Information Research Communications, 2025; 2(3):369-376.
https://inforescom.org

Research Article

Artificial Intelligence Research in Africa and the Importance of Recall Concept

Anastassios Pouris[1,*], Androniki Thirion[2]

[1]University of Pretoria, EBIT Faculty, Public University in Pretoria, Pretoria, SOUTH AFRICA.
[2]Quantitative Evidence Research Consultancy Services cc, Pretoria, SOUTH AFRICA.

ABSTRACT

Introduction: This article investigates the publication performance of African countries in the field of Artificial Intelligence (AI), with a particular emphasis on the methodological importance of recall in scientometric analyses. Recall rate plays a pivotal role in shaping research funding decisions, influencing resource allocation and determining the effectiveness of funded projects. Our investigation reveals that several stakeholders publish research with limited emphasis on the shortcomings of recall. This potentially undermines the robustness of policy recommendations and validity of findings. This article aims to rectify the findings of deficient investigations related to AI research in Africa and provide findings closer to reality. **Methodology:** In this article using an extensive search strategy comprising over 387 search terms, 19 AI-focused journals, and the Web of Science category "Computer Science: Artificial Intelligence,". **Results:** we identify a significant growth in AI publications across Africa-from 1,659 in 2014 to 6,756 in 2023. Egypt leads with 11,920 publications and it is followed by South Africa (7,221), Tunisia (6,987), and Morocco (6,013). China is identified as a key funder of AI research in Africa. Collaboration patterns show a preference for international partnerships over intra-African collaboration. **Conclusion:** The article concludes with policy recommendations and a critique of methodological practices in AI-related scientometric studies.

Keywords: Africa, Artificial Intelligence, Methodologies, Recall concept, Scientometrics.

Correspondence:
Prof. Anastassios Pouris
University of Pretoria, EBIT Faculty, Public University in Pretoria, Pretoria, SOUTH AFRICA.
Email: apouris@icon.co.za

Received: 11-07-2025;
Revised: 24-09-2025;
Accepted: 06-11-2025.

INTRODUCTION

Artificial Intelligence (AI) is reshaping global innovation ecosystems, offering transformative potential across sectors such as healthcare, agriculture, education and infrastructure. In Africa, AI presents unique opportunities to address systemic challenges and support inclusive development (Trabelsi, 2024). Examples range from improving healthcare accessibility in remote areas to advancing precision agriculture in regions affected by adverse climate change conditions to facilitating the improvement and development in infrastructural facilities and systems However, the continent's AI research landscape remains underexplored, particularly in terms of its scientometric characteristics, funding dynamics and collaboration networks (AUDA-NEPAD, 2021).

The current article leverages scientometric analyses to explore the current state and trajectory of AI research and application across Africa. By analysing scientometric patterns in academic research, collaborative networks and funding trends, we aim to highlight Africa's emerging role in AI innovation but also to identify potential areas for growth, collaboration and investment to drive the Continent's technological future forward.

A key methodological concern addressed in this article is the challenge of recall rate in scientometric investigations. Recall-the proportion of relevant publications successfully retrieved by a search strategy-is often underemphasized in AI-related bibliometric studies (Zhang *et al.*, 2008). This oversight can lead to incomplete datasets, biased interpretations, and ultimately, flawed policy recommendations. In fast-evolving fields like AI, where terminology is diverse and rapidly changing, low recall can significantly distort assessments of national research performance, funding impact and dynamics collaboration. By foregrounding recall as a critical metric, this article seeks to improve the methodological robustness of African AI research mapping and offer more accurate insights for evidence-based policy and strategic planning. The article also makes a substantive contribution in the methodological frameworks utilised in scientometric investigations in fast growing research fields like the artificial intelligence one.

The literature review elaborates on the scientometric approaches utilised for investigating issues of artificial intelligence and the

OPEN ACCESS

Manuscript TECHNOMEDIA

DOI: 10.5530/irc.2.3.36

Publishing Partner : Manuscript Technomedia. [www.mstechnomedia.com]

methodology section focuses on the approach we utilise for the current investigation. The findings section describes our findings, and the section discussion elaborates on the findings and develops recommendations.

LITERATURE REVIEW

Scientometric approaches are increasingly employed to analyze the evolution and impact of Artificial Intelligence (AI) research both globally and within Africa. These methods offer valuable insights into publication trends, collaboration networks and thematic developments. Common techniques include keyword searches, bibliometric mapping, co-citation analysis and bibliographic coupling.

Keyword Searches involve using specific terms or phrases to locate relevant articles in databases. Their effectiveness is governed by two key metrics: precision (the proportion of retrieved documents that are relevant) and recall (the proportion of relevant documents that are retrieved). As Buckland (1994) notes, precision and recall are often tension-improving one may reduce the other. In fast-evolving fields like AI, where terminology proliferates rapidly, recall becomes especially critical for comprehensive analysis.

Discipline Categorization is a foundational step that determines how publications are grouped and analysed by subject area. Major bibliometric databases like Web of Science (WoS) and Scopus, use structured classification systems to assign publications to disciplines. For example, in the WoS each journal is assigned to one or more of ~250 subject categories (e.g., "Computer Science: Artificial Intelligence"; "public health" etc.). Scopus also uses a journal classification system called the All Science Journal Classification (ASJC) system. ASJC includes ~330 subject areas grouped into 27 broad disciplines (e.g., "Engineering", "Computer Science" etc.,). Analyses based on categories reflecting journal-level discipline boundaries may not capture article-level interdisciplinarity or articles published in multidisciplinary journals.

Bibliometric Mapping provides spatial representations of how disciplines, fields, specialties and individual documents are related (Small, 1999). Tools such as VOSviewer and CiteSpace are commonly used to visualize these relationships.

Co-citation Analysis measures how frequently two documents are cited together, revealing intellectual linkages (Small, 1973). Bibliographic Coupling identifies connections between documents that cite common references (Martyn, 1964).

Full-Text and Abstract Mining refer to using natural language processing or machine learning to analyse full texts or abstracts for relevance (Yau *et al*., 2014).

Despite the utility of these methods, few studies have applied them rigorously to African AI research. Foundational works by (Pouris *et al*., 2014; Sooryamoorthy 2021) provide broad assessments of African research systems but do not delve deeply into AI-specific dynamics. More recent studies have begun to fill this gap, though many rely on limited keyword strategies that constrain their scope and recall.

A number of studies use limited keyword strategies to achieve their objectives. Examples include the following: (Njei *et al*., 2023) investigated AI applications in African healthcare using PubMed, Scopus, and Web of Science. Their search terms included clusters related to AI ("Artificial Intelligence," "Machine Learning," "Deep Learning"), technical processes ("Feature extraction," "Classification," "Detection"), and performance metrics ("Precision," "Recall," "F-score"). Despite this structured approach, only 26 relevant articles were identified across 31 countries. The authors also performed backward citation analysis but did not employ iterative keyword expansion or subject category filters, limiting the comprehensiveness of their dataset. (Kondo *et al*., 2023) examined general AI research in Africa from 2013 to 2022 using Scopus. Their keyword strategy was broad but shallow, relying primarily on "Artificial Intelligence," "Machine Learning," "Deep Learning," and "Natural Language Processing." This yielded 1,644 publications-higher than Njei *et al*., but still modest compared to high-recall studies. The absence of term expansion and journal filters likely contributed to under coverage of emerging subfields and interdisciplinary work.

(Lianou *et al*., 2022; Pandey *et al*., 2021) conducted global AI reviews using short keyword strings, often restricted to "AI," "ML," or "DL." These studies, while methodologically sound in other respects, suffer from low recall and are less suitable for regional or sectoral benchmarking.

- In contrast with the above investigations (Liu *et al*., 2021) developed a multi-stage scientometric approach to maximize recall while maintaining conceptual precision. Their methodology involved: Benchmarking Core Records using a combination of keyword and journal filters.
- Keyword Extraction and Frequency Analysis from "Author Keywords" and "Keywords Plus."
- Co-occurrence Analysis and Manual Refinement to validate term relevance.
- Augmentation via Subject Category Search using the Web of Science category "Computer Science: Artificial Intelligence."

The approach is described in more detail in the Methodology section

Liu *et al*., compared their results with those of (Gao *et al*., 2019; Zhou *et al*., 2020; WIPO, 2021). Their approach retrieved 100% of Gao's records and 78% of Zhou's, while excluding over 50% of

WIPO's broader but less precise dataset. This demonstrated the superiority of high-recall strategies in capturing the full spectrum of AI research.

In the African context, where AI research is emerging across diverse sectors and institutions, high-recall methodologies are essential to ensure visibility of underrepresented actors and themes. Studies with limited keyword sets risk producing skewed or incomplete findings, which can misinform policy decisions, funding allocations and strategic planning. As Liu *et al*., argue, the use of hundreds of validated keywords, journal filters and subject categories is not merely a technical enhancement but a methodological imperative.

To summarise the reliance on short or generic search strings in many scientometric studies risks underestimating the true scale and diversity of AI research. This has serious implications particularly for scientifically small countries and expensive scientific disciplines. Incomplete data may lead to skewed assessments of national research capacity, affecting funding and strategic planning. Furthermore, low-recall studies may overlook emerging areas or underrepresented institutions, distorting investment priorities. Finally, it should be emphasised that publishing studies with flawed methodologies in peer-reviewed journals undermines the integrity of scientometric research.

METHODOLOGY

This investigation adopts and adapts the high-recall scientometric methodology developed by (Liu *et al*., 2021), which was specifically designed to overcome the limitations of narrow keyword-based searches in fast-evolving fields such as Artificial Intelligence (AI). Traditional bibliometric studies often rely on a small set of generic terms-such as "Artificial Intelligence" or "Machine Learning"-which can lead to significant under-coverage of relevant literature. Liu *et al*. proposed a multi-stage, systematic approach to maximize recall while maintaining conceptual precision, thereby improving the robustness of scientometric analyses and policy-relevant insights.

The first step involved identifying a set of core AI publications to serve as benchmarking records. This was achieved by combining two filters:

- A core keyword search using "Artificial Intelligence" in the title, abstract, and keywords.
- A journal filter, selecting publications from 19 leading AI-focused journals indexed in the Web of Science (WoS) and Scopus databases.

These benchmarking records were assumed to represent high-confidence AI literature and formed the basis for subsequent keyword expansion.

The second step involved keyword extraction and frequency analysis. Using the benchmarking records, Liu *et al*., extracted two types of metadata:

- Author Keywords: Terms provided by authors to describe their work.
- Keywords Plus: Terms algorithmically generated by WoS based on the titles of cited references.

The frequency of each keyword was calculated, and high-frequency terms were subjected to semantic validation. This involved cross-referencing definitions and usage contexts from authoritative online sources (e.g., Wikipedia, ACM Digital Library, IEEE Xplore) to ensure that each term was genuinely relevant to AI and not a generic statistical or computational concept.

The next step involved co-occurrence analysis and manual refinement. To refine the keyword set, Liu *et al*., conducted co-occurrence analysis using tools such as VOSviewer and CiteSpace. This helped identify clusters of related terms and eliminate outliers or ambiguous keywords. Manual inspection was also employed to validate the inclusion of terms based on their conceptual relevance to AI. For example, terms like "neural network," "reinforcement learning" and "natural language processing" were retained, while more generic terms like "logistic regression" or "fuzzy logic" were excluded unless they appeared in explicitly AI-related contexts.

The final step involved augmenting the refined keyword set with a subject category filter. Specifically, Liu *et al*., used the WoS category "Computer Science: Artificial Intelligence" to capture additional relevant records that may not have been retrieved through keyword searches alone. This hybrid strategy-combining keyword expansion with subject classification-ensured both breadth and depth in the dataset.

To validate their methodology, Liu *et al*., compared their results with three prominent studies:

- Gao *et al*., (2019): Focused on AI patenting and publication trends.
- Zhou *et al*., (2020): Used a narrower keyword set to map global AI research.

Table 1: Regional AI publications.

Region	Number of Publications
Northern Africa	31 228
Southern Africa	7 482
Western Africa	4 438
Eastern Africa	3 740
Central Africa	542

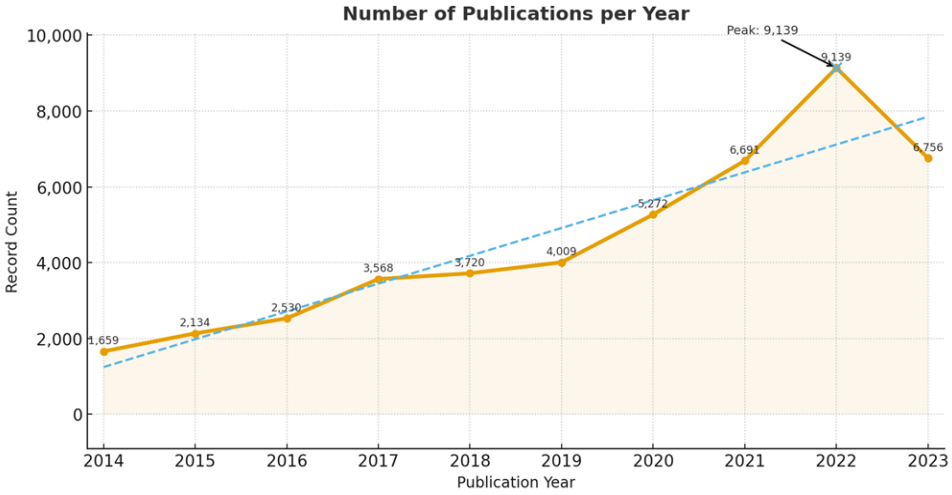

Figure 1: Number of AI publications per year: Africa 2014-2023.

Table 2: **Funding Agencies; North Africa.**

T 2: Funding Agencies; North Africa	Record Count
National Natural Science Foundation of CHINA NSFC	556
King Saud University	555
Princess Nourah Bint Abdulrahman University	442
Egyptian Knowledge Bank EKB	385
Science and Technology Development Fund STDF	365
King Khalid University	299
European Union EU	295
Natural Sciences and Engineering Research Council of Canada NSERC	197
Spanish Government	185
Ministry of Higher Education Scientific Research of Tunisia	183

Table 3: **Funding Agencies: Southern Africa.**

T 3: Funding Agencies: Southern Africa	Record Count
National Research Foundation South Africa	569
National Natural Science Foundation of China NSFC	207
UK Research Innovation UKRI	206
National Science Foundation NSF	164
European Union EU	131
United States Department of Health Human Services	128
National Institutes of Health NIH USA	127
National Research Foundation NRF	109
National Research Foundation	102
Research Council of Finland	98

- WIPO (2021): Employed a broader search strategy that included also statistical and mathematical terms.

Liu *et al.*, successfully retrieved 100% of Gao's records and 78% of Zhou's, demonstrating strong coverage. However, they found that 54% of WIPO's results included documents that did not meet their conceptual definition of AI-highlighting the trade-off between recall and precision. Their critique emphasized the importance of excluding overly generic terms to avoid inflating AI publication counts with unrelated literature.

For the current investigation, we replicate Liu *et al.*, methodology to assess the scale and scope of AI research across the African continent. We applied the refined keyword set, journal filters, and subject category search to the WoS and Scopus databases, focusing on the period 2014-2023. The full list of search terms, journal titles, and classification criteria is provided in Appendices 1 and 2. This approach ensures high recall and conceptual precision, enabling a more accurate mapping of Africa's AI research landscape and informing evidence-based policy recommendations.

AI Research in Africa

Our investigation identifies that African researchers were involved in 45 937 AI publications indexed in the WoS during the period 2014-2023. The drop during 2023 can be argued that it is the result of the pandemic of COVID 2019- a post pandemic correction. During the COVID-19 years (2020-2022), there was an explosive surge in publications, especially in health and biomedical fields. Researchers rushed to publish findings on vaccines, treatments, and public health strategies. In 2023 the publishing ecosystem began to normalize returning to pre-pandemic growth rates (Whitaker *et al.*, 2025).

Figure 1 shows the annual number of AI publications on the Continent. AI publications increased from 1659 during 2014 to 6756 during 2023. The Main contributing countries were Egypt

Table 4: Funding Agencies: Eastern Africa.

T4: Funding Agencies: Eastern Africa	Record Count
National Natural Science Foundation of China NSFC	144
United States Department of Health Human Services	99
National Institutes of Health NIH USA	97
Bill Melinda Gates Foundation	94
UK Research Innovation UKRI	87
CGIAR	86
European Union EU	65
Norwegian Agency for Development Cooperation Norad	53
King Saud University	51
Wellcome Trust	48

Table 5: Funding Agencies: Western African.

T5: Funding Agencies: Western African	Record Count
National Natural Science Foundation of China NSFC	180
UK Research Innovation UKRI	69
King Saud University	41
Deutscher Akademischer Austausch Dienst DAAD	39
United States Department of Health Human Services	39
National Institutes of Health NIH USA	38
Federal Ministry of Education Research BMBF	36
Medical Research Council UK MRC	36
National research foundation South Africa	34
Wellcome Trust	34

with 11920 publications during the period; South Africa with 7221 publications; Tunisia 6987 and Morocco 6013 publications.

We also identified the type of documents produced during the period from the top two countries- Egypt and South Africa. Egypt's publications were 76% articles and 19.3% proceeding papers. South Africa's publications were 65.3% articles and 26.7% proceeding papers. A recent publication (Pouris 2025) it was estimated that "In the total SA publications, the average proceedings is 12%." (p 6). Furthermore, it was argued that "NRF supports traveling to conferences. This is probably one of the few ways that a researcher can benefit from NRF funding. Based on this assumption it can be argued that energy researchers are supported by NRF to participate in international conferences, and this affects their outputs in proceedings". (p 12). As NRF is also the main funder of AI research it can be argued that this is the reason that AI research produces twice the number of proceedings 26.7% as the average of the country (12%).

The focus of the AI publications was Computer science 27 219 publications and engineering 15 189 publications. The two disciplines cover 92.3% of the total number of AI publications.

Table 1 shows that Northern Africa countries produce most publications in the Continent (68%). Southern Africa follows and the region with the least number of AI publications is Central Africa.

Figure 2 shows the AI publications per region. It is interesting to notice that Northern African countries were well advanced in the AI field in the beginning of the under-examination period. Northern African countries produced 5885 AI publications during 2022 just before their decline to 4405 publications during 2023.

Tables 2 to 6 identify the main funders of the articles in the five African regions. Identification of the main funders as they are identified in the publications by the authors show that the National Natural Science Foundation of China (NSFC) is the main funder. NSFC is top funder in North African countries (556 listings) and in Eastern (144) and Western Africa countries (180). It is second in the Southern Africa countries (207) where the National Research Foundation of South Africa appears to be the top funder with approximately 900 listings (with name permutations).

King Saud University (555) appears as second funder in Norther African countries with the same number of listings as NSFC. The UK Research Innovation appears third in Southern African countries.

Overall, it is apparent that National Natural Science Foundation of China is the main funder of AI in Africa. Arab organisations appear to dominate Northern Africa countries research. It should be noted while China has a presence across all regions, NRF provides support only within South Africa.

The recent political changes in the USA should be expected to affect negatively the support by USA organisations.

Table 7 shows the collaboration matrix of the five African regions among themselves, and Table 8 shows the collaboration with non-African countries. It becomes apparent that collaboration with foreign countries dominates the collaboration domain.

FINDING AND DISCUSSION

This article aims to provide a realistic picture of AI research in the African Continent using an appropriate methodology. It is identified that Africa produced 45 937 AI publications indexed in the WoS during the period 2014-2023.

It should be mentioned that in a similar investigation (Kondo *et al.*, 2023) 1644 publications identified in SCOPUS

during the decade 2013-2022. The more detailed approach in searching for AI publications from Africa identified just below 28 times more publications than the search with a limited number of search terms. It is apparent that limited attention to recall issues can severely underestimate the publications in the field and provide misleading conclusions. It is interesting to note that the set of key words identified 33 179 African AI publications. The category indexed in the WoS as Artificial Intelligence identified 19 145 African publications. Finally, the search for relevant publications in the journals identified as journals focusing on AI identified only 462 relevant publications. It is apparent that key words searching cover a wider spectrum of articles than the other approaches. Furthermore, it is emphasised that a relatively recent study comparing the databases (with shortcomings) found 27 million documents in Scopus and 23 million in Web of Science, with an overlap of 18 million (Visser, *et al*., 2020). Hence, Scopus was expected to cover more AI documents than WoS. Such challenges in recall rate will also lead to wrong conclusions (e.g. which country is more productive in the field and where it is the searched for specialization).

Table 6: Funding Agencies: Central African.

T6: Funding Agencies: Central African	Record Count
European University of the Atlantic	14
National Natural Science Foundation of China NSFC	13
Natural Sciences and Engineering Research Council of Canada NSERC	11
European Union EU	10
National Institutes of Health NIH USA	10
Princess Nourah Bint Abdulrahman University	10
United States Department of Health Human Services	10
New Brunswick Innovation Foundation NBIF	9
Center for Nonlinear Systems Chennai Institute of Technology India	8
CGIAR	8

Our findings show that AI publications increased from 1659 during 2014 to 6756 during 2023. The Main contributing countries were Egypt with 11920 publications and South Africa with 7221 publications during the period.

Regional analysis identifies that the Northern African countries dominate the AI publications domain. Identification of the main funders, as they are identified in the publications by the authors, show that the National Natural Science Foundation of China (NSFC) is the main funder followed by King Saud University (555) which appears as second funder in Northern African countries with the same number of listings as NSFC. South African publications appear to be supported by the National Research Foundation.

Comparisons of the collaboration patterns of the regions among themselves and with non-African countries identifies that African countries collaborate mainly with the rest of the World and less among themselves. This finding confirms those by (Pouris *et al*.,

Table 7: Matrix of African regions: Collaboration.

	Northern Africa	Southern Africa	Central Africa	Eastern Africa	Western Africa
Northern Africa	X	229	66	134	159
Southern Africa	229	X	69	313	416
Central Africa	66	69	X	24	55
Eastern Africa	134	313	24	X	205
Western Africa	159	416	55	205	X

Table 8: Regional collaboration with non-African countries.

Northern Africa 31228	Southern Africa 7482	Central Africa 542	Eastern Africa 3740	Western Africa 4438
Saudi Arabia 4773	USA 850	France 116	India 880	PR China 510
France 3707	England 562	USA 89	USA 598	USA 483
USA 1846	PR China 509	Spain 65	PR China 393	Malaysia 459
PR China 1824	India 463	Mexico 57	England 326	India 422
India 1273	Germany 412	Pakistan 56		England 335

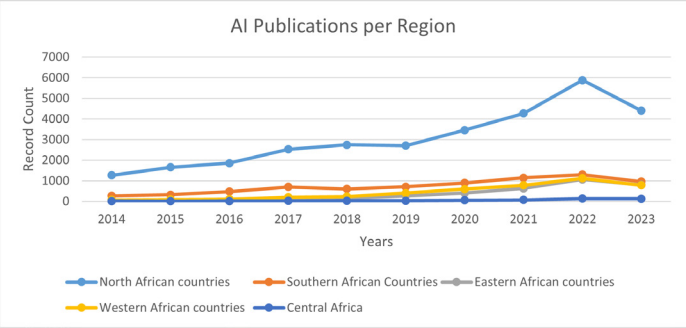

Figure 2: AI publications per Region 2014-2023.

2015). It was argued that African researchers are attracted by research resources and funding which is almost always abroad.

Identification of the type of publications produced indicates that the field of AI is affected by the way the National Research Foundation supports research and the field of AI produces twice as many proceedings that the average scientific discipline in the country.

CONCLUSION

The analysis demonstrates that AI research in Africa is significantly underestimated when limited search strategies are used, leading to inaccurate assessments of productivity and specialization. A comprehensive search approach captures a far larger body of work-up to 28 times more-highlighting the importance of addressing recall issues in bibliometric studies. AI publications across the continent have grown substantially over the past decade, with Northern Africa dominating output and Egypt and South Africa emerging as leading contributors. Funding patterns show a strong influence from international agencies, particularly the National Natural Science Foundation of China and King Saud University. Collaboration trends reveal that African researchers partner more frequently with international collaborators than with other African countries, reinforcing earlier findings and reflecting the pull of external research resources. Additionally, the prominence of conference proceedings in AI output indicates the impact of national funding frameworks on publication types within the field.

ACKNOWLEDGEMENT

None.

ABBREVIATIONS

EBIT: EBIT Faculty; **CC:** Consultancy Services CC; **EKB:** Egyptian Knowledge Bank; **STDF:** Science and Technology Development Fund; **NSF:** National Science Foundation; **DAAD:** Deutscher Akademischer Austausch Dienst; **BMBF:** Federal Ministry of Education Research BMBF; **NBIF:** New Brunswick Innovation Foundation.

CONFLICT OF INTEREST

The authors declare that there is no conflict of interest.

REFERENCES

AUDA-NEPAD (2021). Artificial Intelligence for Africa: An Opportunity for Growth. African Union Development Agency. https://www.up.ac.za/media/shared/7/ZP_Files/ai-for-africa.zp165664.pdf

Buckland, M., & Gey, F. (1994). The Relationship between Recall and Precision. Journal of the American Society for Information Science, 45(1), 12-19.

Gao J, Huang X, Zhang L. (2019) Comparative analysis between international research hotspots and national-level policy keywords on artificial intelligence in China from 2009 to 2018. Sustainability. 2019; 11(23): 6574. https ://doi.org/10.3390/su112 36574.

Kondo ST and Diwani AS (2023) *Artificial Intelligence in Africa: a Bibliometric analysis from 2013 to 2022* Discover Artificial Intelligence v 3 no 34.

Lianou TD and Efthenakis CG (2022). "Scientometrics Study of Research Output on Sheep and Goats from Greece". Animals (BASEL) Oct 4;12(19): 2666. doi: 10.3390/ani12192666

Liu N, Shapira P, Yue X. (2021). *Tracking development in AI research: constructing and applying a new search strategy*. Scientometrics. 2021, 126:3153-3192. https://doi.org/10.1007/s11192-021-03868-4

Martyn, J (1964). "Bibliographic coupling". *Journal of Documentation*. 20 (4): 236. doi:10.1108/eb026352

Njei B., Kanmounye US, Mohamed, M.F.*et al*. (2023) Artificial intelligence for healthcare in Africa: a scientometric analysis. Health Technol. 2023, 13: 947-955 (2023). https://doi.org/10.1007/s12553-023-00786-8

Pandey S, Manoj Kumar Verma, Ravi Shukla (2021) A Scientometric Analysis of Scientific Productivity of Artificial Intelligence Research in India. Journal of Scientometric Research · October 2021, 10, 2, 245-250 DOI: 10.5530/jscires

Pouris A, (2025) Energy research in a pluralistic system: Bibliometric analysis of SA publications. *Journal of Policy and Society* 2025, 3(2), 2284.

Pouris A, and Y.S. Ho, (2015) "Research Emphasis and Collaboration in Africa," Scientometrics, vol. 98(3), pp. 2169-2184, 2014, https://doi.org/10.1007/s11192-013-1156-8

Small, H., (1999). Visualizing science by citation mapping. *Journal of the American Society for Information Science*, 50(9), 799-813.

Small H. (1973). "Co-citation in the scientific literature: A new measure of the relationship between two documents". *Journal of the Association for Information Science and Technology*. 24 (4): 265-269.

Sooryamoorthy R. (2021) "Science in Africa: Contemporary Trends in Research" *Journal of Scientometric Research*, 2021, 10, 3, 366-372.

Trabelsi, M.A. (2024). The impact of artificial intelligence on economic development. Journal of Electronic Business & Digital Economics, Vol. 3 No. 2, pp. 142-155.

Visser M, van Eck NJ, Waltman L. (2020). *Large-Scale Comparison of Bibliographic Data Sources: Scopus, Web of Science, Dimensions, Crossref, and Microsoft Academic*. Available at https://arxiv.org/abs/2005.10732. Accessed 26 August 2023.

Zhang L. and Rousseau R. (2008) *Defining and measuring the precision of search strategies in bibliometric studies*. Journal of Informetrics, 2(3), 248-256.

Zhou X, Huang L, Zhang Y, Yu M. (2019). *A hybrid approach to detecting technological recombination based on text mining and patent network analysis*. Scientometrics. 2019, 121(2), 699-737. https ://doi.org/10.1007/s1119 2-019-03218 -5.

Whitaker, M., Rodrigues, S., Cooke, G., Virlon, B., Donnelly, C. A., Ward, H., Elliott, P., & Chadeau-Hyam, M. (2025). How COVID-19 affected academic publishing: A 3-year study of 17 million research papers. International Journal of Epidemiology, 54(3), dyaf058.

WIPO. WIPO technology trends (2019). *Artificial intelligence. Data collection method and clustering scheme*. Geneva: World Intellectual Property Organisation. https ://www.wipo.int/expor t/sites /

Yau, C. K., Porter, A., Newman, N., & Suominen, A. (2014). Clustering scientific documents with topic modeling. Scientometrics, 100(3), 767-786. https://doi.org/10.1007/s11192-014-1321-0

Cite this article: Pouris A, Thirion AEM. Artificial Intelligence Research in Africa and the Importance of Recall Concept. Info Res Com. 2025;2(3):369-76.

Appendix 1: Artificial Intelligence Search Terms.

No	Search strategy	Search terms
# 1	Core lexical query	TS = ("Artificial Intelligen*" or "Neural Net*" or "Machine* Learning" or "Expert System$" or "Natural Language Processing" or "Deep Learning" or "Reinforcement Learning" or "Learning Algorithm$" or "*Supervised Learning" or "Intelligent Agent*")
# 2	Expanded lexical query 1	TS = (("Backpropagation Learning" or "Back-propagation Learning" or "Bp Learning") or ("Backpropagation Algorithm*" or "Back-propagation Algorithm*") or "Long Short-term Memory" or ([Pcnn$ not Pcnnt) or "Pulse Coupled Neural Net*") or "Perceptron$" or ("Neuro-evolution" or Neuroevolution) or "Liquid State Machine*" or "Deep Belief Net*" or ("Radial Basis Function Net*" or Rbfnn* or "Rbf Net*") or "Deep Net*" or Autoencoder* or "Committee Machine*" or "Training Algorithm$" or ("Backpropagation Net*" or "Back-propagation Net*" or "Bp Network*") or "Q learning" or "Convolution* Net*" or "Actor-critic Algorithm$" or ("Feedforward Net*" or "Feed-Forward Net*") or "Hopfield Net*" or Neocognitron* or Xgboost* or "Boltzmann Machine*" or "Activation Function$" or ("Neurodynamic Programming" or "Neuro dynamic Programming") or "Learning Model*" or (Neurocomputing or "Neuro-Computing") or "Temporal Difference Learning" or "Echo State* Net*")
# 3	Expanded lexical query 2	TS = ("Transfer Learning" or "Gradient Boosting" or "Adversarial Learning" or "Feature Learning" or "Generative Adversarial Net*" or "Representation Learning" or ("Multiagent Learning" or "Multi-agent Learning") or "Reservoir Computing" or "Co-training" or ("Pac Learning" or "Probabl* Approximate* Correct Learning") or "Extreme Learning Machine*" or "Ensemble Learning" or "Machine* Intelligen*" or ("Neuro fuzzy" or Neurofuzzy) or "Lazy Learning" or ("Multi* instance Learning" or "Multiinstance Learning") or ("Multi* task Learning" or "Multitask Learning") or "Computation* Intelligen*" or "Neural Model*" or ("Multi* label Learning" or "Multilabel Learning") or "Similarity Learning" or "Statistical Relation* Learning" or "Support* Vector* Regression" or "Manifold Regulari?ation" or "Decision Forest*" or "Generali?ation Error*" or "Transductive Learning" or (Neurorobotic* or "Neuro-robotic*") or "Inductive Logic Programming" or "Natural Language Understanding" or (Adaboost* or "Adaptive Boosting") or "Incremental Learning" or "Random Forest*" or "Metric Learning" or "Neural Gas" or "Grammatical Inference" or "Support* Vector* Machine*" or ("Multi* label Classification" or "Multilabel Classification") or "Conditional Random Field*" or ("Multi* class Classification" or "Multiclass Classification") or "Mixture Of Expert*" or "Concept* Drift" or "Genetic Programming" or "String Kernel*" or ("Learning To Rank*" or "Machine-learned Ranking") or "Boosting Algorithm$" or "Robot* Learning" or "Relevance Vector* Machine*" or Connectionis* or ("Multi* Kernel$ Learning" or "Multikernel$ Learning") or "Graph Learning" or "Naive bayes* Classifi*" or "Rule-based System$" or "Classification Algorithm*" or "Graph* Kernel*" or "Rule* induction" or "Manifold Learning" or "Label Propagation" or "Hypergraph* Learning" or "One class Classifi*" or "Intelligent Algorithm*")
#4	WoS category	WC = ("Artificial Intelligence")
#5	Total	#1 OR #2 OR #3 OR #4

Source: (Liu *et al*., 2021).

Appendix 2: AI journals included in the search.

1. Artificial intelligence Elsevier,
2. Journal of machine learning research,
3. Autonomous agents and multi-agent systems,
4. IEEE transactions on neural networks and learning systems,
5. Journal of artificial intelligence research,
6. Machine learning,
7. Computational intelligence,
8. Expert systems,
9. International journal of intelligent systems,
10. Neurocomputing,
11. Journal of experimental and theoretical artificial intelligence,
12. IEEE computational intelligence magazine,
13. Artificial intelligence review,
14. Autonomous robots,
15. International journal of machine learning and cybernetics,
16. ACM transactions on intelligent systems and technology,
17. AI magazine,
18. Progress in artificial intelligence,
19. Swarm intelligence.