A Thousand Minarets, A Million Parameters: Machine Learning Research for Islamic and Muslim-World Challenges

Dayam Nadeem [1] **Safdar Mustafa** [1] **Shehzad Ali** [2] **Shahab Saquib Sohail*** [1]

Abstract

Islamic thought and artificial intelligence (AI) have become an exciting and fast-developing scientific field in an interdisciplinary research context. A keyword query was used to identify 445 documents from Scopus-indexed journals that included AI/ML and Islamic jurisprudential concepts *(maqasid, fiqh, fatwa, halal, Islamophobia, etc.)*. The publication trend is analysed, key sources and authors identified, and the thematic development of this field explored, using the *bibliometrix* R-package. Annual output surged from 36 documents in 2020 to 159 in 2025, with a Lotka-curve growth peak around 2024–2025 ($K \approx 449$). The vast majority of this research is led by scholars from Muslim-majority countries, notably Indonesia, Malaysia, and Saudi Arabia, with Qatar and the United Kingdom emerging as the leading countries in citation impact. Thematic clusters range from Qur'anic NLP, Islamic fintech, and AI ethics governance to halal tourism, supply chain, and Islamophobia detection. New frontiers encompass Sharī′ah-grounded AI ethics benchmarking and LLM-based Islamic jurisprudence assistants.

1. Introduction

Artificial intelligence and machine learning are reshaping virtually every domain of human activity, including religion, ethics, and law (Sohail et al., 2026; Jobin et al., 2019). Within the Islamic scholarly tradition, the permissibility, ethical grounding (*maqāsid al-sharī′ah*), and jurisprudential implications (*fiqh*, *fatwā*) of AI technologies represent a highly significant area of inquiry, one where scholarly contributions from the Muslim world may play a meaningful role in shaping global AI governance (Elmahjub, 2023). Simultaneously, AI researchers have found Islamic corpora—the Qur'an, Hadith, and classical legal texts to be rich benchmarks for NLP, question-answering, and classification tasks.

Scholars and institutions from Muslim-majority countries are actively influencing the role of AI in religious knowledge, ethical governance, and Islamic financial systems. This growing contribution deserves systematic recognition. Although this activity has been ongoing, no structured survey of the entire literature at this intersection exists. Science mapping methods offer an objective and reproducible lens: they capture scholarly productivity, map intellectual networks, and reveal thematic clusters without the selection bias inherent in narrative reviews (Aria & Cuccurullo, 2017).

This study is guided by four research questions: **RQ1** How has this research area grown over time? **RQ2** What are the major Islamic issues being explored, and which authors, scholars, and Muslim/Islamic countries are contributing to this research area? **RQ3** What thematic clusters characterise the literature and how have they evolved? **RQ4** What are the emerging frontiers?

2. Methodology

2.1. Search Strategy

Data were retrieved from **Scopus** on 24 May 2026 using:

```
("Islamic ethics" OR "maqasid" OR
"sharia" OR "niyyah" OR "islam"
OR "Quran" OR "fiqh" OR "fatwa"
OR "halal" OR "Islamophobia")
AND ("artificial intelligence"
OR "machine learning" OR "large
language model" OR "generative AI")
```

Restricted to 2020–2026, the initial retrieval yielded 594 documents, filtered to English and Malay language articles and conference papers, yielding a final corpus of 445 documents. The *bibliometrix* R-package (Aria & Cuccurullo, 2017) was used for descriptive statistics, source and author impact (h-, g-, m-indices), country collaboration (SCP vs. MCP), co-word networks (Louvain), thematic mapping, and Lotka lifecycle modelling.

[1]Jamia Hamdard, India [2]Sungkyunkwan University, South Korea. Correspondence to: Shahab Saquib Sohail <shahabssohail@jamiahamdard.ac.in>.

Published at the 6th Muslims in Machine Learning (MusIML) Workshop (ICML-26), Seoul, South Korea, July 9, 2026.

Table 1. Annual production and average citation indicators.

YEAR	ARTICLES	MEAN CIT./ART.	MEAN CIT./YEAR
2020	36	15.53	2.22
2021	38	12.18	2.03
2022	28	11.21	2.24
2023	59	10.03	2.51
2024	81	5.01	1.67
2025	159	1.36	0.68
2026	44	0.20	0.20
TOTAL	**445**	5.75	–

3. Results

3.1. Publication Growth and Lifecycle (RQ1)

Figure 1 traces annual output alongside the fitted Lotka growth curve. The field expanded at **3.4% per year**, accelerating sharply from 2023 onward, as shown in Table 1.

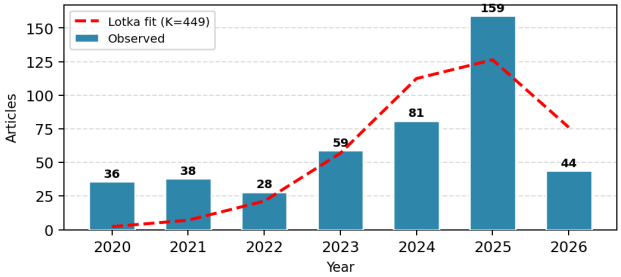

Figure 1. Annual scientific production (2020–2026) with Lotka growth-curve fit ($K = 449$, peak $\approx$ 2024.7).

Growth was modelled using the Lotka lifecycle function, a well-established bibliometric tool for capturing the rise-and-fall dynamics of emerging research fields (Ravikumar et al., 2015; Cobo et al., 2011). The model yields $K = 449.5$, $t_m = 2024.7$, $\Delta t = 3.77$ years ($R^2 = 0.58$, RMSE$= 27.3$). The 10th-percentile year is 2022.8 and the 90th-percentile is 2026.6, placing the field near the end of its fastest-growth phase. Annual output is forecast to moderate to $\sim$31 in 2027, though the ongoing generative AI wave may reset this trajectory. Average document age is 2.28 years; average citations per document stand at 5.75 across 41,347 total references.

3.2. Islamic Issues, Authors, and Contributing Countries (RQ2)

3.2.1. MOST PRODUCTIVE SOURCES

Figure 2 reveals *Quranica – International Journal of Qur'anic Research* as the leading outlet (24 articles, all 2025–2026), followed by *Lecture Notes in Networks and Systems* (13) and *IJACSA* (10). The prominence of *Quranica* signals a major surge of Qur'anic NLP research driven by

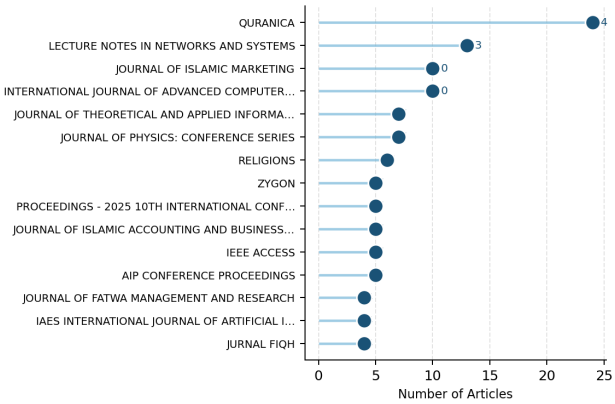

Figure 2. Top 15 most productive sources (lollipop chart).

Indonesian and Malaysian scholars. By citation impact, the *Journal of Islamic Marketing* achieves the highest g-index (10) and m-index (1.0), with an h-index of 4 shared by *IEEE Access* and *Religions*.

3.2.2. CONTRIBUTING AUTHORS AND SCHOLARS

Figure 3 maps the most active researchers in this field. Zuherman RUSTAM (Indonesia) leads with 7 articles, followed by ALSALKA and ATWELL (UK), BATTOUR (Malaysia), HUDAEFI (Indonesia), and RABBANI (Saudi Arabia/India) at 4 articles each. The majority are affiliated with institutions in Muslim-majority countries, reflecting a sustained scholarly engagement with AI from within Islamic academic traditions. By local citation impact, ELMAHJUB (Libya/Australia) and QADIR (Pakistan) each lead with 22 intra-corpus citations.

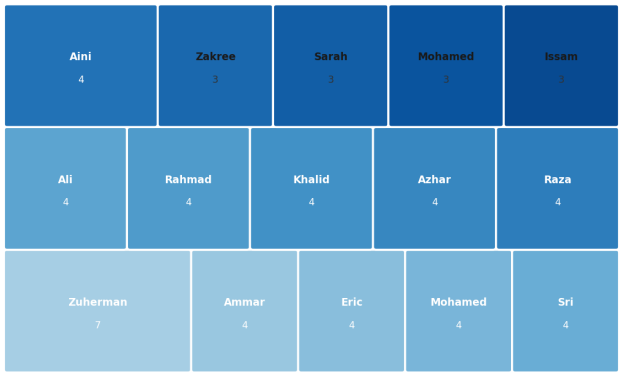

Figure 3. Top 15 most relevant authors by article count (treemap).

3.2.3. MUSLIM AND ISLAMIC COUNTRIES: PRODUCTION VS. IMPACT

Figure 4 shows that **Indonesia** (248 articles) and **Malaysia** (212) lead global production, with **Saudi Arabia** (91), **Turkey** (45), **Egypt** (34), **Iran** (28), **Pakistan** (24), and

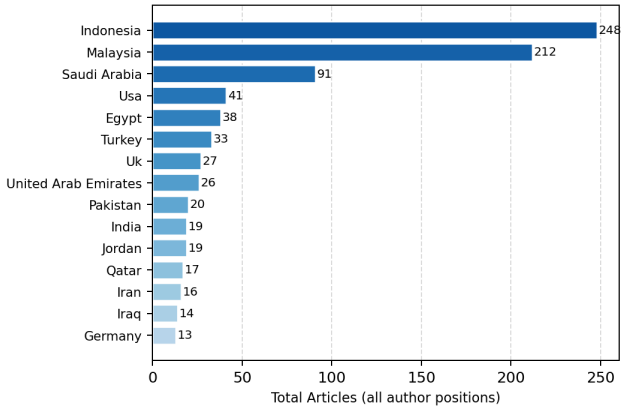

Figure 4. Top 15 countries by total article count (bubble dot plot).

the **UAE** (21) also featuring prominently collectively accounting for over 70% of the corpus. This geographic concentration in the Islamic world reflects the intrinsic scholarly motivation to examine AI through the lens of Islamic ethics, jurisprudence, and digital economy priorities.

Figure 5 reveals an important nuance: Qatar (28.1 avg citations/article), the UK (31.9), and the UAE (20.9) generate substantially higher citation impact per paper than high-volume producers, suggesting that internationally collaborative outputs achieve greater global visibility. Table 2 summarises country-level output and citation impact. The international co-authorship rate stands at **26.3%**. Jordan (60%), UK (57.1%), and Qatar (55.6%) show the highest multi-country paper rates.

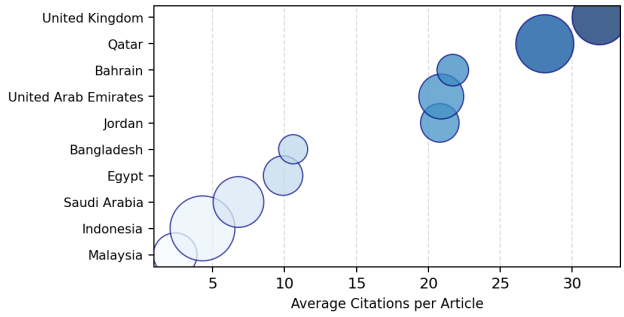

Figure 5. Top 10 countries by average citation impact per article. Bubble size represents total citation count.

3.3. Highly Cited Documents

Figure 6 and Table 3 present the most globally cited works in this corpus. Vidgen & Yasseri (2020) leads with 140 citations for their work on detecting Islamophobic hate speech on social media. Elmahjub (2023) is the most influential normative contribution (69 citations; 22 local citations), explicitly calling for pluralist AI ethics benchmarking that incorporates Islamic frameworks alongside Western liberal traditions. Raquib et al. (2022) articulates Islamic virtue-based principles for AI design (47 citations).

Table 2. Top countries by corresponding-author output and citation impact. (Cit. = Citations; Avg = Average citations per article.)

Country	Articles	Total Cit.	Avg Cit.
Indonesia	74	319	4.3
Malaysia	58	137	2.4
Saudi Arabia	28	189	6.8
Egypt	11	109	9.9
USA	10	47	4.7
Qatar	9	253	28.1
Turkey	9	18	2.0
UAE	7	146	20.9
UK	7	223	31.9

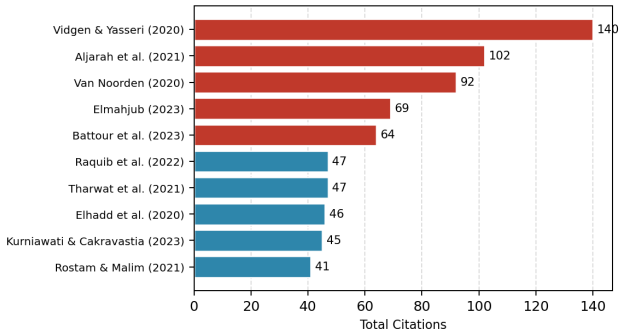

Figure 6. Top 10 globally cited documents. Red bars: ≥60 citations.

3.4. Keyword Trends and Thematic Evolution (RQ3, RQ4)

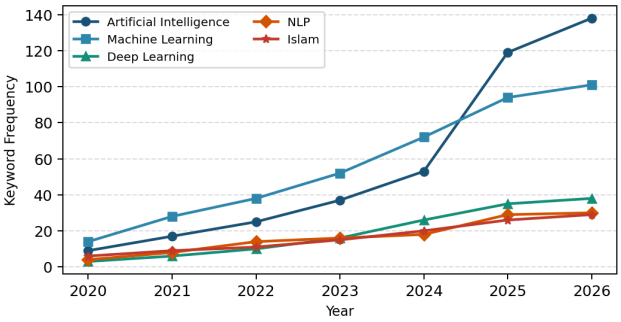

Figure 7. Frequency of top keywords over time (2020–2026).

Figure 7 traces how the vocabulary of this field has evolved. "Artificial intelligence" overtakes "machine learning" as the dominant term in 2025–2026, driven by the generative AI wave. "Islam" as a standalone keyword remains stable, indexing a persistent applied-NLP thread rather than the ethics and governance discourse, which surfaces under "Islamic ethics" and "maqasid".

Table 3. Top-10 most globally cited documents.

Document	Year	Cit.
Vidgen & Yasseri Vidgen & Yasseri 2020	2020	140
Aljarah et al. Aljarah et al. 2021	2021	102
Van Noorden Van Noorden 2020	2020	92
Elmahjub Elmahjub 2023	2023	69
Battour et al. Battour et al. 2023	2023	64
Tharwat et al. Tharwat et al. 2021	2021	47
Raquib et al. Raquib et al. 2022	2022	47
Elhadd et al. Elhadd et al. 2020	2020	46
Kurniawati & Cakravastia Kurniawati & Cakravastia 2023	2023	45
Rostam & Malim Rostam & Malim 2021	2021	41

Figure 8 uncovers a three-phase intellectual evolution:

Phase 1 (2020–2022): Classical ML methods were explored and applied to Islamic text corpora and Arabic NLP the *foundation* phase.

Phase 2 (2023–2024): The scope extended to deep learning, AI for halal tourism, Islamic fintech, and Qur'anic QA the *expansion* phase.

Phase 3 (2025–2026): The emergence of *benchmarking* and *shariah compliance* as trend keywords signals a shift from applying AI to Islamic data toward evaluating AI against Islamic normative standards the *normative convergence* phase.

Six thematic clusters were identified: (1) **Islamic AI Ethics & Governance**; (2) **Arabic/Qur'anic NLP**; (3) **Islamophobia & Hate Speech**; (4) **Halal Tourism & Supply Chain**; (5) **Jurisprudence & QA**; and (6) **Islamic Fintech & Blockchain**. Clusters 5 and 6 occupy the emerging/niche quadrant, signalling rapid growth from a focused base.

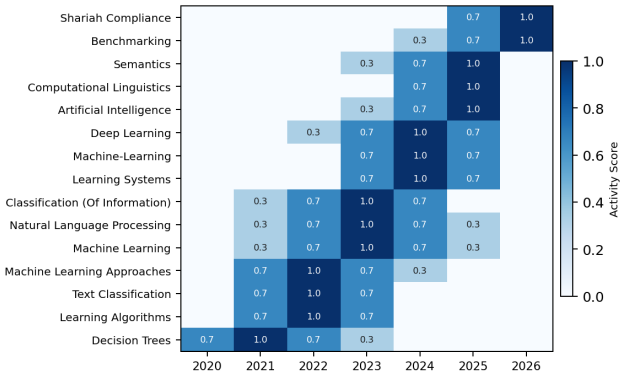

Figure 8. Trend topics heatmap: keyword activity scores.

4. Discussion

Dual-track structure. The corpus organises into two distinct tracks: *AI-for-Islam* applying ML/NLP to Islamic texts and services; and *Islam-for-AI* drawing on Islamic jurisprudence to evaluate and govern AI systems. The second track is newer but more highly cited (Elmahjub, 2023; Raquib et al., 2022), suggesting it as a potential intellectual frontier.

Geographic productivity–impact gap. Indonesia and Malaysia produce ∼30% of all output but achieve modest citation rates (4.3 and 2.4 citations/article), compared with Qatar (28.1) and the UK (31.9). As Muslim-majority countries, Indonesia and Malaysia contribute nearly ten times more articles than the UK and Qatar, which naturally dilutes their average citations per article a well-known volume-dilution effect in bibliometrics. Greater international collaboration could help boost global visibility.

Generative AI inflection. The 2025 output surge (159 articles) and the rising dominance of "artificial intelligence" as a keyword are consistent with post-ChatGPT diffusion of LLM research into Islamic scholarship. This may invalidate the Lotka saturation prediction and initiate a new growth phase (Cobo et al., 2011).

Limitations. The study is limited to Scopus; grey literature and non-indexed Arabic/Malay proceedings are excluded. Regional self-citation practices may affect citation counts.

5. Conclusion

This study examined 445 Scopus documents (2020–2026) at the Islamic ethics AI nexus, tracing the field's growth, mapping key contributors, and uncovering its evolving intellectual structure. The field expanded at 3.4% annually; Indonesia, Malaysia, and Saudi Arabia lead in output, while Qatar and the UK lead in citation impact. Six thematic clusters were identified, with a clear shift from applying AI to Islamic data toward using Islamic principles to evaluate and govern AI systems. The newest emerging themes *benchmarking* and *shariah compliance* point toward a future where Muslim scholars may contribute a meaningful voice to global conversations on responsible and ethical AI.

Acknowledgements

The authors would like to thank the open-access scientific community whose published work forms the foundation of this bibliometric analysis. The developers of Biblioshiny, through their *bibliometrix* R package, provided essential analytical tools which enabled this research to proceed. The authors declare no conflicts of interest and received no specific funding for this research.

References

Aria, M., & Cuccurullo, C. (2017). bibliometrix: An R-tool for comprehensive science mapping analysis. *Journal of Informetrics*, 11(4), 959–975. https://doi.org/10.1016/j.joi.2017.08.007

Jobin, A., Ienca, M., & Vayena, E. (2019). The global landscape of AI ethics guidelines. *Nature Machine Intelligence*, 1(9), 389–399. https://doi.org/10.1038/s42256-019-0088-2

Sohail, S.S., Madsen, D.O., Nadeem, M., & Cambria, E. (2026). Ethical AI in business. *IEEE Intelligent Systems*, 1–12. https://doi.org/10.1109/MIS.2026.3688455

Aljarah, I., Habib, M., Hijazi, N., & Faris, H. (2021). Intelligent detection of hate speech in Arabic social network: A machine learning approach. *Journal of Information Science*, 47(4), 483–501. https://doi.org/10.1177/0165551520917651

Battour, M., Mady, K., Salaheldeen, M., & Elsotouhy, M. (2023). AI-enabled technologies to assist Muslim tourists in halal-friendly tourism. *Journal of Islamic Marketing*, 14(5), 1291–1309. https://doi.org/10.1108/JIMA-05-2021-0136

Cobo, M.J., López-Herrera, A.G., Herrera-Viedma, E., & Herrera, F. (2011). Science mapping software tools: Review, analysis, and cooperative study among tools. *Journal of the American Society for Information Science and Technology*, 62(7), 1382–1402. https://doi.org/10.1002/asi.21525

Elhadd, T., Mall, R., Bashir, M., et al. (2020). Artificial intelligence (AI) based machine learning models predict glucose variability and human insulin requirements in type 1 diabetes. *Diabetes Research and Clinical Practice*, 169, 108388. https://doi.org/10.1016/j.diabres.2020.108388

Elmahjub, E. (2023). Artificial intelligence (AI) in Islamic ethics: Towards pluralist ethical benchmarking for AI. *Philosophy & Technology*, 36(4), 92. https://doi.org/10.1007/s13347-023-00668-x

Kurniawati, J., & Cakravastia, A. (2023). Halal supply chain management: A literature review and future research directions. *Cleaner Logistics and Supply Chain*, 6, 100090. https://doi.org/10.1016/j.clscn.2022.100090

Raquib, A., Channa, B., Zubair, T., & Qadir, J. (2022). Islamic virtue-based ethics for artificial intelligence. *Discover Artificial Intelligence*, 2, 28. https://doi.org/10.1007/s44163-022-00028-2

Ravikumar, S., Agrahari, A., & Singh, S.N. (2015). Mapping the intellectual structure of scientometrics: A co-word analysis of the journal Scientometrics (2005–2010). *Scientometrics*, 102(1), 929–955. https://doi.org/10.1007/s11192-014-1402-8

Rostam, N.A.P., & Malim, N.H.A.H. (2021). Text categorisation in Quran and Hadith using machine learning and term weighting. *Journal of King Saud University – Computer and Information Sciences*, 33(8), 874–884. https://doi.org/10.1016/j.jksuci.2019.04.013

Tharwat, A., Schenck, W., & Hassanien, A.E. (2021). Feature extraction: A survey of the types, techniques, applications. *Journal of Electrical and Computer Engineering*, 2021, 3145622. https://doi.org/10.1155/2021/3145622

Van Noorden, R. (2020). The ethical questions that haunt facial-recognition research. *Nature*, 587, 354–358. https://doi.org/10.1038/d41586-020-03187-3

Vidgen, B., & Yasseri, T. (2020). Detecting weak and strong Islamophobic hate speech on social media. *Journal of Information Technology & Politics*, 17(1), 66–78. https://doi.org/10.1080/19331681.2019.1702607