial intelligence in news production and distribution has raised concerns about the potential for bias and a lack of human oversight (Diakopoulos 2019). The spread of misinformation and fake news on digital platforms has also posed a significant challenge regarding the credibility of and trust in journalism (Lazer et al. 2018).

Despite these challenges, technological disruption has also created new opportunities for journalism, such as the ability to reach global audiences, engage with readers in real- time, and experiment with innovative forms of storytelling (Witschge et al. 2016). As the journalism industry continues to evolve in response to technological change, it will be crucial for news organizations to adapt and innovate.

The adoption of AI in journalism still faces challenges such as competition for talent and ethical issues around automated storytelling. Moreover, the integration of artificial intelligence in journalism raises important ethical issues regarding accuracy, fairness, and transparency in reporting (Grzybowski et al. 2024; Kieslich et al. 2022). Today, digital media has intensified news dissemination in manifold ways. The influx of digital media has revolutionised news dissemination (Holt et al. 2019), with artificial intelligence playing an important role in this transformation. While AI has shown significant potential in experimental studies, especially in scientific and technological fields, its application in jour- nalism is not without its challenges. Competition for talent and ethical issues surrounding automated news generation are some of the hurdles AI faces in journalism.

As the use of AI in news media becomes more prevalent, fostering digital literacy and algorithmic awareness among journalists and audiences is crucial. News organisations should prioritise educating staff and the public about the capabilities and limitations of AI technologies, empowering them to critically assess AI-generated content and understand the implications of algorithmic decision-making (Ozmen Garibay et al. 2023). By promoting algorithmic literacy, news organisations can facilitate informed and intelligent interactions with AI-driven news products and services.

In facing the ethical challenges of AI integration, news organisations have a responsi- bility to uphold the principles of journalistic integrity, transparency, and accountability. By integrating human judgement, addressing biases in AI algorithms, prioritising data privacy, and promoting algorithmic literacy, the journalism industry can harness the potential of AI in a rigorous and ethical manner (Silberg and Manyika 2019). This approach ensures that AI serves as a tool for advancing the quality and depth of news reporting while preserving the fundamental values of journalism in the digital age.

The integration of artificial intelligence (AI) in journalism has emerged as a significant area of research, with many studies exploring its impact on the creation, production, and distribution of news products and services. Bibliometric analysis, a quantitative approach to assessing research trends and impacts, offers valuable insights into the current state of AI research in journalism and identifies opportunities for further exploration. By uncovering salient research trends, mapping the intellectual structure of the field, evaluating the impact of specific contributions, identifying knowledge gaps, and facilitating evidence-based decision-making, bibliometric analysis plays an important role in shaping the future of news media in the digital age. As the journalism industry navigates the challenges and opportunities presented by AI technologies, insights gained from bibliometric analysis will guide resource allocation, strategic planning, and policy development, ensuring that AI investments are aligned with the needs and priorities of the journalism industry.

2.   Materials and Methods

In this research, we use bibliometric methods to analyse the development of scholarly works on artificial intelligence in journalism. The corresponding methodology involved the categorisation and classification of articles based on various criteria, such as year of publication, journal source, and author affiliations. This classification process facilitates a comprehensive understanding of the temporal and institutional distribution of scholarly work on artificial intelligence in journalism.

Overall, the applied methodology includes a systematic and rigorous approach to analysing and evaluating the development of scholarly works on artificial intelligence in journalism, providing a foundation for the findings and subsequent discussions in this research study.

The cited researcher used bibliometric analysis to examine relevant articles on artificial intelligence in journalism (Moed 2009). This study collected data from the Scopus database, specifically selecting articles published between 2019 and 2023. The Scopus database was chosen as the data source for this study because it is considered one of the most complete and up-to-date databases used in scientific research.

A complete and rigorous search was performed using the keywords

"Artificial In- telligence", "AI", "Artificial Intelligence (AI)", "Journalism", "News", and "Media", as well as Boolean operators, i.e., logical operators that connect words to expand or narrow search results, such as "and". Articles that met the inclusion criteria set for this study were selected, including research articles published in social sciences journals. The aim was to provide an evolutionary overview of the subject.

Bibliometric analysis is a method used to measure and analyse the trends, patterns, and impact of research in a particular field through scientific publications. In the context of this research, bibliometric analysis was conducted on journal articles published and indexed in the Scopus database with the keywords "artificial intelligence", "ai", "Artificial Intelligence (AI)", "journalism", "news", and "mass media". Restrictions were made, with only English-language articles, content from social science fields, and research published within the 2019–2023 timeframe being selected.

Data were extracted according to the possibilities in Scopus, and descriptive data on the articles were recorded, such as title, authorship, journal, year of publication, keywords, abstract, abstracts, citations received, academic affiliation and research funding, etc. With the data extracted from Scopus, two databases were created: one in Excel format for quantitative content analysis and another in CSV format (a file that divides values by commas) to perform bibliometric analysis with VOSviewer Version 1.6.20.

After collecting and combining the relevant articles, the next step was data analysis using bibliometric analysis software, specifically the VOSviewer application. VOSviewer is a commonly used tool for visualising and analysing bibliometric networks (Mejia et al. 2021). This software allows researchers to perform co-citation analysis, co-authorship analysis, and keyword co-occurrence analysis to identify the most influential articles, authors, and keywords in the field of artificial intelligence in journalism.

This research study, involving a bibliometric analysis of the development of scholarly works on artificial intelligence in journalism, uses a systematic methodology. The findings from the bibliometric analysis shed light on significant trends and patterns in scholarly works relating to artificial intelligence in journalism. This detailed analysis provides valuable insights into the evolving landscape of artificial intelligence in journalism and the key contributors to its development (Wang 2021).

3.   Results

Based on data obtained from the Scopus Document Search, 331 articles were found. Each year shows a significant upward trend (Figure 1). In 2019, there were 41 articles published, while in 2023, the number of articles increased dramatically to 122 articles. This increase indicates that interest and research related to the application of Artificial Intelligence (AI) in the fields of

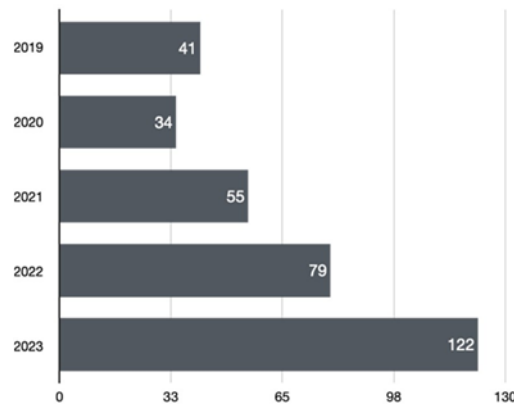journalism, news, and media are increasing every year.

Figure 1. Article distribution for the 2019–2023 period.

Table 1. Country-based distribution of articles' authors and citations (>5).

Country	Documents	Citations
United States	82	1729
Spain	46	534
United Kingdom	33	881
India	22	84
China	21	160
Netherlands	19	454
Canada	14	278
Brazil	13	118
Germany	13	119
South Korea	11	85
Australia	10	213
Switzerland	10	80
United Arab Emirates	10	691
Italy	9	33
Norway	9	30
Taiwan	9	181
Saudi Arabia	8	56
Singapore	7	169
Austria	6	27
Portugal	6	26
Russian federation	6	4

The United States has the highest number of documents (82) and citations (1729) in the dataset, indicating a strong presence in AI journalism research. Other countries with significant numbers of documents and citations include the United Kingdom (33 documents, 881 citations), Spain (46 documents, 534 citations), and China (21 documents, 160 citations). Countries such as the Netherlands (19 documents, 454 citations), Canada (14 docu- ments, 278 citations), and Brazil (13 documents, 118 citations) also have prominent research results in this area. Interestingly, the United Arab Emirates has a relatively high number of citations (691) compared to its number of documents (10), indicating the high impact of AI journalism research. Some countries, such as Russia (six documents, 4 citations) and Portugal (six documents, 26

citations), have a lower research output in this area based on the available data (Table 1). Publishers who publish articles are quite diverse, there are 12 publishers, the majority of which are reputable publishers (Table 2).

Table 2. Number of published articles from publishers (>5).

Publisher	Articles
Routledge	58
SAGE Publications Inc.	37
Elsevier	21
Springer	18
Multidisciplinary Digital Publishing Institute (MDPI)	17
Emerald Publishing	11
Taylor and Francis	11
Institute of Electrical and Electronics Engineers Inc.	9
Association for Computing Machinery	6
CEU Ediciones	6
El Profesional de la Informacion	6
Oxford University Press	6

Table 3. The 10 most cited articles.

Document	Citations	Links
The effects of explainability and causability on perception, trust, and acceptance: Implications for explainable AI (Shin 2021)	398	0
Fake news detection: A hybrid CNN-RNN based deep learning approach (Nasir et al. 2021)	310	0
Deepfakes and Disinformation: Exploring the Impact of Synthetic Political Video on Deception, Uncertainty, and Trust in News (Vaccari and Chadwick 2020)	259	0
Ethical Implications and Accountability of Algorithms (Martin 2019)	242	0
Collaborating with ChatGPT: Considering the Implications of Generative Artificial Intelligence for Journalism and Media Education (Pavlik 2023)	226	1
On the Democratic Role of News Recommenders (Helberger 2019)	172	10
War of the chatbots: Bard, Bing Chat, ChatGPT, Ernie and beyond. The new AI gold rush and its impact on higher education (Rudolph et al. 2023)	159	0
An incentive-aware blockchain-based solution for internet of fake media things (Chen et al. 2020)	127	0
Strategizing in a digital world: Overcoming cognitive barriers, reconfiguring routines and introducing new organizational forms (Volberda et al. 2021)	122	0
Automation, Journalism, and Human–Machine Communication: Rethinking Roles and Relationships of Humans and Machines in News (Lewis et al. 2019)	119	0

3.1. Citation Analysis

Of the 331 articles on Artificial Intelligence in journalism, there were 10 articles

that were the most cited. This indicates that these articles have significant impact and influence in the related research field. Only 1 of the 10 articles, "On the Democratic Role of News Recommenders" (Helberger 2019), is linked to or cited by other articles in this study (Table 3). Meanwhile, the other 8 of the 10 most cited articles do not have links or are not cited by other articles in this study.

- Other heavily cited articles may have links or citations from articles outside the scope of this study.
- There may be limitations in the data collection process or methodology used, so links or citations between articles may not be identified.
- The articles may be pioneering or discourse-opening writings in the field of AI and journalism, so they are widely cited as primary references but have not been developed or cited in other articles studied.

To understand this situation more deeply, further analysis of the content of the articles, the research methodology used, and the context of publication and research developments in the field of AI and journalism is required.

Table 4. Keyword clusters and frequency of occurrence (>5).

Cluster 1		Cluster 2		Cluster 3		Cluster 4	
Keyword	N*	Keyword	N*	Keyword	N*	Keyword	N*
artificial intelligence	181	fake news	47	automated journalism	17	journalism	38
algorithms	23	social media	23	ChatGPT	8	media	11
automation	16	disinformation	20	ethics	8	technology	11
big data	10	machine learning	20	robot journalism	8	data journalism	10
bots	7	misinformation	20	chatbots	7	fact-checking	9
news production	7	natural language processing	11	computational journalism	7	news	8
communication	6	deep learning	10	trust	6	innovation	7
content analysis	6	COVID-19	9	algorithmic journalism	5		
news media	6	deepfake	8	education	5		
newsrooms	6	Twitter	7	higher education	5		
Democracy	5	social networking (Online	6	human–machine communication	5		
Public opinion	5	feature extraction	5				
Robotics	5						

* Occurrence.

3.2. Keyword Analysis

Identifying the most frequently used keywords in the articles can give an idea of the specific topics that are widely researched. From the 331 articles processed using the vosviewer application with a minimum occurrence rate of 5 (Table 4), 43 keywords were obtained that were interconnected and formed a network. The network was formed from four clusters: cluster 1 has 13 keywords, with the most occurrences of artificial intelligence, amounting to 181; cluster 2 has 12 keywords, with the most occurrences of fake news, amounting to 47; cluster 3

has 11 keywords, with the most occurrences of automated journalism, amounting to 17; and cluster 4 has 7 keywords, with the most occurrences of journalism, amounting to 38 keywords.

4.   Discussion

Basically, the development of journalism always goes hand in hand with the devel- opment of information technology. This can be seen from the evolution of print media into online media as well as the use of social media as a means of disseminating news. Information technology has enabled journalists to search, collect, and present information more quickly and efficiently.

One of the main impacts of the development of information technology in journalism is the creation of a faster, wider, and more open information environment. This provides opportunities for the public to obtain news in real time and enables active participation in the journalism process.

However, this development also brings new challenges to the journalism industry, such as the spread of fake news or hoaxes, as well as changes in the media business model (Pavlik 2023). Therefore, it is important for journalists and media stakeholders to continuously adapt to the ever-changing developments in information technology. The development of information technology also allows for the diversification of news presentation, featuring multimedia formats such as video, audio, and infographics. This not only enriches the reader's experience but also provides freedom of expression for journalists in delivering information (Deuze 2004).

In addition, information technology also plays an important role in increasing accessi- bility to information. Thanks to the internet, one can access news from various sources and viewpoints, allowing for a more comprehensive understanding of an issue.

However, journalists also need to improve their understanding of ethics in regard to the use of information technology, especially in relation to data privacy and security. The skills to sort and verify information are also becoming more important in an era where information can be easily processed and edited (Díaz-Campo and Segado-Boj 2015).

In the study of journalism today, we see significant developments as information technology advances. Artificial Intelligence (AI) is one of the factors that greatly influences the way information is produced; the accuracy, trustworthiness, and understanding of journalism has changed drastically.

Based on bibliometric analysis, it can be seen that studies on journalism and infor- mation technology still do not have a wide distribution. Developed countries with a high level of information technology development are the dominant topics in studies in this field (Figure 2). The use of keywords in this study indicates the existence of several new paradigms in journalism studies that are strongly influenced by technology (Figure 3). Some of the new
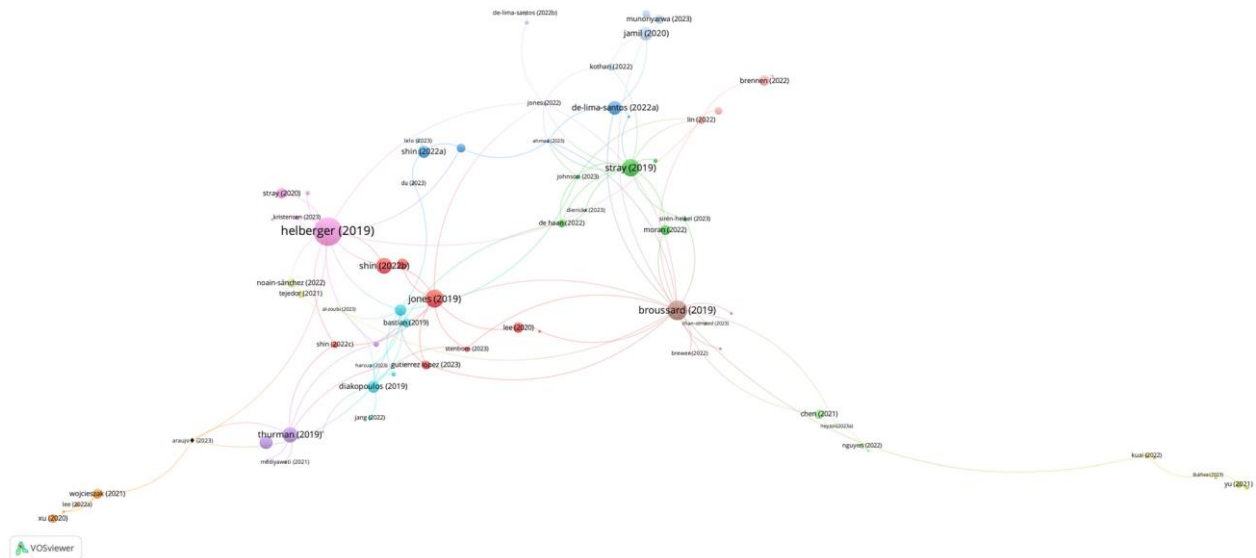
paradigms that have emerged are shown below.
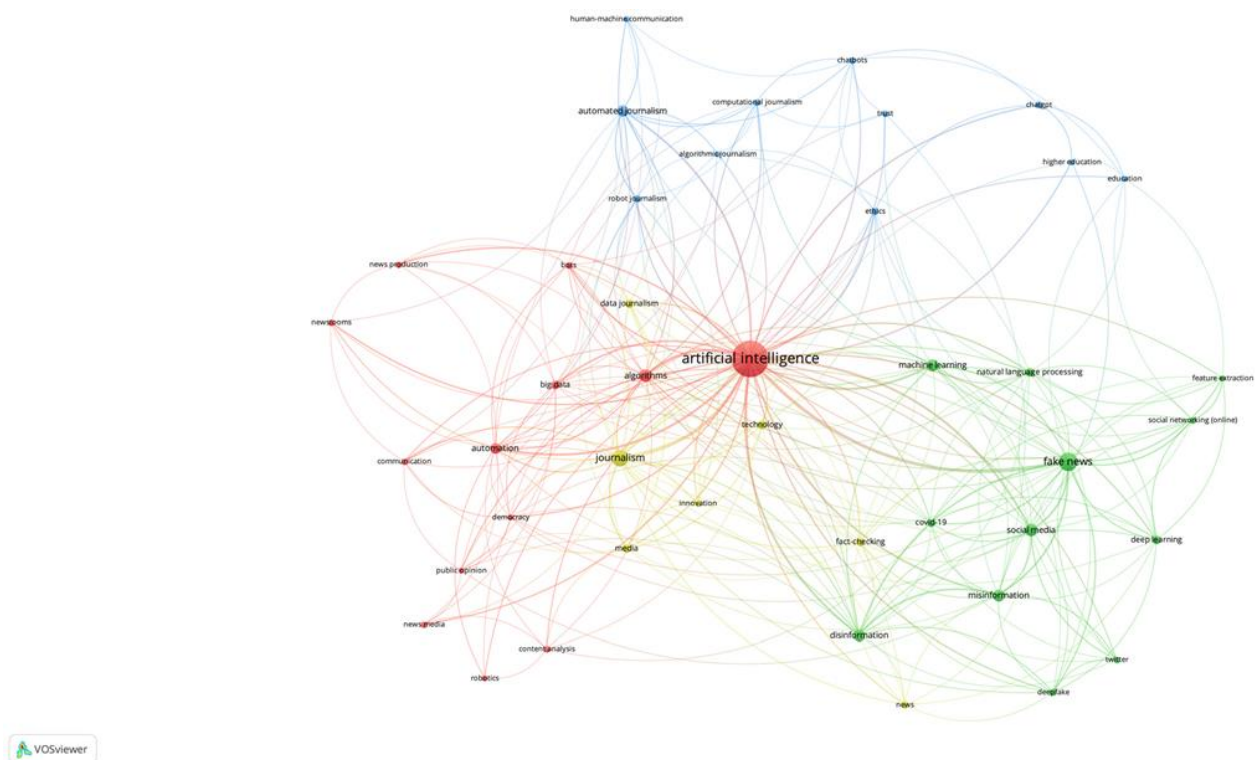

Figure 2. Visual citation analysis.

Figure 3. Visual occurrence analysis.

4.1.   Fake News

The term fake news is used to describe false or misleading information presented as news. Fake news can take the form of fabricated stories, manipulated images or videos, or deliberately misleading headlines. The spread of fake news has become a major concern in today's digital age, as it can have serious impacts on public opinion and decision-making. It is important for

individuals to critically evaluate the source and validity of the news they encounter and rely on trusted and reputable news sources for information. Efforts are being made by various organisations and platforms to combat the spread of fake news and educate the public about media literacy. Fake news is intentionally false or misleading information presented as news. Fake news is designed to deceive readers and manipulate public opinion (Weikmann and Lecheler 2023).

Fake news has become a rampant issue in today's media landscape, posing a significant threat to the integrity of journalism. The spread of misinformation and disinformation has the potential to erode public trust in the media and undermine the important role of journalism in a democratic society.

One of the main challenges in combating fake news is the ease and speed at which it spreads through digital platforms and social media. Without robust fact-checking and verification processes, false information can quickly spread and influence public opinion. In addition, the monetisation of clickbait and sensational content creates perverse incentives to create and amplify fake news.

Journalism, as a profession dedicated to reporting the truth, faces the daunting task of regaining public trust and combating the spread of fake news. This requires a multi-faceted approach that involves promoting media literacy, strengthening editorial standards, and holding the spreaders of fake news accountable.

To address these issues, journalists and media organisations must prioritise trans- parency, accuracy, and ethical reporting practices. By upholding these principles, journalism can serve as a bulwark against the spread of fake news and continue to fulfil its important role in informing the public and fostering an informed society (Kovach and Rosenstiel 2021).

4.2. Algorithms

Algorithms have undeniably revolutionised journalism in the age of Artificial Intelli- gence. With the ability to parse large amounts of data at an incredible speed, algorithms have become an essential tool for journalists in gathering and analysing information. These technological advancements have enabled news organisations to deliver more person- alised content to their audiences and conduct in-depth investigative reporting. However, as algorithms play a greater role in determining the content that will be shown to audi- ences, concerns about algorithmic bias and potential misinformation have also surfaced (de-Lima-Santos and Ceron 2022).

In addition to aiding news gathering, AI-powered algorithms have also facilitated automated content creation, natural language processing for real-time language translation, and the identification of patterns and trends in data sets. As AI evolves, it is imperative for journalists to critically assess the impact of this technology on the integrity and quality of journalism and utilise its potential

to enhance storytelling and audience engagement (Kotenidis and Veglis 2021).

Algorithms not only automate news production but also make it faster and cheaper, and they potentially make fewer errors than human journalists (Graefe 2016). This raises concerns about the future of work in the newsroom.

4.3.   Automated Journalism

In recent years, the increasing role of AI in news media has sparked heated debates. Some argue that AI technology can improve the efficiency and productivity of journalism, while others express concern about the potential impact on news quality and authenticity (Wang et al. 2021). One of the key areas where AI is making an impact is in automated news generation. By utilising natural language generation algorithms, AI systems can now generate simple news articles, earnings reports, and sports summaries.

The application of AI in newsrooms has also raised questions about potential job losses for human journalists. While AI can handle routine reporting and data analysis, human journalists are essential for complex investigative reporting, critical analysis, and ethical decision-making (de-Lima-Santos and Ceron 2022). Therefore, the future of journalism may depend on a harmonious balance between AI automation and human expertise.

As AI evolves, news media organisations must adapt and evolve their practices to harness the benefits of AI while upholding journalistic integrity and accuracy. In addition, ethical considerations related to the use of AI in news reporting, including with respect to issues of bias and transparency, need to be carefully addressed to maintain audience trust (Dörr and Hollnbuchner 2017).

5.   Conclusions

The application of bibliometric analysis in the study of artificial intelligence in jour- nalism provides valuable insights into the evolution of the dynamic intersection between technology and media. Through the analysis of citation patterns, collaboration networks, and keyword trends, researchers can gain a comprehensive understanding of the growth of research, key contributors, and the most influential publications in the field. This method not only identifies emerging trends and areas to be explored in the future but also informs academic research, publication strategies, industry practices, and policy decisions. By keep- ing up with the latest developments and incorporating insights from bibliometric analyses into broader discussions, stakeholders can ensure that technological advancements are in line with the broader interests of journalism and media. Overall, bibliometric analyses play an important role in advancing the understanding of artificial intelligence in journalism and driving innovation in this field.

While this bibliometric analysis provides valuable insights into the

current state of research on artificial intelligence in journalism, there are several promising avenues for future research that could further contribute to our understanding of this rapidly evolving field. Another promising area for future research is the impact of AI on the changing roles and skills of journalists. As AI takes on more tasks traditionally performed by human journalists, such as data analysis, content generation, and fact-checking, the nature of journalistic work is likely to evolve. Researchers could study how journalists' roles and required skills are changing in response to AI and propose new models for journalism edu- cation and professional development that prepare journalists to work effectively alongside AI technologies.

Additionally, future research could explore the potential of AI to enhance and trans- form journalistic practices in new and innovative ways. Researchers could also study how AI could be leveraged to promote greater diversity and inclusion in news cover- age by identifying and mitigating biases in AI algorithms and enabling the surfacing of underrepresented perspectives.

Finally, future research could contribute to the development of new tools and plat- forms for AI-powered journalism. Researchers could work with industry partners to design and test new AI technologies specifically tailored to the needs of journalists and news organizations, such as tools for automated fact-checking, content moderation, and audience engagement.

The application of bibliometric analysis in the study of artificial intelligence in jour- nalism provides valuable insights into the evolution of the dynamic intersection between technology and media. Through the analysis of citation patterns, collaboration networks, and keyword trends, researchers can gain a comprehensive understanding of the growth of research, key contributors, and the most influential publications in this field.

By keeping up with the latest developments and incorporating insights from bib- liometric analyses into broader discussions, stakeholders can ensure that technological advancements are in line with the broader interests of journalism and media. Furthermore, by pursuing promising avenues for future research, such as developing ethical frameworks, studying the changing roles of journalists, exploring innovative applications of AI, and contributing to the development of new AI-powered tools and platforms, scholars can continue to make valuable contributions to this important and rapidly evolving field.

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