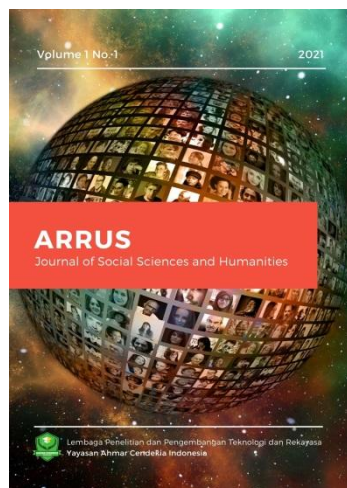




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RESEARCH ARTICLE

Consumer Protection in the Use of AI in Digital Services, A Bibliometric Analysis of Consumer Protection in AI an Evidence from Scopus (2018–2026)

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Abstract: Artificial intelligence (AI) is getting increasingly used in digital services such as recommendation systems, scoring engines, and conversational agents, thus prompting important issues concerning consumer protection. The present study maps the research domain of consumer protection in AI by means of bibliometrics on the Scopus database. Search was conducted in one database using title/abstract/keyword terms, which returned 3,307 documents (retrieval date: 27 June 2026). These documents were filtered based on titles to identify the works that explicitly focused on consumer protection in AI, yielding a core of 192 documents that were published in 2018-2026. Bibliometric analysis of the core was conducted to analyze its output display, document types, sources, citation impact, influential documents, authors, and open access. The annual growth rate of output display has been consistently high, rising from few papers before 2020 to 63 documents in 2025. Unlike other research fields, this set of consumer protection-related publications is primarily represented by journal articles (44.8%) and not conference papers (37.5%). 192 documents have been published in 155 sources by 603 authors and received a total of 1,542 citations, amounting to an average of 8 citations per paper and corpus h-index of 19, the most productive source being IEEE Transactions on Consumer Electronics. Most of the highly cited papers address such topics as consumer trust and privacy, fairness and explainability, ethical use of consumer data, and protection of consumers from malicious AI pricing. 23.4% of the corpus is open access. The results show that the research area is relatively new, actively developing and fragmented but thematically consistent. It provides researchers and policymakers with empirical foundation, including in countries like Indonesia.

Keywords: Artificial Intelligence, Bibliometric Analysis, Consumer Protection, Digital Services, Research Trends

1. Introduction

The role of digital services is quite significant in today's world and artificial intelligence (AI) (Eriksson & Ineland, 2023; Yousafzai et al., 2003) plays an important part in making these services work. Recommendation engines in online markets rank the products; financial firms use score automation to either accept or deny applications; conversational agents provide customer support (Criveanu, 2025; Kowalkowski et al., 2024; Sari et al., 2025; Saunila et al., 2025). All of these have their own benefits in terms of improving efficiency and personalizing the service but what needs to be noted here is that this creates a new dimension in the interaction between the customers and the providers.



Given that decision-making based on AI technologies stems from a process of statistical modeling, which is not easy to inspect, consumers are unable to see, understand, or contest decisions made against them (Hwang et al., 2020; Kim & Seo, 2023). With these issues of opacity, discrimination, manipulation, privacy, and inadequate opportunities for remedy having gained importance in public policy, there has emerged a need for regulations like the General Data Protection Regulation, the EU Artificial Intelligence Act, and the Indonesian Personal Data Protection Law.

The key to navigating the body of knowledge lies in comprehending the process of building this information. The bibliometric study offers an approach that is systematic and replicable for the study of characteristics of a scientific field on the basis of statistical measures derived from its publication output, it does not summarize the findings of each individual study but rather defines the structure of the whole field (Judijanto, 2025; Mas-Tur et al., 2020; Moosavi et al., 2025; Ragazou et al., 2023).

The present paper adopts the consumer protection angle on AI-powered digital products, using the Scopus database as the only source for its analysis. Three research questions will direct the investigation process. Firstly, how did the scientific production on the issue change from 2016 to 2026? Secondly, what are the sources, documents, and authors that gained more prominence in the area, and what can be inferred about the thematic core of the discipline based on its most cited articles? Lastly, what does the structure of publications and citations, in particular, the usage of open access, say about the state of maturity of the field?

2. Material and Methods

2.1. Research design

The study uses the method of bibliometric analysis, which is the quantitative approach to research in order to explore the structure and dynamics of a scientific field based on the data from publications (Azzari et al., 2020; Pasko et al., 2021). Such an approach was chosen since the research questions relate to the field itself, its development, important publications, journals, etc., not to the details of each study.

2.2. Data source and search strategy

Scopus was used as the only bibliographic database that has an extensive number of articles published in peer-reviewed journals (Ekka, 2023; Harsanto et al., 2024; Moosavi et al., 2025), in addition to having consistently accurate metadata. A search strategy based on three different concept blocks was formulated using the Boolean AND operator. The search strategy is represented in Table 1 below. The search process is shown in Figure 1 below.

Table 1. Scopus search strategy and query structure

Concept block	Representative terms (OR-combined)	Role
AI / automation	"artificial intelligence", "machine learning", "algorithmic decision", "automated decision-making"	Technology focus
Consumer / user	consumer, customer, user, data subject	Beneficiary focus
Protection / harm	"consumer protection", fairness, transparency, discrimination, privacy, redress, manipulation	Outcome focus
Combined query (TITLE-ABS-KEY, blocks joined with AND)	("artificial intelligence" OR "machine learning" OR "algorithmic decision" OR "automated decision-making") AND (consumer OR customer OR user OR "data subject") AND ("consumer protection" OR fairness OR transparency OR discrimination OR privacy OR redress OR manipulation)	

Source: Scopus (single database). Search fields: title, abstract, keywords. Timespan: 2016–2026. Retrieved 27 June 2026, yielding 192 documents with no additional document-type or language restrictions applied.

2.3. Data extraction and analysis

The full result set of 3,307 documents was exported in CSV format with 19 metadata fields, including authors, title, year, source title, citation count, document type, and open-access status. Because the study targets consumer protection in AI specifically, rather than AI in

general, the records were screened to retain only documents whose titles signalled an explicit consumer-protection focus, operationalised as a consumer or customer term (for example consumer, customer, end-user, or data subject) appearing together with a protection-related term (for example protection, privacy, fairness, transparency, trust, discrimination, or redress), or an unambiguous phrase such as “consumer protection.” This step excluded 3,115 general AI or machine-learning records without a consumer-protection focus and produced the focused corpus of 192 documents analysed here (Figure 1). The corpus was then analysed along four dimensions: publication dynamics, source and venue productivity, citation impact (including total and mean citations and the corpus h-index), and open-access profile. Because the export did not include abstracts, author keywords, or affiliations, screening relied on titles and content-level techniques such as keyword co-occurrence were outside scope; all counts reflect the database state on the retrieval date.

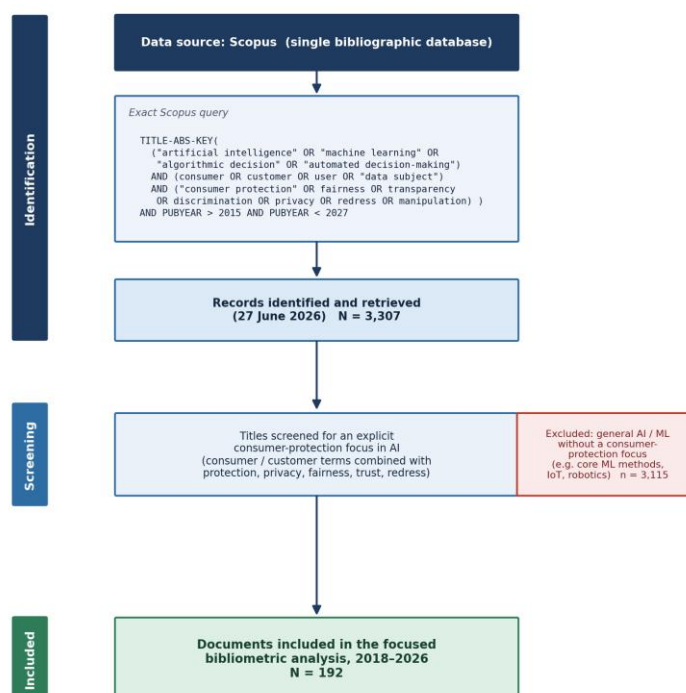


Figure 1. Identification and screening of the focused consumer-protection corpus

3. Results and Discussion

3.1. Corpus overview and annual production

The focused corpus comprises 192 documents published between 2018 and 2026 across 155 sources and authored by 603 researchers. Collectively the corpus has attracted 1,542 citations, an average of 8 citations per document, with 52.1% of documents cited at least once and a corpus h-index of 19. These headline indicators are summarised in Figure 2.



Figure 2. Summary indicators of the Scopus corpus

Annual output grew steadily over the period, as shown in Figure 3 and detailed in Table 2. The focused literature begins in 2018 and remained small until 2020, then expanded to 24 documents in 2024 and 63 in 2025, the single most productive year, before a partial count of 53 for 2026 reflecting the mid-year retrieval date. Citations received, plotted on the secondary axis, behave inversely to recent output because newer papers have had less time to accumulate citations; the relatively high citation totals attached to 2021–2023 are driven by a small number of influential works discussed below.

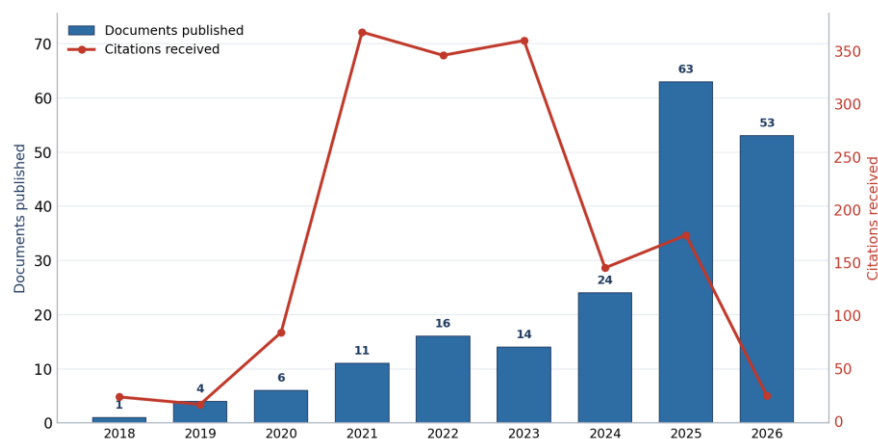


Figure 3. Annual document output and citations received, 2018–2026

Table 2. Annual scientific production and citation impact

Year	Documents	Share (%)	Citations
2018	1	0.5	23
2019	4	2.1	16
2020	6	3.1	84
2021	11	5.7	368
2022	16	8.3	346
2023	14	7.3	360
2024	24	12.5	145
2025	63	32.8	176
2026	53	27.6	24
Total	192	100.0	1,542

3.2. Document types

Unlike the more general AI body of knowledge, the consumer protection literature is mostly made up of journal articles. In particular, there are 86 (44.8%) journal articles, followed by 72 (37.5%) conference papers, 27 (14.1%) book chapters, and some reviews. The entire breakdown is shown in Figure 4. This prevalence of journal articles and book chapters comes from the nature of the consumer protection subject being found mostly in law, business, and information systems journals rather than conferences as in machine learning.

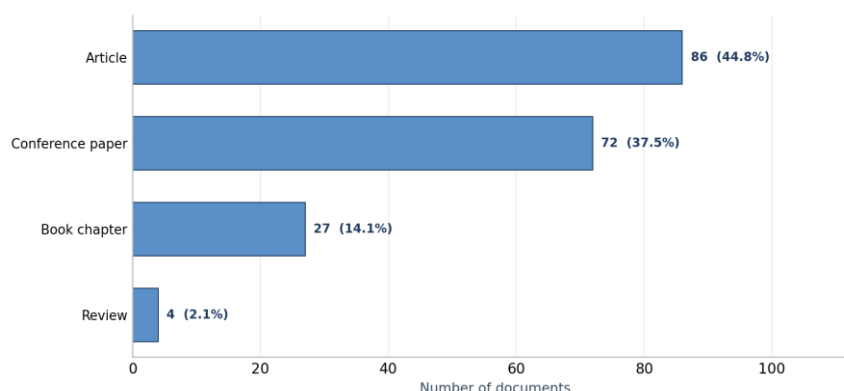


Figure 4. Distribution of documents by type

3.3. Leading sources

However, the 192 papers have been spread out across 155 different sources, which suggests a diverse field but with one major exception. “IEEE Transactions on Consumer Electronics” emerges as the most productive source, as it is responsible for 24 papers, far more than any other source, which accounts for just a few papers. The top ten sources listed in Table 3 include journals about consumer electronics as well as computing, along with some conference proceedings, which demonstrates that this is a field that lies somewhere between applied artificial intelligence engineering and consumer research.

Table 3. Ten most productive sources

Rank	Source title	Documents
1	IEEE Transactions on Consumer Electronics	24
2	Lecture Notes in Networks and Systems	4
3	Communications in Computer and Information Sci	3
4	Consumer Protection and the Digital Economy: A	2
5	Procedia Computer Science	2
6	Computer Law and Security Review	2
7	Strategic Innovations of AI and ML for E-Comme	2
8	Proceedings of the ACM on Human-Computer Inter	2
9	Proceedings of the Annual Hawaii International	2
10	Lecture Notes in Computer Science (LNCS/LNAI)	2

3.4. Citation impact and influential works

Citations are concentrated in a set of influential contributions listed in Table 4. The most cited documents address consumer trust, privacy, and experience with AI-enabled services; ethical and privacy considerations in fintech; protecting consumers from collusive algorithmic pricing; involving end-users in AI fairness; and consumers' willingness to pay for explainable AI. Read together, these works cluster around four themes that define consumer protection in AI: consumer trust and privacy, fairness and non-discrimination, transparency and explainability, and the ethical and regulatory governance of consumer data. The thematic focus is markedly tighter than in the broader AI literature, confirming that the screening isolated work genuinely concerned with protecting consumers.

Table 4. Ten most cited documents

Rank	Title	Source (journal / proceedings)	Year	Citations
1	Exploring the role of personality, trust, and privacy in customer experience performance during voice shopping: Evidence from SEM and fuzzy set qualitative comparative analysis (Bawack et al., 2021)	International Journal of Information Management	2021	218
2	Building Trust in Fintech: An Analysis of Ethical and Privacy Considerations in the Intersection of Big Data, AI, and Customer Trust(Aldboush & Ferdous, 2023)	International Journal of Financial Studies	2023	177
3	Protecting consumers from collusive prices due to AI: Price-setting algorithms can lead to noncompetitive prices, but the law is ill equipped to stop it(Calvano et al., 2020)	Science	2020	63
4	Toward Involving End-users in Interactive Human-in-the-loop AI Fairness(Nakao et al., 2022)	ACM Transactions on Interactive Intelligent Systems	2022	60
5	Consumers are willing to pay a price for explainable, but not for green AI. Evidence from a choice-based conjoint analysis(König et al., 2022)	Big Data and Society	2022	53
6	Ethical considerations for the use of consumer wearables in health research(Sui et al., 2023)	Digital Health	2023	52
7	Consumer Privacy Protection With the Growth of AI-Empowered Online Shopping Based on the Evolutionary Game Model(Wang et al., 2021)	Frontiers in Public Health	2021	46
8	Attitudes and Folk Theories of Data Subjects on Transparency and Accuracy in Emotion Recognition(Grill & Andalibi, 2022)	Proceedings of the ACM on Human-Computer Interaction	2022	46



9	End-User Privacy Protection Scheme from cyber intrusion in smart grid advanced metering infrastructure(Singh & Mahajan, 2021)	International Journal of Critical Infrastructure Protection	2021	46
10	A Privacy-Preserving Framework for Efficient Network Intrusion Detection in Consumer Network Using Quantum Federated Learning(Abou El Houda et al., 2024)	IEEE Transactions on Consumer Electronics	2024	44

3.5. Authorship

Authorship is broad and collaborative: 603 distinct authors contributed to the corpus, and the most prolific individuals each account for only a small share of total output, as shown in Table 5. The leading names are associated with high-volume research groups; the prevalence of common surnames also signals the well-known limitation of author-name disambiguation in large bibliographic datasets, so these counts should be read as indicative.

Table 5. Ten most productive authors

Rank	Author	Documents
1	Kumar S.	3
2	Kumar A.	3
3	Singh S.	3
4	Li B.	3
5	Mohan A.	2
6	Yang S.	2
7	Kumari S.	2
8	Singh A.	2
9	Sharma S.	2
10	Liu X.	2

3.6. Open-access profile

Just over a quarter of the corpus is openly accessible: 45 documents (23.4%) are open access, while 147 remain behind paywalls. Among open-access items, the gold route dominates with 39 documents, ahead of green (5) and bronze (1). The distribution is shown in Figure 5.

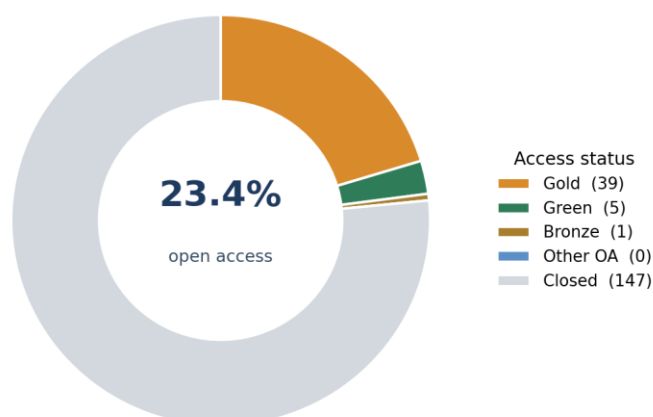


Figure 5. Open-access status of the retrieved documents

3.7. Principal findings

This analysis highlights a developing but clearly growing area of research with distinct themes. With minimal contributions prior to 2020 and 63 publications published in 2025, the year with the highest number of contributions, the rapid growth started in 2024 and coincides with increased AI governance activity in connection with the EU's Artificial Intelligence Act and mature data-protection regimes around the world. There are three distinguishing features of this body of literature compared to the overall literature on AI. Firstly, the leading scholarly

contributors are journal articles (44.8%) and book chapters (14.1%), instead of conference papers (37.5%), which means that consumer protection is closer to legal, business, and information systems scholarship than to machine learning scholarship. Secondly, despite the dispersion of this body of literature across 155 different outlets, it has a distinctive center in *IEEE Transactions on Consumer Electronics*, which is the only journal with more than five publications in the corpus. Thirdly, the number of 603 authors shows that there is a diverse community of scholars without any single dominating figure or group.

3.8. The thematic structure of consumer protection in AI

The most cited works provide a reliable map of the field's intellectual core, and they fall into four mutually reinforcing themes. The first, consumer trust and privacy, is the largest: the two most cited documents examine the role of trust and privacy in customer experience with AI services (218 citations) and ethical and privacy considerations in fintech (177 citations). The second, fairness and non-discrimination, appears in work on involving end-users in interactive AI fairness and on detecting and explaining unfairness in consumer contracts. The third, transparency and explainability, is visible in studies of consumers' willingness to pay for explainable AI and of data subjects' attitudes toward transparency and accuracy. The fourth, ethical and regulatory governance of consumer data, runs through work on protecting consumers from collusive algorithmic pricing, on consumer privacy protection in online shopping, and on the ethics of consumer wearables. Taken together, these themes mirror almost exactly the principles that consumer-protection and data-protection policy seek to operationalise, namely privacy, fairness, transparency, and accountable governance. This tight alignment between scholarship and policy is the clearest dividend of focusing the corpus on consumer protection specifically rather than on AI in general.

3.9. Field maturity and citation impact

The impact profile is consistent with an emerging but consequential field. A corpus h-index of 19, a mean of 8 citations per document, and 52.1% of documents already cited together indicate meaningful uptake for a literature whose substantive growth is only five years old. Impact is, however, concentrated: a small number of influential papers account for a large share of the 1,542 total citations, while the large 2024–2025 cohorts have had little time to accumulate citations. The apparent fall in citations for the most recent years in Figure 2 is therefore an artefact of citation lag rather than declining influence, and the 53 documents recorded for 2026 reflect a partial publication year captured at the 27 June 2026 retrieval. The combination of rapid recent output and a still-forming citation base suggests the field is entering, rather than leaving, its formative phase.

3.10. Publication venues and access

These two structural features have practical implications. The skewed distribution of output in *IEEE Transactions on Consumer Electronics* against the backdrop of a long tail of 155 other sources suggests that the field lacks clear disciplinary homes that could facilitate the development of common methodologies and standards. At the same time, just 23.4% of the body of research is available in an open format (39 gold, 5 green, and 1 bronze against 147 closed), thus limiting the spread of the information precisely to those who will benefit from it – the regulators, consumer groups, and professionals working in low-resource environments.

3.11. Implications for Indonesia's personal data protection framework

With the above-mentioned thematic framework, one can gain an insight into consumer protection issues in the context of Indonesia, which has seen a rapid emergence of digital services that employ AI technologies in e-commerce, digital lending, and ride-hailing sectors. The fundamental legislative tools in Indonesia in regard to consumer protection include the Consumer Protection Law (No. 8/1999) (Consumer Law, 1999; Rosadi & Pratama., 2016; Yuniarti, 2019), and the more contemporary Personal Data Protection Law (No.

27/2022)(Insani et al., 2024). While the former law establishes the basic rights of consumers, it was enacted prior to the emergence of automated decision-making technologies, the latter establishes for the first time the comprehensive rights of data subjects and obligations of controllers in accordance with the internationally recognized data protection principles.

Mapping these four research themes in the current framework reveals the areas where improvement holds the most promise. With respect to privacy and trust, Indonesia already has legislation that provides a sound legal basis in the form of the Personal Data Protection Law; the next step is implementation, which should include setting up and funding the supervisory body, issuing implementing regulations, and ensuring proper informed consent rather than consent per se. As regards transparency and explainability, it could be enhanced through the imposition of obligations on the side of data subjects to notify of the automation of a significant decision and to explain the main elements of the reasoning process behind the decision in a topic where the reviewed literature shows that the need is recognized among consumers. In the realm of fairness and non-discrimination, at present there are no Indonesian measures requiring a bias test or auditing of algorithms that make decisions affecting consumers (such as credit scoring and pricing algorithms); such reasonable obligations could plug what was found to be a major gap in the literature on the subject. Finally, in the sphere of accountable governance and redress, there seems to be a weakness that persists in different jurisdictions; Indonesia could complement its data protection obligations with cost-effective means for challenging the consequences of automation and seeking compensation for any harm.

There are two practical reasons why the improvements could not be more timely for Indonesia. First, considering that the digital adoption is happening rapidly and in the mobile first fashion, security measures will prove effective only if they are stated in simple Indonesian through applications which people use on a regular basis, and not through convoluted notice statements. Second, since the regulatory structure is still evolving, it presents an opening where AI-aware regulatory advice can be incorporated from the get-go, and not after the fact. The integration of implementing regulations with the four evidence-based principles of privacy, transparency, fairness, and accountability, will provide Indonesia with a mechanism to make good use of its good legislative foundation by ensuring protection of AI service users, while remaining compatible with international standards.

3.12. *Limitations*

Several limitations follow from the design. By choice, the analysis draws on a single database, Scopus, so coverage differs from multi-database designs that also include Web of Science. Because the export contained no abstracts or author keywords, the focused corpus was delineated by screening titles; relevant work whose titles do not explicitly name consumer or protection concepts may therefore have been missed, and the boundary of what counts as consumer protection involves judgement. The absence of abstracts, keywords, and affiliations also precluded keyword co-occurrence, thematic mapping, and country-level analysis, so the thematic structure in Section 4.2 is inferred from the most cited titles rather than from full-text coding. Citation counts and the open-access profile are time-sensitive and reflect the state of Scopus on 27 June 2026, and the 2026 publication year is incomplete. Finally, author counts are affected by name-disambiguation limits inherent to large bibliographic datasets. These constraints point to natural extensions, including multi-database and full-metadata analyses, science-mapping of thematic and collaboration structures, and a closer doctrinal study of how the four themes are reflected in Indonesian implementing regulations

4. **Conclusion**

This bibliometric study mapped the Scopus-indexed literature on consumer protection in AI, screening 3,307 retrieved records down to a focused corpus of 192 documents published between 2018 and 2026. The field is young and expanding, led by journal articles, dispersed

across 155 sources around the anchor venue *IEEE Transactions on Consumer Electronics*, and authored by 603 researchers, having accumulated 1,542 citations and a corpus h-index of 19. Its most influential works concentrate on consumer trust and privacy, fairness, explainability, and the ethical governance of consumer data, the same concerns that animate consumer-protection policy.

Collectively, the results form a replicable and condensed roadmap of the progression of research on protecting consumers from AI-based risks, thus providing a basis for future research and policies in this area. The extension of the study to include several databases and all metadata will enable thematic and collaborative maps, while longitudinal mapping of the field will show how scholars respond to the evolving nature of AI governance, even in emerging economies like Indonesia.

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