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Diamonds in the data mine: A bibliometric analysis of the use of artificial intelligence in retailing, ethics, and future research directions.

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Abstract

Purpose: This study presents a state-of-the-art systematic review of the evolution and structure of empirical research on the use of artificial intelligence (AI) in retail and offers recommendations for how AI research contributes to this field, including the current prospective context and implications for future knowledge management. It is based on 1382 articles that were published between 2012 and April 2022 in top journals.

Study design/methodology/approach: Making use of the Scopus database and a variant of the traditional Systematic Literature Network Analysis and a six-step review protocol, research articles on the use of AI in retail were extracted and analysed to uncover this topic's intellectual development and key themes through a mixed-methods approach of quantitative bibliometric and qualitative content analyses. The bibliometric analysis allowed for scholarly analysis and visualisation of the usage of AI in retail research.

Findings: The findings highlight several implications for theory and management as well as avenues for future research directions. The analysis indicates an increase in smart retailing and AI literature during the last few years. However, none of these studies has systematically addressed the ethical challenges regarding the use of AI in retail. The area of research is fragmented in scope and has relevant gaps. The main research themes were identified as sentiment analysis, trust, personalization, and optimisation. It also recognises the United States and China as leaders in this field of study.

Research limitations/implications: The final sample for this study was selected based on articles ranked 3 or above on the Academic Journal Guide 2021 and published before April 7, 2022. Therefore, articles published after this date have not been included, nor have journals that were either ranked 1 or 2 on the Academic Journal Guide 2021 or not listed at all. However, the contribution of this study remains relevant to the body of knowledge on the use of AI in retail.

Originality/value: This study makes a significant contribution and provides a systematic exploration of the extent to which academics and other stakeholders are aware of the ethical challenges when implementing AI in retail. To the best of the authors' knowledge, this paper is the first to attempt to synthesise AI ethics in the field of retail. It provides academics with suggestions about how to move further in this field of research. It provides practitioners with a well-organised resource for learning how AI may help them with their smart retail endeavours.

Keywords: AI in retail; Bibliometric analysis; Literature review; Artificial intelligence; Ethical issues; AI ethics in retail; smart retailing.

1. Introduction

A substantial and ever-growing body of literature has indicated that today's dynamic, hyper-connected business environment demands that businesses utilise strategies, tactics, and technologies that allow them to obtain a significant advantage over their rivals (Verhoef *et al.*, 2021). For some years now, the retail industry has been undergoing a digital transition (Guha *et al.*, 2021; Cheng *et al.*, 2022). The integration of advanced data and predictive analytics tools is helping retailers make business decisions that are based on data, which has led to better speed, efficiency, and accuracy across every branch in the retail industry as a whole (Vrontis, Thrassou and Amirkhanpour, 2017; Shankar, 2018; Guha *et al.*, 2021; Loureiro, Guerreiro and Tussyadiah, 2021), despite discourse in some quarters regarding the persistent and highly contested issue surrounding its ethical implications (Martin and Palmatier, 2020; Martin *et al.*, 2020). Technological innovations such as artificial intelligence (hereinafter referred to as AI), the Internet of Things (IoT), and big data analytics (BDA) have influenced how retailers attract, interact with, and retain consumers in a very competitive market (Aguirre *et al.*, 2015; Rangaswamy *et al.*, 2020; Ameen *et al.*, 2021; König, Hein and Nimsgern, 2022). Indeed, theorists and leading industry players have widely acknowledged that the adoption of AI is revolutionising retail business processes, including how retailers engage with their consumers (Vrontis, Thrassou and Amirkhanpour, 2017; Guha *et al.*, 2021).

The term "artificial intelligence," as a linguistic concept, was initially introduced in 1956, and as a field of study, it refers to a scientific field that sought to conceptualise and simulate intelligent behaviour using computational processes (Gînguță *et al.*, 2023). Based on extant literature AI can be defined as a software application that is specifically designed to demonstrate intelligent behaviour by constantly analysing its surroundings and executing suitable actions to achieve its intended goals (Shankar, 2018; Guha *et al.*, 2021; Shankar *et al.*, 2021).

The number of effective AI-based applications in retail is steadily rising (Shankar, 2018; Guha *et al.*, 2021; Chen, 2022). Robotic process automation (RPA), the Internet of Things (IoT), virtual/augmented reality (VR/AR), and robotic and autonomous vehicles (RAVS) are all having a big impact (both positive and negative) on retail (Wedel, Bigné and Zhang, 2020; Mostaghel *et al.*, 2022). AI is distinct from human intelligence; in that it is predicated on rapid data processing. Intelligence may be broadly described in artificial intelligence as the capacity to interpret and turn input into information in order to inform goal-directed behaviour (Ameen *et al.*, 2021; Verhoef *et al.*, 2021). More specifically, AI refers to "computational agents that act intelligently" (Ameen *et al.*, 2021), which are supposed to be able to mimic human abilities while outperforming them in

terms of accuracy (Dwivedi *et al.*, 2021). This is done by modelling biological and natural intelligence using a collection of computational models (Ameen *et al.*, 2021), which has raised some ethical concerns (Martin *et al.*, 2020; Wedel, Bigné and Zhang, 2020).

Research has shown that the adoption of AI by retailers like Amazon and Zara can increase their profits, thus enhancing their in-store sales, online sales, and supply chain efficiency (Roe *et al.*, 2022). As a result, many retailers are interested in AI technologies because they have the potential to boost in-store sales, online sales, and possible cross selling opportunities, as well as improve the supply chain and retail operations (Shankar *et al.*, 2021; Mostaghel *et al.*, 2022). This view is also shared by Shankar (2018), who argues that AI improves omnichannel and shopping profitability by sharpening customised suggestions across several areas, including in-store experience management, payments, customer service, logistics, and inventory optimization. Contrarily, the costs associated with AI, the issues of reorganising human resources to accommodate such technologies, as well as the public's perception of how machines and algorithms handle the vast amounts of personal data collected by businesses, pose major challenges for retailers, and require appropriate action in the context of risk management (Kozinets and Gretzel, 2020; Kopalle *et al.*, 2021).

Growing evidence has indicated that businesses, including retailers and consumers, are responding to the increasing attractiveness of "smart lifestyles". The retail industry, in particular, has rapidly adopted "smart retailing" as a business strategy. There has been a lot of talk and study recently about "smart retailing," which is when businesses use AI enabled technology and digital platforms such as mobile apps and chatbots to connect with consumers, transact business and interact with them (Priporas, Stylos and Fotiadis, 2017; Du *et al.*, 2022). However, although these cutting-edge technologies create a unique retail experience, not much is known about the influence of AI traits and features on consumer behaviour (Martin and Palmatier, 2020; Guha *et al.*, 2021; Loureiro, Guerreiro and Tussyadiah, 2021). Researchers argue that further study is needed to show causal linkages between AI features and smart retail technology engagement (Okazaki *et al.*, 2020; Kopalle *et al.*, 2021; Roe *et al.*, 2022). Davenport *et al.* (2020) agrees that the field's lack of understanding of how AI affects consumer perceptions and engagement is a major concern and contend that the influences of AI may be more. They contend that the influence of AI may be more circumscribed than popular media suggests. As a result, more research is needed to work out how AI adoption affects consumer attitudes and behaviour, as well as how much benefit and challenge AI adoption has for smart retailers (Davenport *et al.*, 2020; Okazaki *et al.*, 2020; Kopalle *et al.*, 2021; Shankar *et al.*, 2021; Roe *et al.*, 2022).

Given the above, it is undeniable that there will be winners and losers in the future as a direct result of the use of AI in retail on consumers, business operations and processes from its evolution, and that decision-makers must be strategic in their vision for the future. This study attempts to fill that research gap through a systematic literature review on AI in smart retailing research domain including emerging challenges, opportunities and agenda or research and practice. In addition, the study will seek to answer the following research questions:

1. What are the bibliometric trends (performance) of the use of AI in retail research?
2. What are the trending topics and future research directions for the use of artificial intelligence in retail?

The remaining sections of this article are organised as follows, a review of the literature, a description of the research methodology, findings, a discussion of the findings, and a conclusion.

2. Literature review

Research on the digital transformation, including technological advancement in retail, has been at a considerably frenetic pace (Vlačić *et al.*, 2021; Saha and Sahney, 2022), with scholars seeking to understand how technology improvements affect business processes and knowledge potential when it comes to the management of consumer demands, including providing products and services (Kumar *et al.*, 2019). There are prior studies that evaluate the effects and implementation of various technologies on retail performance that abound in the current body of research. However, research at the confluence of Artificial Intelligence (AI) and retail has just recently gotten increased attention, with recent calls for research promoting deeper examination of AI-related subjects and their roles in retail (Davenport *et al.*, 2020; Kopalle *et al.*, 2021; Verma *et al.*, 2021; Vlačić *et al.*, 2021). The main characteristic of emerging technologies such as AI integrated into retail is interactivity. These technologies provide consumers with the ability to engage with products, services, and retailers both online and offline (Davenport *et al.*, 2020; Shankar *et al.*, 2021; Yi and Oh, 2022). The evolving retail sector is currently based on a new covenant of data-driven retail experiences and elevated consumer expectations. However, delivering a meaningful and personalised consumer experience at scale is a challenging mission for retailers (Luo *et al.*, 2019; Adapa *et al.*, 2020; Grewal, Guha, *et al.*, 2021).

As digital and physical shopping channels merge, businesses that can reinvent their retail channels will distinguish themselves as industry leaders, because the impact of AI on retail is expected to be significant (Grewal, Roggeveen and Nordfält, 2017; Guha *et al.*, 2021).

Today's reality is unlikely to be the same as tomorrow's, from consumer behaviour and market trends to competitive dynamics and the economic outlook (Chopdar *et al.*, 2022). Factory closures, overburdened supply chains, sourcing shortages, and even harsh weather conditions are all issues that retailers are dealing with. This is the nature of modern retailing, and it will continue to be so in the future.

Given this dilemma, emerging technologies such as AI have become a strategic imperative for retailers if they are to remain relevant and profitable (Sajeesh, Singh and Bhardwaj, 2021). Smart technology and advanced analytics will play a big role in the future of retail. This will allow retailers to change their operating models and economics to meet changing consumer expectations (Bonfrer, Chintagunta and Dhar, 2022).

2.1 Theoretical underpinning and recent debate on AI in retailing

Retail is significant because it integrates the demands of consumers with the specialised offerings of manufacturers (Reinartz, Wiegand and Imschloss, 2019). The provision of a product or service to consumers is a component of the value chain, and the primary responsibilities of retailing are direct consumer interaction, product diversity, and the actual flow of commercial goods. Digital and physical (brick-and-mortar) retail have become inextricably linked, with touch points no longer acting as barriers but rather collaborating in a ubiquitous capacity aided by technology (Grewal, Roggeveen and Nordfält, 2017; Davenport *et al.*, 2020). Despite these positive developments, experts remain concerned about moral issues, arguing that their primary motivations are geopolitical and economic competitiveness, and that moral considerations like consumer privacy have been pushed to the sidelines, posing governance concerns in the process (Martin *et al.*, 2020; Rainie, Anderson and Vogels, 2021). While bricks-and-mortar retailing continues to benefit the value chain, emerging digital technologies such as AI have revolutionised markets into multi-channel structures by limiting physical merchandising, undermining the traditional retail business model, and dramatically influencing consumer experience and behaviour (Aydinli *et al.*, 2021; Grewal, Gauri, *et al.*, 2021). Given AI's potential for ubiquity and power, experts argue that its deployment should be rigorously regulated. However, there is not

much agreement on how this should be done or who should set the rules (Pazzanese, 2020; Kim *et al.*, 2022).

AI-based solutions are critical when it comes to developing efficient retail procedures for consumers (Grewal, Gauri, *et al.*, 2021; Cheng *et al.*, 2022). Recent research defines AI-based solutions as systems that can operate intelligently by accurately analysing external inputs and employing these objectives to perform specific activities in a flexible configuration, even to the point of mimicking human behaviours with cognitive, social, and emotional intelligence (di Vaio *et al.*, 2020). Since its inception (Syam and Sharma, 2018), AI's ultimate objective has been to replicate intelligent human behaviour. According to Huang and Rust (2018), AI can be mechanical (e.g., automation), analytical (e.g., propensity modelling), intuitive (e.g., content development), or empathic (e.g., empathy) (i.e., social robotics). According to Davenport *et al.* (2020), business models, sales processes, customer service, and consumer behaviour will all be transformed. To thrive in the digital age, businesses must build a distinct set of innovative digital value propositions that set them apart from established and start-up competition (Grewal, Roggeveen and Nordfält, 2017; Roy *et al.*, 2017; Grewal *et al.*, 2018, 2020).

Technologies vary in features, advantages, and applications. Various studies have analysed various technologies, including self-service technology (Collier and Barnes, 2015; Kimes and Collier, 2015; Reinartz, Wiegand and Imschloss, 2019; Davenport *et al.*, 2020; Shankar *et al.*, 2021). However, the technology implementation strategies of the past will no longer be enough to fully realise current value propositions. New approaches to solutions and talent development are essential given the current pace and size of the transition and the role future technologies such as mobile applications and smartphones, AR/VR (augmented and virtual reality), radio-frequency identification, and the like will play in retail (Ziaie, ShamiZanjani and Manian, 2021), prompting the need for collaboration across technological ecosystems to be successful, which is a change from traditional transactional partnerships (Kopalle *et al.*, 2021; Shankar *et al.*, 2021).

While emerging retail technologies encompass a wide range of technologies, many of them may be classified under the umbrella of AI. Because of the massive amounts of consumer data available across formats (e.g., supermarkets, pharmacies, and warehouses), AI is a useful tool for informing and influencing retail decisions (Ziaie, ShamiZanjani and Manian, 2021; Abedin, 2022). Scholars anticipate that AI will become a dominant force in the retail business as a result of the insights and information it can bring to retailers (Roy *et al.*, 2017; Reinartz, Wiegand and Imschloss, 2019; Adapa *et al.*, 2020; Grewal, Gauri, *et al.*, 2021; Shankar *et al.*, 2021). Recognizing this,

Guha et al. (2021) concentrates on the expanding significance of AI solutions in retail, emphasising the plethora of AI-based solutions available. Voice-activated gadgets like Amazon's Alexa, smart shelves at Kroger that can offer consumers tailored deals, customer-service robots like Pepper, and bots in vee | 24 that can guide consumers along their shopping adventure are just a few examples.

With unpredictable consumer behaviour (leading to noisy and outlier data) and inconsistent institutional data protection policies, the influence of AI on retail is now unquantifiable, especially during the COVID-19 pandemic-induced "new normal" (Ameen *et al.*, 2021; Vlačić *et al.*, 2021). For now, AI-powered retailing tools will rely on greater human-AI interaction (Coldewey, 2018). Thus, more study is needed on how retailers can analyse and predict consumers' behaviour and business activities using AI to innovate and adapt to the new reality (Grewal, Gauri, *et al.*, 2021). Given that AI is data-driven, there is a need for future research to consider how retailers can collect and share data – both old and new – to inform new AI retailing strategies. Furthermore, how can AI-powered retail technologies assist retailers in analysing consumer attitudes, beliefs, and behaviour?

3. Methodology

The methodology section details the two complementary review methods used to conduct this study: a systematic literature review and a bibliometric analysis (Donthu *et al.*, 2021). First, a structured, transparent, and reproducible method was used to identify and select articles for the systematic literature review (Littell, Corcoran and Pillai, 2008). The 6-step strategy for retrieving articles in this study consists of the following steps: Scopus database searches were conducted. The first step was to figure out what keywords and databases to use. The second step was to search for articles in the chosen database. The third step was to remove duplicates. The fourth step was to filter based on titles and keywords; the fifth step was to filter based on abstracts; and the sixth step was to read the full text of the articles, similar to a recent study (Mostaghel *et al.*, 2022).

Second, a complementary bibliometric study was conducted based on the final sample to determine the most influential papers, authors, and journals, as well as significant developments and the use of AI in retail. Based on this mapping, themes were identified as well as future directions for research. Figure 1 shows the process used to identifying and selecting articles, followed by a description.

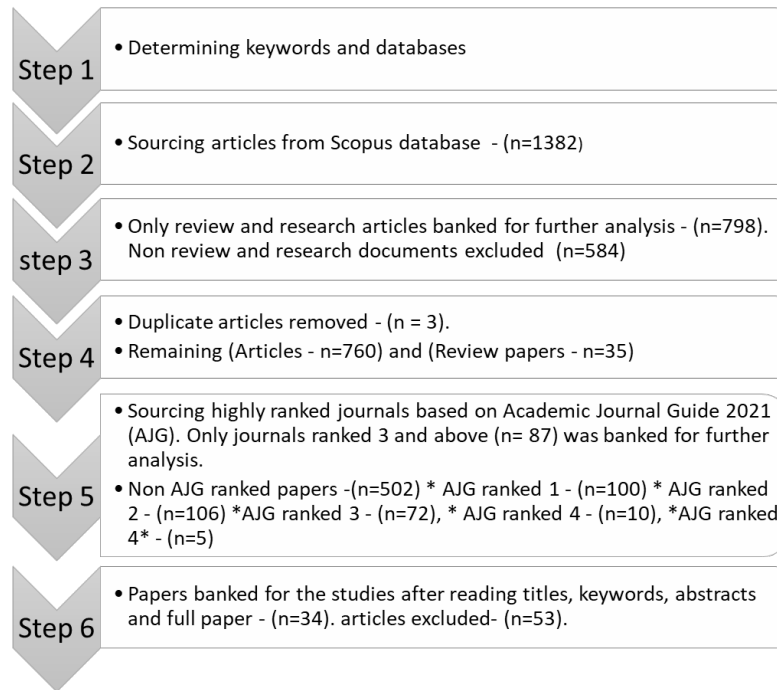


Figure 1 : This diagram depicts the steps adopted for this systematic literature review.

3.1 Data collection

Step 1: To determine the databases and keywords for this study, Boolean operators and wildcards were deployed to encompass all possible combinations and variations of the keywords "artificial intelligence," "big data," including "augmented reality" and "retail" as shown in table 1 below. The Boolean operator "AND" combined the terms and wildcard "*" to retrieve possible variations of the keywords used. For instance, "retail*" returned documents containing the words "retailer" and "retailing." Screening through the initial searches resulted in many documents, confirming that keywords have a general strategic view that embeds more specific terms. For instance, chatbots in retail are part of artificial intelligence in retail business. To reduce research bias, no further specific keywords were included in the search. The chosen strategy has an inadequacy that excludes relevant studies with a very specific focus. In other words, if a potential article does not use any of our chosen general terms, it will be excluded even if it is relevant. This is a limitation of this study that needs to be addressed by future studies. The combination of keywords was searched in the SCOPUS database. The database was carefully selected based on its reliability in indexing highly ranked journals (Mou and Benyoucef, 2021). This method was used, as opposed to the selection of specific journals to avoid potential biases, to exclude relevant and influential articles from the final list of articles.

Table 1: Queries used for the search in the database.

Database	Query
Scopus	1382 - (ALL("Artificial intelligence" OR "air" OR "big data" OR "computer vision" OR "Data analytics" OR "augmented reality" OR "virtual reality") AND TITLE-ABS-KEY("Shop" OR "retail" OR "retail*" OR "ecommerce" OR "e retailing" OR "Online Shopping" OR "retairling") AND TITLE-ABS-KEY(impact)) AND (LIMIT-TO (LANGUAGE, "English"))
Note: Data was retrieved on 7th April 2022	

Step 2: On April 7, 2022, a search was conducted in the Scopus database with additional filters. Table 1 shows the queries used in the database. Additional screening focused on scholarly peer-reviewed journal papers written in English. These were set to ensure article quality (Mou and Benyoucef, 2021). The initial Scopus search yielded almost 1382 studies, which were downloaded (Bibliometric details) and maintained in an excel spreadsheet and Mendeley reference manager. (a) authors; (b) abstracts; (c) addresses; (d) ISSNs/ISBNs; (e) IDS numbers; (f) funding information; (g) PubMed IDs; (h) titles; (j) cited counts; and (k) cited reference counts were exported.

3.2 Data analysis

Step 3: The extracted articles were further analysed. To make sure only high-quality studies were used in the studies, only review and research articles (798) were kept for further study.

Step 4: All duplicate articles (3) were eliminated from the total number of articles, resulting in a total of 795 articles remaining. Thus, there are 760 research articles and 35 review articles for further analysis.

Step 5: As a result of the removal of duplicate articles, the remaining articles were confined to journals listed in the Academic Journal Guide 2021 (formerly the ABS ranking) to ensure the quality of the dataset. This reduced the article count to 795. In another step, a filter was applied to only bank quality papers from journals ranked 3 and above (highly ranked) for further analysis. This resulted in 502 articles that were not ranked by the Academic Journal Guide 2021, as well as articles ranked 1 (100) and 2 (106) being excluded. There were 87 articles that were ranked 3 or above and were banked for further analysis.

Step 6: After screening the titles, keywords, and abstracts as well as reading the full articles of all relevant publications (for example, research on the use of AI in retail), all irrelevant articles were excluded. As a result, a total of 53 articles deemed irrelevant (typically, articles that were on job flow, job scheduling, and non-retail) were excluded. In the end, 34 articles were chosen to make up the final sample, which was then used in the other parts of the study, and especially in the bibliometric analyses.

3.2.1 Bibliometric analysis

Bibliometric analysis is a useful tool for large collections of bibliographic resources (Mostaghel *et al.*, 2022). A bibliometric overview of the final sample was created using a descriptive and network analysis. This helped in understanding the journal's chronicle of publications as well as the visualised descriptive statistics with a Microsoft Excel pivot table and VOSViewer to show co-authorship and co-occurrence of keywords. Co-authorship and keyword co-occurrence, which are important parts of bibliometric notions, were then applied to identify areas in which further study is required in the future. Finally, the use of artificial intelligence in retail was investigated to ensure a thorough view of the industry.

4. Results

The review's findings are divided into two sections in accordance with the research questions: bibliometrics performance (RQ1), which encapsulates the bibliometrics approach that used to compare, contrasts, and integrates the data from several indicators; The results are classified based on the type of analysis performed: journals, authors, articles, conceptual topics, and keywords performance.

To accomplish the studies objective (RQ2), the results of the bibliometric analysis, visualisations, and identified themes are presented in the following sections: descriptive analysis, network analysis, characteristics of digitally enabled retail business model innovation, digitalization-driven retail business model innovation for each dimension, and areas for future research on digitally enabled retail business model innovation.

4.1 Corpus analysis

Using Microsoft Excel's pivot table and graph, as shown in Figure 2, each year since 2012, highly ranked scholarly publications (based on Academic Journal Guide 2021) on AI in retail have been published. The review period is segmented into two periods (2012–2017 and 2018–2022 (first quarter)) to better understand the paper publishing pattern. In the first five years (2012–2017), only eight articles about the use of AI in retail were published in high-ranking journals (Academic Journal Guide 2021). This shows that the field grew very slowly after the concept was first introduced. This is a regular occurrence in a burgeoning research topic.

The number of publications has been consistently growing since 2018, with the exception of a small decrease in 2020, which might be linked to the current COVID-19 epidemic. Publications increased in 2021, and by the first quarter of 2022, they had reached roughly half of what they had in 2021, signalling possible growth this year.

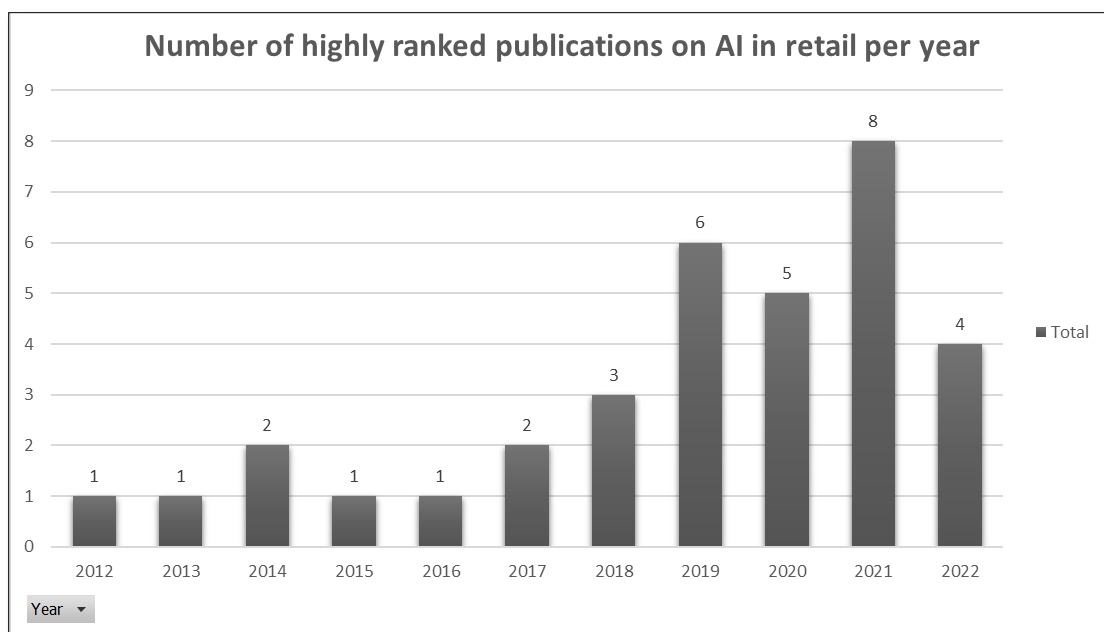


Figure 2: Number of publications on AI in retail per year.

4.2 Article performance

Co-citation analysis has been performed in order to assess the citation performance of publications. Table 2 analyses all articles by the total number of citations to identify the most influential article among the 34 publications (final sample). With 220 total citations, Chang, Kauffman, and Kwon's (2014) paper on Understanding the Paradigm Shift to Computational Social Science in the Presence of Big Data had the most influence. Even though the article was published in 2014, it had 32 citations in 2021, demonstrating the continuous impact of this article.

Chang, Kauffman, and Kwon (2014) was the most-cited AI in retail article by other AI in retail articles in the corpus (220 citations). Their article asserts that the era of big data has created new opportunities for researchers to achieve high relevance and impact amid changes and transformations in how we study social science phenomena. The contexts include social networks and blogs, political discourse, digital journalism, mobile telephony, online gaming, financial services, online shopping, social advertising, and social commerce. In their paper, they argue against the idea that theory doesn't matter anymore and give some new research ideas (Chang, Kauffman and Kwon, 2014).

The article by Merle, Senecal and St-Onge (2011) is the second most-cited article among other AI usage in retail articles in the corpus (77 citations). Their paper discussed there are several forms of virtual experience that assist consumers in evaluating apparel online. This paper focuses on one form of IIT, the "virtual try-on" (VTO) Using a virtual 3D model to try on clothes influences cognitive, affective, and conative responses to a retail Web site. VTO does not lead to greater influence over consumer responses per se (Merle, Senecal and St-Onge, 2012).

Overall, the top 15 most cited papers on the use of AI in retail received 780 citations, implying that each piece in the corpus refers to an average 52.0 crucial articles ($780 / 15$ articles). The comparatively low (local) citation average of seminal publications, which contrasts with the high

worldwide citations seen in (Chang, Kauffman and Kwon, 2014) and (Chang, Kauffman and Kwon, 2014), is concerning, but may hopefully be addressed by this comprehensive review. Thus, it is hoped that future research on the use of AI in retail will use the foundational AI-based publications above to show a more accurate picture of seminal research while making their own case for theoretical extension and uniqueness.

Table 2: Top 15 most cited articles from the final sample

Cites	Title	Authors	Journal	Year
220	Understanding the paradigm shift to computational social science in the presence of big data	Chang R.M., Kauffman R.J., Kwon Y.	Decision Support Systems	2014
77	Whether and how virtual try-on influences consumer responses to an apparel web site	Merle A., Senecal S., St-Onge A.	International Journal of Electronic Commerce	2012
73	Online shopping intention in the context of data breach in online retail stores: An examination of older and younger adults	Chakraborty R., Lee J., Bagchi-Sen S., Upadhyaya S., Raghav Rao H.	Decision Support Systems	2016
65	Device switching in online purchasing: Examining the strategic contingencies	De Haan E., Kannan P.K., Verhoef P.C., Wiesel T.	Journal of Marketing	2018
55	To immerse or not? Experimenting with two virtual retail environments	Papagiannidis S., Pantano E., See-To E.W.K., Dennis C., Bourlakis M.	Information Technology and People	2017
45	The Impact of Perceived Visual Complexity of Mobile Online Shops on User's Satisfaction	Sohn S., Seegebarth B., Moritz M.	Psychology and Marketing	2017
40	Assessing the Impact of Price Promotions on Consumer Response to Online Stockouts	Peinkofer S.T., Esper T.L., Smith R.J., Williams B.D.	Journal of Business Logistics	2015
35	The influences of online service technologies and task complexity on efficiency and personalization	Xu J.D., Benbasat I., Cenfetelli R.T.	Information Systems Research	2014
34	Psychological antecedents and risk on attitudes toward e-customization	Park J., Han H., Park J.	Journal of Business Research	2013
31	Store layout effects on consumer behavior in 3D online stores	Krasonikolakis I., Vrechopoulos A., Pouloudi A., Dimitriadis S.	European Journal of Marketing	2018
26	Does "Being There" Matter? The Impact of Web-Based and Virtual World's Shopping Experiences on Consumer Purchase Attitudes	White Baker E., Hubona G.S., Srite M.	Information and Management	2019
24	A semantic measure of online review helpfulness and the importance of message entropy	Fresneda J.E., Gefen D.	Decision Support Systems	2019
21	Involvement in consumer-generated advertising: Effects of organizational transparency and brand authenticity on loyalty and trust	Busser J.A., Shulga L.V.	International Journal of Contemporary Hospitality Management	2019
17	Comparison of perceived acquisition value sought by online second-hand and new goods shoppers	Fernando A.G., Sivakumaran B., Suganthi L.	European Journal of Marketing	2018
17	Interactive music for multisensory e-commerce: The moderating role of online consumer involvement in experiential value, cognitive value, and purchase intention	Hwang A.H.-C., Oh J., Scheinbaum A.C.	Psychology and Marketing	2020

4.3 Country performance

United States-based affiliations appeared in publications the most frequently, as one might anticipate (16 articles). They have more than 2.5 times the number of appearances as affiliations based in China (6). Table 3 shows the overall number of publications and ranks based on the total number of times articles from a given country appeared in publications. Surprisingly, there were only 4 publications affiliated with the United Kingdom.

Table 3: The distribution of AI in Retail articles by countries (by quantity)

Countries	Ranking based on Total Output	Output, n (%)
United States	1	16 (27)
China	2	6 (10)
Germany	3	5 (8)
South Korea	4	4 (7)
United Kingdom	5	4 (7)
Canada	6	3 (5)
France	7	3 (5)
Hong Kong	8	3 (5)
India	9	2 (3)
Italy	10	2 (3)
Australia	11	1 (2)
Austria	12	1 (2)
Finland	13	1 (2)
Greece	14	1 (2)
Iran	15	1 (2)
Lebanon	16	1 (2)
Netherlands	17	1 (2)
Singapore	18	1 (2)
Sweden	19	1 (2)
Switzerland	20	1 (2)
Taiwan	21	1 (2)

4.4 Journals performance

As seen in Table 1, the publications comprised a diverse variety of journals. With five publications, Information Technology and People was the journal with the most papers. Four papers were published in Decision Support Systems, while the remaining twenty-five publications were spread throughout several other academic sources. As a result, among the use of AI in retail research, information technology and decision support systems remained important publications. The Decision Support Systems outranked all other publications in terms of citations, with 317 total citations, followed by Information Technology and People, which had 78 total citations. When it came to average citations per publication, however, Decision Support Systems came out on top with 105.66 citations (see Table 4).

Table 4: Citations ranking by journal.

Journals	Articles	TC	AC
Decision Support Systems	3	317	105.66
European Journal of Marketing	2	48	24.00
Information and Management	1	26	26.00
Information Systems Frontiers	1	4	4.00
Information Systems Journal	1	0	0.00
Information Systems Research	1	35	35.00
Information Technology and People	5	78	15.60
International Journal of Contemporary Hospitality Management	1	21	21.00
International Journal of Electronic Commerce	1	77	77.00
Internet Research	3	2	0.66
Journal of Business Logistics	1	40	40.00
Journal of Business Research	2	49	24.50
Journal of Electronic Commerce in Organizations	1	3	3.00
Journal of Marketing	1	65	65.00
Journal of Retailing	1	2	2.00
Journal of the Association for Information Science and Technology	1	2	2.00
MIS Quarterly: Management Information Systems	1	11	11.00
Psychology and Marketing	4	62	15.50
Technological Forecasting and Social Change	2	1	0.50
Tourism Management	1	3	3.00
Total	34	846	475.42

Note: TC = total number of citations; AC = average number of citations.

4.5 Keywords Analysis

A co-occurrence analysis of keywords was used to denote the knowledge development process in the use of AI in retail research. The authors' keywords are extracted and grouped according to their thematic similarity (Lim *et al.*, 2022). In this regard, the clusters of the use of AI in retail papers identified using keyword co-occurrence analysis accurately reflect the state of AI in retail research at the time. Five clusters of the use of AI in retail research were identified as a result of the analysis: consumer engagement as a means of influencing consumption experiences, consumer engagement as a strategy for consumer acquisition, differences in consumer engagement behaviour, consumer relationship management via consumer engagement, and consumer engagement mediated smart retail.

Figure 3 depicts the network of five clusters, which contains 21 keywords out of 271 that appeared at least twice in the use of AI in retail articles. By establishing the criterion that articles included in the study must be cited a minimum of 2 times by other AI in retail articles, they can curate a pragmatic set of clusters for network visualisation based on the number of prolific or prominent cited articles in clusters in the corpus, which is necessary given the sheer volume of cited articles in this review. This co-citation analysis criteria are also compatible with Donthu, Kumar, Mukherjee, et al. (2021) and Hollebeek et al (2021).

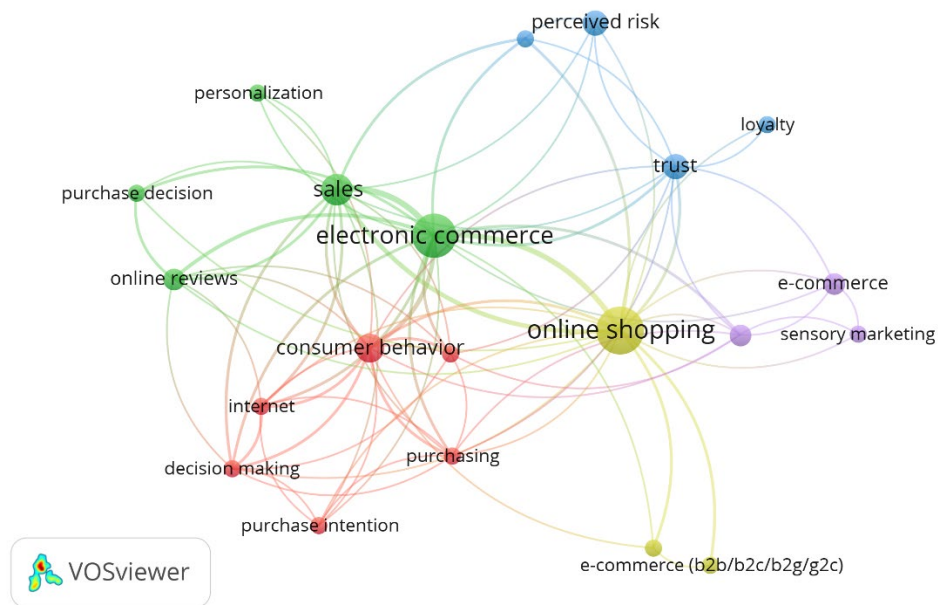


Figure 3: Keywords analysis

5. Discussion (Research Impact)

The overall focus of this research was to synthesise studies on AI in e-commerce and suggest areas for further research. As a result, it attempted to respond to three research questions: (1) How will the adoption of AI impact retailers' strategies and growth? (ii) How can smart retailers best use AI technology to meet smart consumers' everchanging needs and demands, grow their market share, and still be ethical? (iii) What are the trending topics and future research directions for the use of artificial intelligence in retail? The results of the bibliometric analysis and literature evaluation are summarised in this section. It focuses on a few major takeaways from the findings, beginning with China's and the United States' leadership roles in this field. The focus of contemporary research on recommender systems, the considerable use of design science and experimentation in this study field, and a limited focus on modelling consumer behaviour are discussed after this highlight. This section also covers the paucity of studies on some research topics and the scarcity of publications in particular fields. This section concludes with a discussion of the implications for research and practise.

5.1 Implication for theory

By synthesising extant literature, this study contributes to the body of research on the integration of AI into retail settings. Despite recent advancements in AI and the growing amount of research on how it influences smart retail settings, there is still a lack of comprehensive reviews of this research area. Recent research has indicated that how AI will affect retail is an important area of research, especially for the fourth industrial (industry 4.0) and fifth industrial (industry 5.0) revolutions (Davenport *et al.*, 2020; Kopalle *et al.*, 2021; Shankar *et al.*, 2021; Vlačić *et al.*, 2021).

By providing a global overview of AI integration in retail, this study attempted to address existing research gaps from a fictional, normative, and interpretative perspective based on the findings of this study and offer direction for future research. Using this insight, researchers may be able to uncover new avenues and contribute to other fields as well as discover relevant publication channels. In addition, the study demonstrates how this research project is constructed from the ground up and highlights the relevance of AI in recommender system design and the literature that supports this research field. Determining research gaps and separating theory and practise is further made easier by showing the discipline's contributions to current research issues.

5.2 Implications for practice

This study indicates that the retail sector relies on emerging technologies, including AI, for its business processes and engagement with consumers and other stakeholders. As a significant research field, it emphasises how to use bespoke AI algorithms to develop and provide optimised, customised, trust-based, and sentiment-based analytics as the core themes in the research area.

Thus, AI developers, smart retailers, and policymakers may well tap into these resources to improve the quality of AI-enabled systems. To be more specific, it might help them understand how to make optimised and personalised analytics that are backed by AI algorithms that have been built just for them.

As a result of this knowledge, retailer competitors would find it difficult to imitate or replicate the quality of suggestions provided by smart retail platforms. Retailers that want to apply AI in retail would need exclusive access to and control of consumer data, AI algorithms, and analytics skills (Shi, Wang and Alwan, 2020; Kandula, Krishnamoorthy and Roy, 2021). Pantano and Pizzi (2020) contend that retail competitors will be unable to replicate such a resource because it is unique to the retailer, even more so if it is patentable.

This research paper arranges the literature on artificial intelligence in retailing by topic, research method, and research theme. As a result, researchers and practitioners interested in using AI in retail platforms will have no trouble finding scholarly articles that offer directions for future research. It saves them time from having to look for articles on their own, which may or may not be relevant or credible.

5.3 Limitations

This study is not without limitations. Determining a category for each article in the sample dataset proved to be a challenging task. Most of the publications might be classified appropriately under many different classification schemes. However, arranging papers into each paradigm facilitates the conceptualization and comprehension of the given subject (Mou and Benyoucef, 2021). Therefore, each article was put into a category based on its title, keywords, and abstract. An additional dilemma was deciding on which research articles to include as part of the final sample and in the review. For instance, while some research articles on the use of AI in retail appeared in the keyword search results, the authors of these articles did not specify whether or not their applications and underlying algorithms were AI-based. In the same vein, some of the works on the use of AI in retail were published in journals that were either ranked 1 or 2 on the Academic Journal Guide 202, or not listed at all, and therefore did not make the final sample or might have been missed all together. However, the contribution of this study remains relevant to the body of knowledge on the use of AI in retail.

5.4 Direction for future research (RQ2)

Academics have largely studied the use of AI technologies, algorithms, and approaches, including chatbots, robots, and recommender systems. It is critical for researchers to define AI and differentiate between the many forms of AI employed in their studies. Context was not given considerable weight in the use of AI in retail research. Future studies should investigate the possibility of analysing behavioural data with "hard" data (facts).

The smart retail ecosystem will benefit more from the ethical considerations and obstacles that both consumers and retail businesses confront when using AI systems and algorithms. Retailers intending to use AI systems must make ethical decisions based on a sociotechnical approach. Future research should investigate how smart retailers deal with these ethical issues while deploying AI solutions, as well as the hurdles they encounter along the way. What impact will artificial intelligence have on the future of jobs? Analysing theory-driven research articles on AI in retail is uncommon. The majority used experimental research methodologies and design science approaches to explain phenomena using AI algorithms. More study into the function of AI-powered voice-based AI is required. Studies are still primarily focused on web-based, social networking (social commerce), and mobile platforms. The key study directions suggested in this work are summarised in Table below.

Table 5: Sample future research questions

Title	Research agenda description	Sample future research questions
Ethics	Ethical decisions and challenges	What is the negative impact of perceived risks to security, privacy, and service on intentions related to online shopping? How are smart retail platforms affected by the new digital/human labour mix that is being driven by AI? What are the legal restrictions on the use and internationalisation of AI in smart retail? What ethical decisions must smart retailers make when deploying AI solutions? What are the ethical considerations that smart retailers encounter when deploying AI solutions? What attributes should retailers include in their AI strategies to alleviate consumers' ethical concerns? What are the consequences of using ethical AI in a multi-channel and transparent way when it comes to pricing retail products? What are the moderating effects of consumer perceived risk of smart retailing in relation to the psychological antecedents of adoption of e-customization products?
Multidisciplinary boundaries in research	More study from other countries is needed.	Is there any evidence of cross-cultural variations affecting the adoption and application of AI in retail? What are the legal restrictions on the use and internationalisation of AI in smart retail?
Supporting decision-making	The role of artificial intelligence in influencing decision-making	How is AI impacting the mindsets and behaviours of smart retail managers? How is AI influencing the rationality of consumers who engage with smart retailing platforms? How does the lack of face-to-face interaction and direct product contact influence consumer purchase decision-making? What is the impact of the length of product descriptions given by smart retailers on consumer purchase intentions?

Themes and areas of research	Themes for research are limited.	When it comes to price elasticity of demand, what are the disparities between the online and offline retail channels? How can AI contribute to the development of sustainable smart retailing practises? What are the effects of organizational transparency and brand authenticity on loyalty and trust? Does perceived uncertainty significantly influence acquisition value within smart retailing settings? Does acquisition value have a significant effect on e-loyalty within smart retailing settings? What is the value perception of smart consumers when engaging with online retailers? What are the hedonic values that impact on consumers' acquisition values and e-loyalty? What role do online social interactions (i.e., active vs. passive) play in improving our understanding of online purchasing demand and the progress of associated ideas and concepts? Is transferring sales to an online channel always associated with considerable cost savings for the retailer?
Consumer Behaviour		How does immersion affect consumer behaviour in virtual retail environments? How is purchase intention influenced by satisfaction, which is in turn influenced by enjoyment and engagement? How do contextual factors like control, 3D authenticity, colour and graphic vividness, and control affect how consumers interact with a product? What are the effects of store layout on consumer shopping behaviour in a virtual retail environment? How can a virtual retail environment that mitigates perceived uncertainty (e.g., reduces perceived risk and enhances trust) lead to greater adoption? What is the relationship between virtual store layout, consumer experience, control, and consumer shopping preference? What are the effects of organizational transparency and brand authenticity on loyalty and trust? What are the determinants of satisfaction and behavioural intentions within smart retail settings?

6. Conclusions

In recent years, the field of AI in retail has advanced significantly, becoming a valuable tool that can discern rival retail businesses. This study utilized a combination of bibliometric and systematic literature review methods to summarize the current state of AI research in the retail industry. The bibliometric analysis revealed that the United States and China are leading in this field, based on the number of publications. The study focused on various technology-related aspects, such as optimization, trust and personalization, sentiment analysis, and AI concepts and technology, which emerged as significant research subjects. Notably, major computer science, AI, business, and management journals were identified as the primary outlets for publishing AI in retail research. The research conducted in this field has primarily centred on AI applications and technological issues, with a particular emphasis on algorithm performance. However, it is important to note that the focus has been primarily on AI algorithms and methodologies, rather than on the implementation of AI systems. The majority of studies employed design science and experimentation-based research methods to investigate the potential of AI in retail.

An important finding of this study is the recognition of intelligent agents as computer programs capable of performing specific tasks. This highlights the potential of AI to automate various retail processes and tasks. The study not only provides a comprehensive overview of the current state of AI research in retail but also identifies future research opportunities based on the findings. It suggests that future studies should address the limitations of the current research, such as the exclusion of relevant studies with specific focuses due to the chosen search strategy. Furthermore, the study suggests that future research should explore potential research avenues based on ongoing debates in the field of information systems regarding AI. Overall, this study contributes to the existing body of knowledge on AI in retail and is expected to facilitate and guide future research in this area. By understanding the current state of AI research in retail and the gaps that exist, researchers can build upon the findings of this study to advance our understanding of AI's potential in transforming the retail industry.

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Appendix

Review vs Article

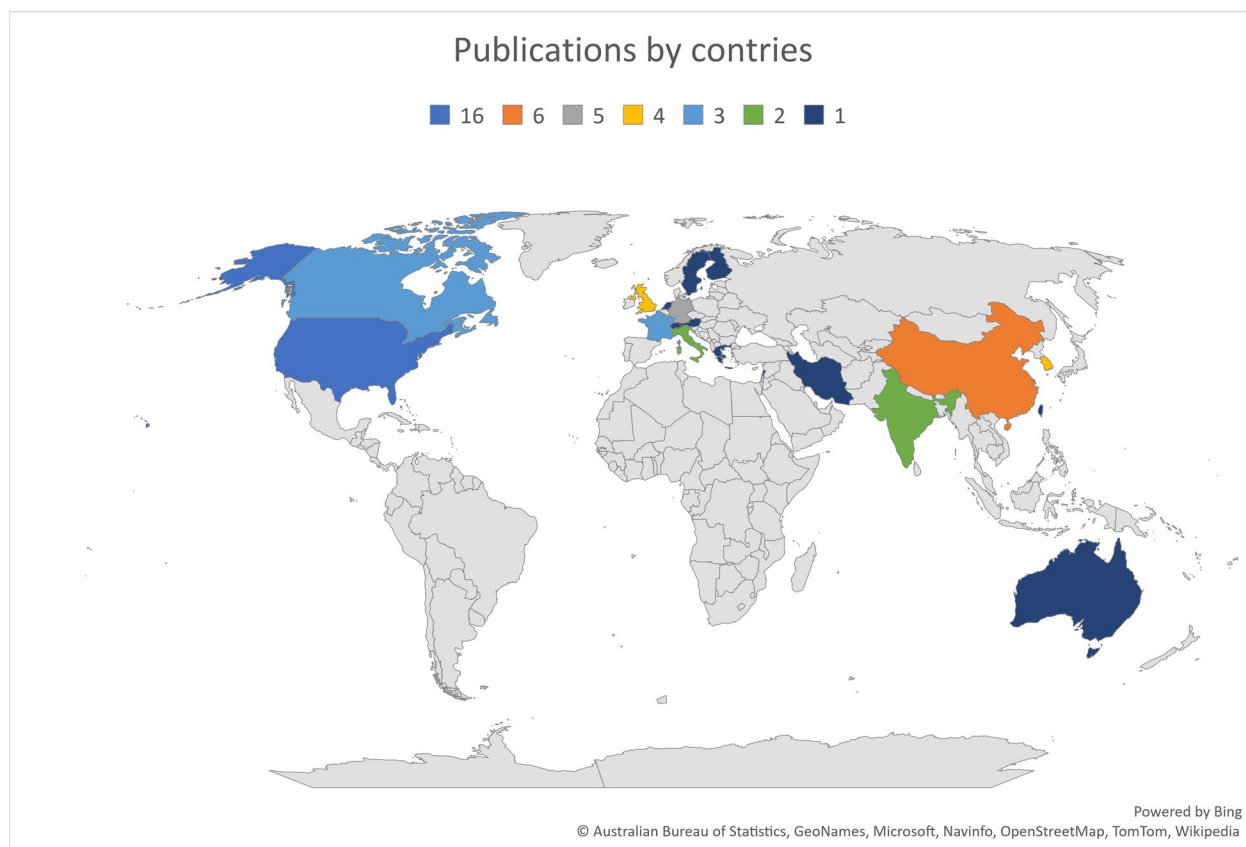
Row Labels	Count of Document Type
Article	760
Review	35
Grand Total	795

Table 3: Breakdown of articles and review papers

ABS Ranking

Row Labels	Count of ABS Rank
1	100
2	106
3	72
4	10
4*	5
N/A	501
Grand Total	794

Table 4: Breakdown of articles by ranking (AJG 2021)



The number of citations per article per year (see Figure 3 and Appendix. 3) was created using the final sample of 34 articles as shown in Figure 3.

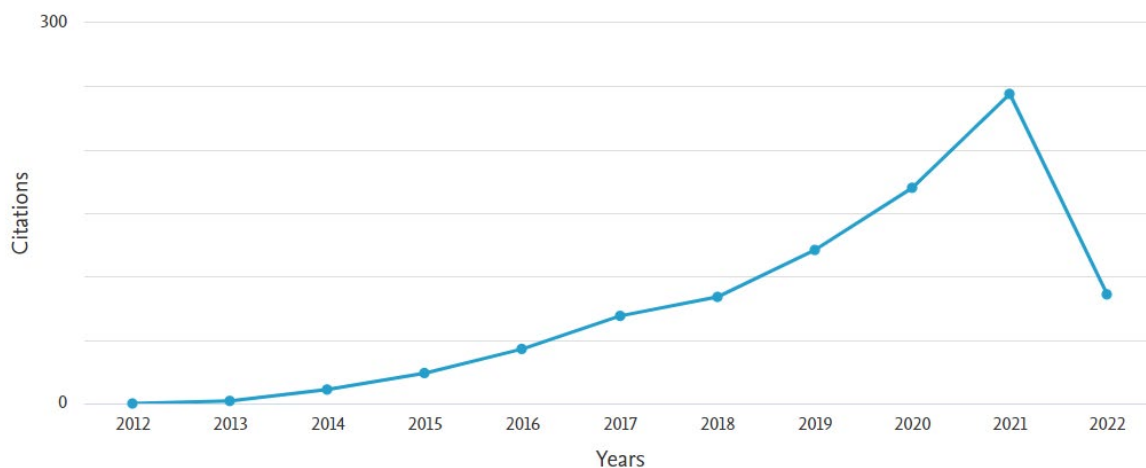


Figure 4: An overview of citations per year for publications included in the final sample.

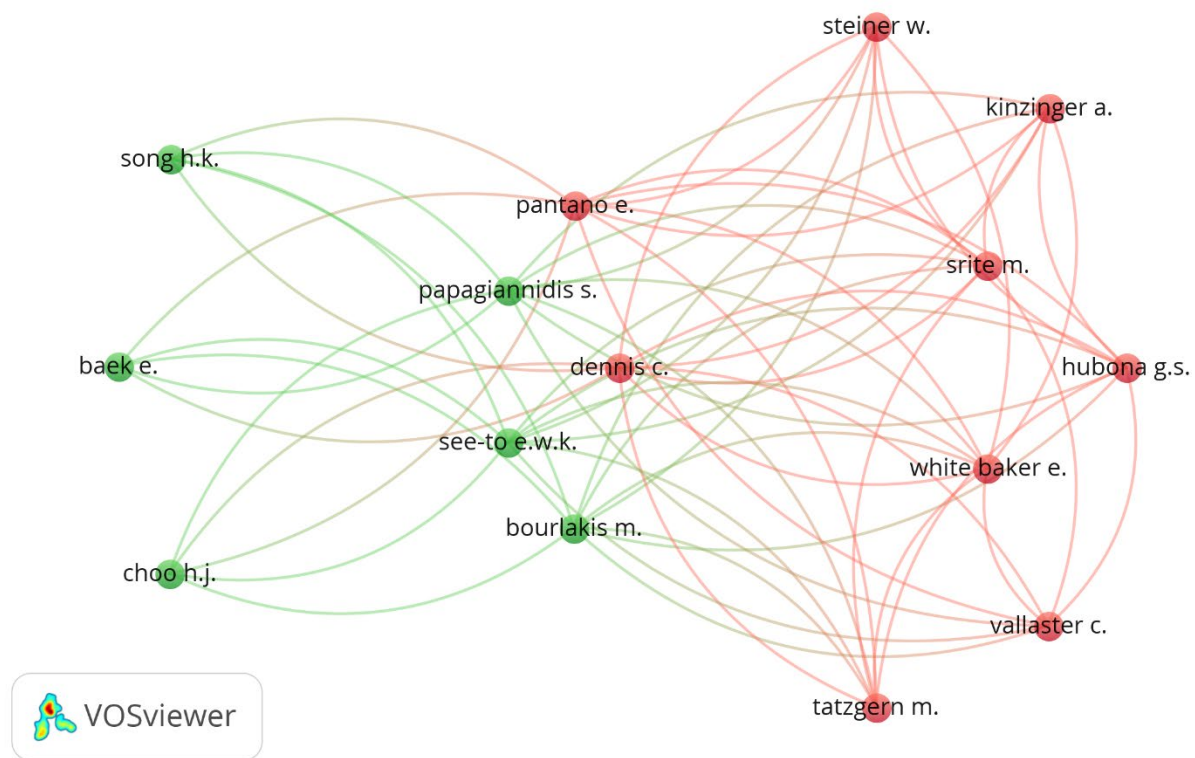


Figure 5: Author analysis