



Bibliometric Mapping of Technology Acceptance in Artificial Intelligence, Machine Learning, and Neuronal Networks: A Comparative Analysis of WoS and Scopus (1999–2023)

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KEYWORDS

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neuronal networks;
AI integration;
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AI emerging research

ABSTRACT

Background: This study presents a systematic bibliometric mapping and analysis on the acceptance of technology in the field of artificial intelligence (AI), machine learning (ML) and neuronal networks (NN), evaluating the evolution and research trends within this interdisciplinary field. Methods: Using data from the Web of Science (WoS) and Scopus databases, we identify important authors, institutions, and geographic distributions, highlighting key research areas and emerging themes. The analysis was performed using VOSviewer (v.1.6.20) and RStudio (v.4.1.3) with the Bibliometrix package. Results: Our analysis reveals a steady increase in scientific output between 1999 and 2023, with a notable acceleration in recent years, indicating a growing interest in how AI technologies are accepted in various domains. The research illuminates the central role of technology and AI acceptance models, as demonstrated by thematic and keyword analyses. The study reveals a pronounced focus on the technological facets of AI acceptance, alongside discernible gaps in research linking energy, climate mitigation, and sustainability. Differences in findings underline the characteristics of the WoS and Scopus databases. Conclusions: The findings argue for a diversified research agenda to overcome these identified gaps, fostering a more comprehensive understanding of technology acceptance in the age of AI. This research charts a course for future explorations within this critical interdisciplinary field.

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1. Introduction

While artificial intelligence (AI) today is part of our world and our technology, recent literature shows a rise in concerns regarding this topic (Cabeza et al., 2020; Stein et al., 2024). AI is utilised in various platforms and systems, including social media, smart devices (Internet of Things, IoT), logistics, buildings, and medicine.

Studying scientific production through bibliometrics or scientometrics enables researchers to evaluate the results of peer-reviewed literature in a more concise manner than traditional review methods (Cabeza et al., 2020). Today, Web of Science (WoS) and Scopus are the main sources for citation data (Chadegani et al., 2013); WoS includes seven citation databases that include journals, conferences, reports, books, and book series with more than 10,000 journals, while Scopus has more than 20,000 peer-reviewed journals, and also conference proceedings, book series, and trade publications. According to Cabeza et al., (2020), WoS has a more social profile, whereas Scopus has a more technological profile.

There are very few previous bibliometric analysis studies related to artificial intelligence and technology acceptance, and none that look at it holistically. For example, Yu & Yu, (2023) used Web of Science to evaluate the acceptance of AI in education, and Mak et al., (2020) studied the acceptance of using machine learning (ML) in craniofacial surgery. Other studies which looked at social acceptance found that AI was one of the biggest concerns; for example, Senyapar & Bayindir, (2023) used both Scopus and WoS to study the social acceptance of smart grids, where they found that the most significant concerns regard safety and AI use. In the health domain, Stoumpos et al., (2023) used Scopus, Science Direct and PubMed databases, finding that technology innovation concerns are significantly related to AI.

This study provides a comprehensive quantification and description of recent literature on technology acceptance and AI, focusing on publications from 1999 to 2023. Our contribution lies in analysing this specific corpus with a combination of query design, database selection, and analytic lenses that differ from earlier syntheses.

Despite the growing importance of artificial intelligence in diverse domains, current research on its acceptance remains fragmented. Most studies address specific applications or sectors, lacking a comprehensive view that integrates different contexts, technologies, and methodological approaches (Ismatullaev & Kim, 2024; Rahimi & Oh, 2024; Thomas et al., 2023). Furthermore, there is limited comparative evidence on how major bibliographic databases represent the field, which may lead to biased or incomplete conclusions.

This gap motivates the present work: a systematic bibliometric analysis that consolidates existing knowledge and highlights emerging themes. By doing so, we aim to provide a clearer picture of how technology acceptance considerations are addressed in the context of AI. To guide this effort, we formulate a set of specific research questions, which are presented in the following section.

In addition to addressing this fragmentation, the originality of our study lies in its generalist scope and dual-database approach. Unlike prior bibliometric analyses that focus on single domains (e.g., education, healthcare, mobility), our work maps AI acceptance research across sectors, providing a holistic overview of the field. By contrasting data from WoS and Scopus, we also reveal systematic differences in coverage and thematic emphasis, thereby offering a broader and more balanced representation of AI acceptance research.

2. Aim and scope

This study examines the literature on technology acceptance in relation to artificial intelligence. More particularly, the objectives of this study are to identify areas of knowledge concentration in terms

of relevant authors, institutes, and geographical distributions; to identify research trends and gaps in terms of keywords and research fields; and to assess the use of the Web of Science (WoS) and Scopus databases for this research field, in terms of content, advantages, and disadvantages. To thoroughly investigate the domain of technology acceptance as it intersects with advanced computational concepts, the study articulates four pivotal research questions:

- RQ1: What is the scope and calibre of scientific research concerning technology acceptance intertwined with artificial intelligence to date?
- RQ2: Which researchers and geographical regions have primarily focused on exploring technology acceptance related to artificial intelligence?
- RQ3: What dimensions of technology acceptance related to artificial intelligence have been examined in existing studies?
- RQ4: What emerging themes are shaping the future research agenda in the domain of technology acceptance related to artificial intelligence?

The paper is structured into four key sections. The initial section adopts a methodical approach to keyword identification, aiming to encapsulate critical study themes. Subsequently, a detailed presentation of the extracted data, including documents, tables, and figures, is utilized to address the formulated research questions. This analysis sets the stage for the discussion section, where the paper synthesizes the evidence to respond to the research inquiries posed. Lastly, the conclusion section encapsulates the principal insights derived from the study, reflecting on the initial hypothesis.

3. Materials and Methods

3.1. Data source, data extraction, and study selection

To enrich the scope of the bibliometric analysis, we incorporated the study of artificial intelligence (AI) techniques, specifically machine learning (ML) and neuronal networks (NN), alongside the concept of technology acceptance. The bibliometric analysis leveraged two comprehensive databases: Scopus and Web of Science (WoS). Searches were conducted individually in each database. The search strategy was carefully crafted to align closely with the study's core objectives, focusing on the critical intersection of «technology acceptance» with advanced computational concepts. Specifically, the strategy harnessed a Boolean search logic, combining «technology acceptance» AND either «artificial intelligence», «machine learning», or «neuronal networks». The exact query conducted on March 1, 2024, was: TITLE-ABS-KEY («technology acceptance») AND («artificial intelligence» OR «machine learning» OR «neuronal networks»). This approach ensured a targeted retrieval of literature that not only discusses technology acceptance but also intersects with key areas of computational innovation, including artificial intelligence, machine learning, and neuronal networks, thereby encapsulating a broad spectrum of relevant research within these intertwined domains. Figure 1 presents a simplified PRISMA-S flowchart for each database, illustrating the search process conducted in this study.

3.2. Data analysis and visualization

The bibliometric analysis was conducted utilizing two specialized software tools: VOSViewer (van Eck & Waltman, 2010) (Version 1.6.20) and RStudio (Version 4.1.3), which are equipped with the

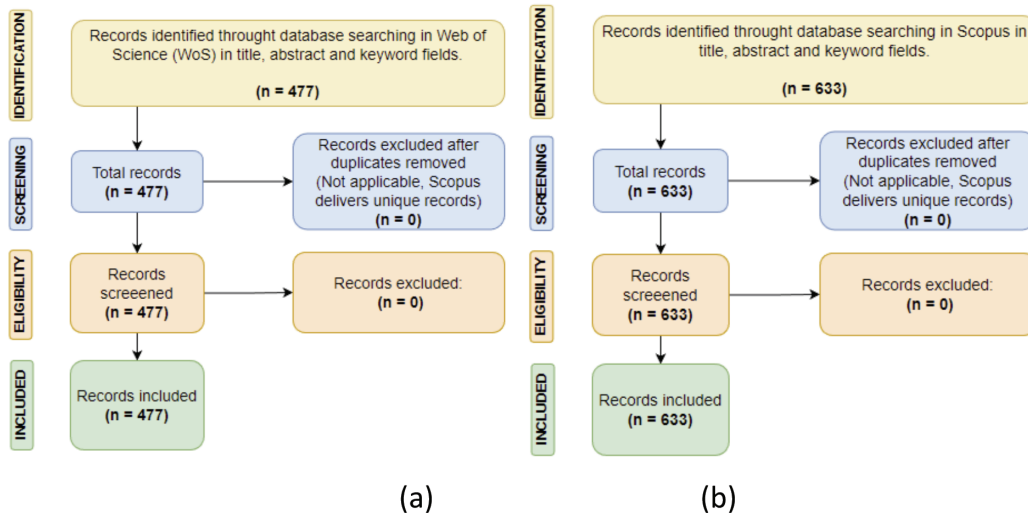


Figure 1. PRISMA-S flowcharts showing the searches conducted in WoS (a) and Scopus (b)

Bibliometrix package (Aria & Cuccurullo, 2017). VOSViewer facilitates the generation of keyword maps through the analysis of co-occurrence data, offering a visual exploration of the relationships between keywords within the scientific literature. Meanwhile, the Bibliometrix package in R offers a comprehensive suite of tools for the quantitative analysis of bibliometric data, allowing for a detailed examination of publication trends, author contributions, and thematic developments.

The annual growth rates reported in this study were obtained directly from the *Biblioshiny* interface of the Bibliometrix package in R. Growth is computed in this tool using the standard compound annual growth rate (CAGR) formula:

$$CAGR = \left(\frac{N_t}{N_0} \right)^{\frac{1}{t}} - 1$$

Where N_0 and N_t represent the number of publications in the first and last year of the interval, respectively, and t is the number of years. This indicator normalizes growth over time and is widely used in bibliometric analyses to describe trends in publication.

To ensure methodological transparency and reproducibility, the specific parameters used to generate each figure are explicitly reported in the corresponding figure descriptions within the manuscript. This includes details such as counting methods, normalization techniques, clustering algorithms, thresholds, and other relevant settings. In addition, supplementary material has been provided, containing: (i) the stop-word list applied, (ii) the thesaurus file used to unify synonyms and lexical variants, and (iii) a complete parameter file with the settings employed for all figures. These resources enable readers to replicate the analyses exactly and validate the robustness of the presented results.

An overview of the Scopus database revealed 633 documents sourced from 370 distinct publications authored by 2,020 researchers. This corpus is characterized by a diverse array of 3028 'Keywords

Plus' and 1,877 keywords specified by the authors, reflecting the wide range of topics covered. The database exhibits a growth rate of 16.75 % annually, indicating a steady increase in research output within the field. This quantitative expansion underscores the dynamic nature of the research area, as well as the increasing interest and contributions from the academic community.

Delving into the WoS database, the analysis uncovered a compilation of 477 documents. These were derived from 267 distinct sources and penned by 1,526 authors, illustrating the field's breadth and depth of collaboration. The research corpus was marked by a rich tapestry of 951 'Keywords Plus' and 1,730 author-specified keywords, showcasing the diverse topics under investigation. Notably, the database demonstrated a healthy annual growth rate of 20.96 %. This consistent upward trajectory in research production vividly highlights the vibrant and evolving nature of the scholarly domain, as well as the escalating engagement and contributions from the global academic community. It is worth noting that the first publication in WoS appeared in 2008.

4. Results

4.1. Bibliometric analysis

Figure 2 shows a line graph detailing the trend in the number of publications from 1999 to 2023. The red line represents data from Scopus and the blue line from WoS. The first Scopus-recorded publication appeared in 1999 with the conference paper «Extending the Technology Acceptance Model to account for social influence: Theoretical bases and empirical validation» published by Malhotra & Galletta,

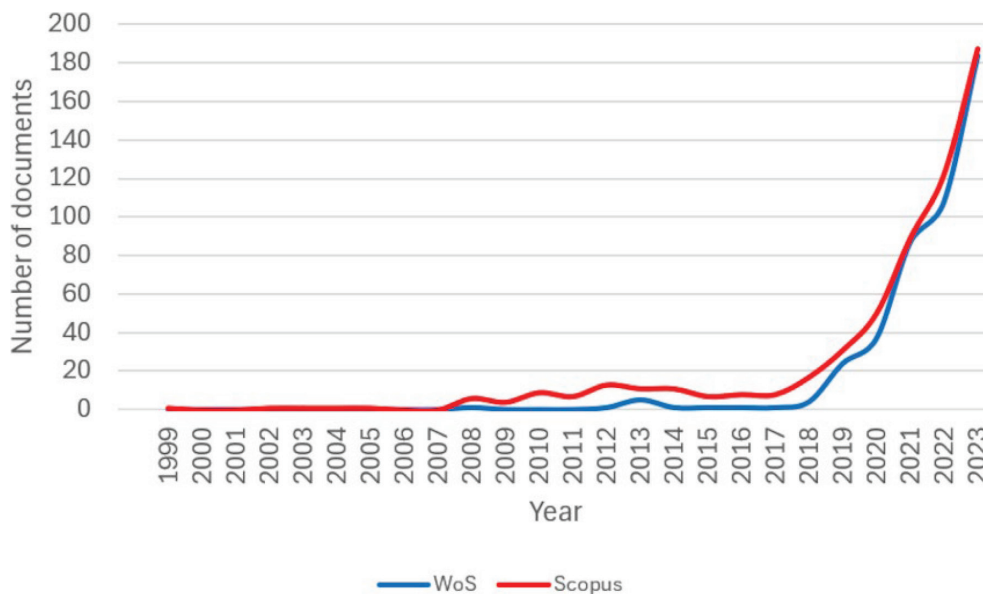


Figure 2. Trends in the number of publications in the field from 1999 to 2023, based on data from WoS (blue line) and Scopus (red line)

(1999). As of April 2024, this paper is the most cited in the Scopus dataset, with nearly 500 citations as of April 2024. The first publication in WoS appeared in 2008 with a study published by Tucker, (2008) on the E-menu system for the E-commerce standard user interface, where a Technology Acceptance Model (TAM) was applied. Over the next several years, there has been a gradual increase in publications in both databases, with the WoS (blue line) consistently lagging behind Scopus (red line) in terms of the number of publications. Starting around 2016, publication numbers for both databases increased significantly. The rate of increase for Scopus is steeper than for WoS, and by 2022, it reported more indexed documents than WoS. This difference should be interpreted cautiously, as it may reflect database coverage rather than substantive variations in publication output. The overall trend shows an acceleration in publication rates over time, with remarkably rapid growth in the last few years of the dataset.

Citation counts were retrieved from WoS and Scopus in April 2024. All counts include self-citations, as no additional filtering was applied. Rankings of the most cited documents are reported separately for each database and are specific to that citation window. To mitigate citation-age effects, we report not only total citations but also citations per year (TC per Year) and Normalized TC, as provided by Biblioshiny. These indicators enable the comparison of papers' relative influence, regardless of publication date.

Table 1 shows the ten most cited documents in Scopus as of April 2024. Although Malhotra (1999) has the highest total citations (495), the study's relative impact is modest (TC per Year = 18.33; Normalized TC = 1.00). In contrast, Kim et al. (2021) records fewer total citations (278) but much higher relative influence (TC per Year = 55.60; Normalized TC = 11.67). This indicates that absolute citation counts alone do not fully reflect research impact.

Table 1. Top ten cited documents in Scopus as for April 2024

Document, Year	DOI	Total Citations	TC per Year	Normalized TC
MALHOTRA Y, 1999	NA	495	18,33	1,00
PANAGIOTOPOULOS I, 2018	10.1016/j.trc.2018.08.013	283	35,38	6,22
KIM S, 2021	10.1016/j.ijhm.2020.102795	278	55,60	11,67
DE KERVENOAEL R, 2020	10.1016/j.tourman.2019.104042	264	44,00	7,19
SOHN K, 2020	10.1016/j.tele.2019.101324	206	34,33	5,61
BUCKLEY L, 2018	10.1016/j.aap.2018.03.021	189	23,63	4,15
CHATTERJEE S, 2021	10.1016/j.techfore.2021.120880	171	34,20	7,18
MORIUCHI E, 2019	10.1002/mar.21192	162	23,14	6,85
LIN H, 2020	10.1080/19368623.2020.1685053	151	25,17	4,11
KAMBLE SS, 2021	10.1016/j.techfore.2020.120465	142	28,40	5,96

Table 2 presents the ten most cited documents in WoS as of April 2024. Gursoy et al., (2019) has the highest number of citations (363), but the study's relative impact is surpassed by more recent works. For instance Kim et al., (2021), with 245 total citations, it achieves a TC per Year of 49.00 and a Normalized TC of 10.16, indicating a stronger influence relative to its publication year. This again demonstrates that absolute citation counts do not fully capture the impact of research.

Table 2. Top ten cited documents in WoS as for April 2024

Document, Year	DOI	Total Citations	TC per Year	Normalized TC
GURSOY D, 2019	10.1016/j.ijinfomgt.2019.03.008	363	51,86	5,18
LU L, 2019	10.1016/j.ijhm.2019.01.005	336	48,00	4,79
HENGSTLER M, 2016	10.1016/j.techfore.2015.12.014	300	30,00	1,00
WONG LW, 2020	10.1016/j.ijinfomgt.2019.08.005	298	49,67	5,68
MCLEAN G, 2019	10.1016/j.chb.2019.05.009	275	39,29	3,92
KIM SS, 2021	10.1016/j.ijhm.2020.102795	245	49,00	10,16
PANAGIOTOPOULOS I, 2018	10.1016/j.trc.2018.08.013	243	30,38	2,67
DE KERVENOAEL R, 2020	10.1016/j.tourman.2019.104042	234	39,00	4,46
BELANCHE D, 2019	10.1108/IMDS-08-2018-0368	214	30,57	3,05
PILLAI R, 2020	10.1108/IJCHM-04-2020-0259	207	34,50	3,95

Note: TC per year = Total citations / Number of years since publication; Normalized TC = Citations of the paper / Average citations of all documents published in the same year.

Figure 3 consists of two pie charts showing the distribution of document types from 1999 to 2023. Figure 3.a depicts data from WoS, and Figure 3.b from Scopus. In Scopus, articles represent a higher proportion of the total documents, while reviews account for a smaller share compared to WoS. WoS includes a larger proportion of reviews and an «Others» category not present in Scopus. Books and book chapters appear more frequently in Scopus, reflecting broader coverage of these document types, whereas WoS includes them only to a limited extent through the Book Citation Index. This suggests that the observed differences are more likely due to indexing practices than to substantive variations in publication formats. Additionally, the percentage of conference papers is double in Scopus compared to WoS.

Figure 4 presents two three-field plots, part (a) using data from WoS and part (b) from Scopus, which relate keywords, affiliations, and countries. The analysis was conducted using RStudio software (Version 4.1.3) and the Bibliometrix libraries. This network visualization uses the left column to list countries, the middle column to list affiliations, and the right column to list keywords. The maximum number of items is set to 15. Lines connect these three fields to illustrate their relationships, specifically, which keywords are associated with which affiliations and countries.

Related to the keywords used to conduct the bibliometric search («Technology Acceptance», «Artificial Intelligence», «Machine Learning», and «Neuronal Networks»), it is observed that the keyword «Neuronal Networks» does not appear in either dataset. This is likely because «Neuronal Networks»

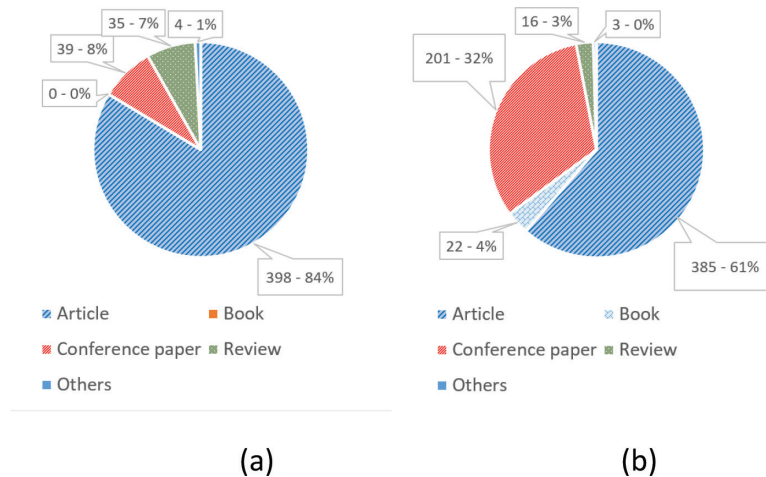
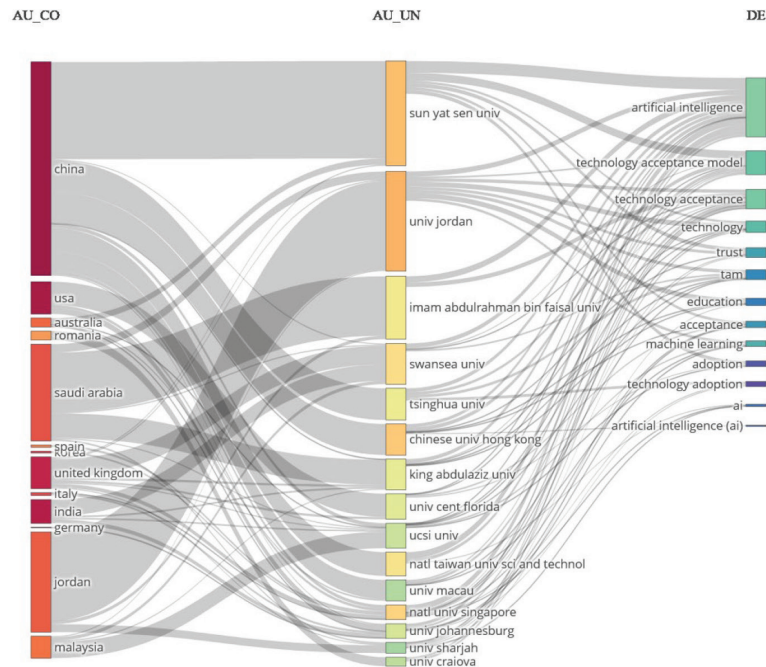


Figure 3. Distribution of document types between 1999 and 2023 in WoS (a) and Scopus (b), expressed as counts and percentages

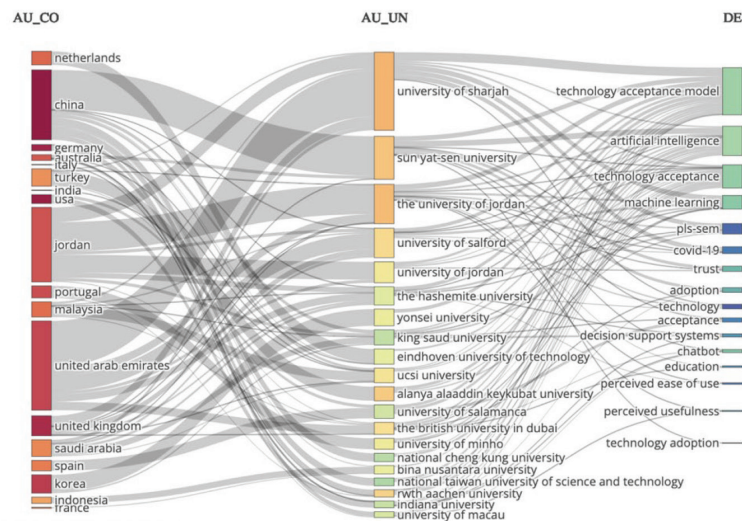
is a specialized subset of artificial intelligence, which may be encompassed within the broader terms used. On the other hand, in the Scopus database (Figure 4.b), the rest of the keywords used in the search appear in the first four places. In the WoS database (Figure 4.a), the keyword «Machine Learning» appears in ninth place. This keyword ranks lower in WoS compared to «Technology Acceptance Model» and «Artificial Intelligence». The keywords «Artificial Intelligence» and «Technology Acceptance Model» which rank first and second in both databases.

Figure 5 comprises two bubble charts, part (a) representing data from Web of Science (WoS) and part (b) from Scopus, to illustrate the most relevant sources cited in the scientific literature according to the bibliometric analysis conducted with R-studio software and Bibliometrix libraries. The number-of-sources parameter was fixed at 10. In both charts, the vertical axis lists the names of the journals or sources, while the horizontal axis indicates the number of documents from each source. Each bubble size corresponds to the number of documents associated with that source, visually representing the sources' relevance. Figure 5.a shows the WoS data, where the bubble with the highest number of documents is Lecture Notes in Computer Science (33 documents), followed by ACM International Conference Proceeding Series (18 documents) and Sustainability (15 documents). Figure 5.b depicts the Scopus data. The largest bubble in this chart is Sustainability (19 documents), followed by the International Journal of Human-Computer Interaction (17 documents).

Figure 6 presents two world maps, each overlaid with coloured regions and connecting lines, representing the scientific production by country and international collaborations, using R-Studio and the Bibliometrix package for WoS (part a) and Scopus (part b). Country collaboration was analysed by constructing a country–country co-authorship matrix from author affiliations. We used full counting, so that each co-authored document contributes one unit to the weight of the corresponding country pair. The minimum edge threshold was set to 2, meaning that only links between countries with at least two co-authored publications were displayed. Countries are shaded in varying intensities of blue to indicate the volume of scientific output, with darker shades representing higher production,

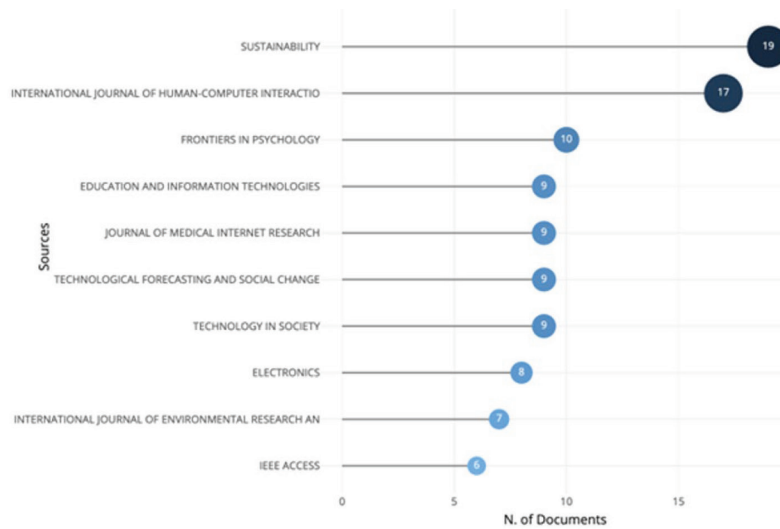


(a)

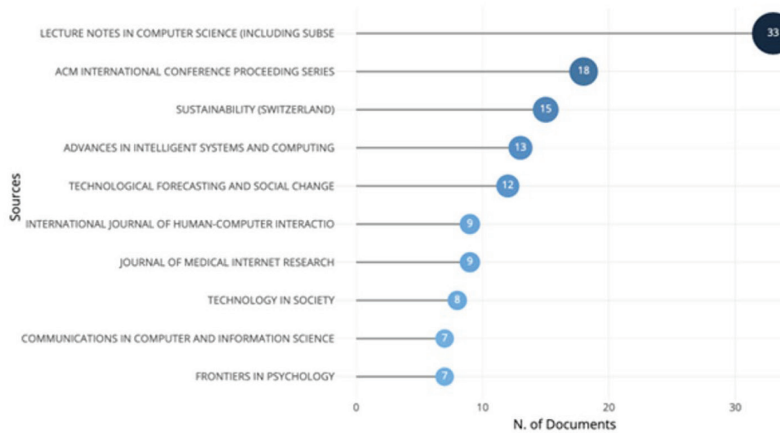


(b)

Figure 4. Three-field plots linking keywords, affiliations, and countries in WoS (a) and Scopus (b), generated with R and the Bibliometrix package



(a)



(b)

Figure 5. Most relevant sources in WoS (a) and Scopus (b), identified using R and the Bibliometrix package

while red lines indicate collaboration links between countries. To reduce size bias, we also calculated the share of internationally co-authored publications relative to each country's total output, thereby complementing the absolute counts represented in the maps. This approach is widely used in bibliometric studies to visualise collaboration networks; however, other normalisation techniques (e.g., similarity indices such as the Salton cosine) could also be applied in future research to further refine

cross-country comparisons. In Scopus, the leading countries in terms of international collaborations are the UK (70), the USA (60), China (37), the United Arab Emirates (35), Australia (29), and Germany (27). In contrast, the WoS data shows the UK with 55 documents, closely followed by the USA and China, with 54 each. India comes next with 30, followed by Australia with 26, Spain with 24, and Italy with 18. The highest number of co-authored publications from the UK is with the United Arab Emirates. The most cited paper according to Scopus was published in 2022 by Almarzouqi et al., (2022). The USA, on the other hand, has a high collaboration counts with Australia, South Korea, and the UK. Nevertheless, one of the most cited papers from the USA is by Buckley et al., (2018) on the psychosocial factors of using automated vehicles, which was published in collaboration between the University of Queensland, Queensland University of Technology, and the University of Michigan. Overall, the United Kingdom emerges as the foremost contributor to scientific output in this field in terms of collaboration, securing the top spot across both databases. The United States, China, and Australia consistently rank among the top five countries in international collaboration. Commencing from the sixth position, a cluster of European nations begins to feature prominently, with Spain, Germany, Italy, Austria, and Greece making notable appearances in the scientific landscape.

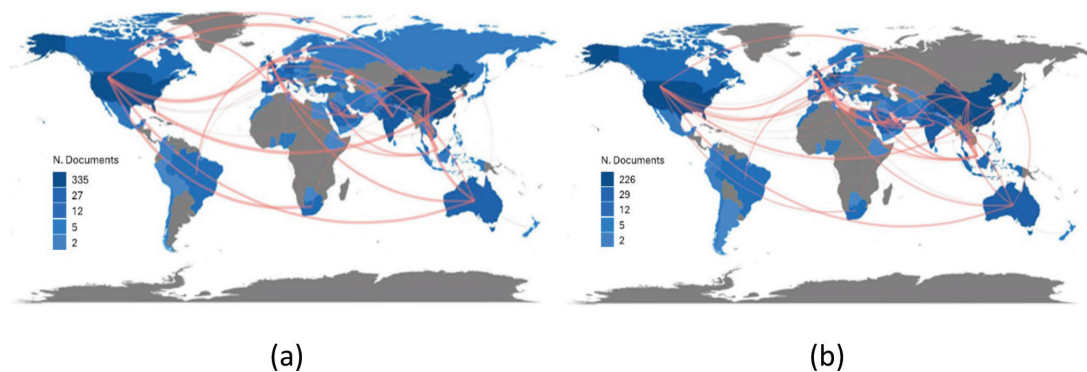


Figure 6. Scientific production by country and international collaborations from WoS (a) and Scopus (b), visualized with Biblioshiny

The United States and China account for the highest scientific output in this field. In Scopus, they represent 105 and 84 documents, respectively, while in WoS China ranks first with 134 documents. According to WoS, the most cited paper from China was published in 2020 by Wong et al., (2020) on the adoption of blockchain in the supply chain of Malaysian SMEs. Another highly cited paper was published by Kim et al., (2021) on the preference for robot service or human service in hotels considering the COVID-19 pandemic. On the other hand, according to Scopus, the most cited papers from China were published by Lin et al., (2020) and from Chen & Tsai, (2019). The first paper examines the acceptance of artificially intelligent robotic devices in hospitality services, while the second addresses the use of personalized location-based mobile tourism applications. Considering the USA, the most cited WoS paper is by Gursoy et al., (2019) which evaluates the acceptance of artificial intelligence devices in service delivery. The same research group is also a co-author of the second most cited paper in WoS, published by Lu et al., (2019) on the development of a service robot integration willingness scale. According to Scopus, the most cited paper was published by Malhotra & Galletta, (1999), as

mentioned above, and the second most cited paper was published by Buckley et al., (2018), which carried out a simulated driving study to determine psychosocial factors related to automated vehicles.

Table 3 presents the top authors with at least six publications on the topic between 1999 and 2023. All the fields in the table are obtained from both databases. Regarding publications, Salloum (h-index = 44 (S) / 19 (W)) from the United Arab Emirates at the University of Sharjah holds the top position. He is followed by Dwivedi (h-index = 103 (S) / 90 (W)) from Swansea University in the United Kingdom and Al Kurdi (h-index = 39 (S) / 8 (W)) from Hashemite University in Jordan.

Table 4 provides the total number of documents published by various institutions between 1999 and 2023 in the field of technology acceptance and artificial intelligence, based on Scopus and WoS data.

At the top of the list is the University of Jordan, leading with a total of 26 publications. This strong performance reflects a concerted research effort in the field, with 15 of those documents indexed in Scopus and 11 in WoS. The university's prominence underscores its strategic focus on technology acceptance studies and the growing importance of the region in artificial intelligence research. UCSI University and the University of Sharjah follow closely, each with 16 publications. UCSI's balanced output, equally divided between Scopus and WoS, indicates consistent productivity across both databases. In contrast, the University of Sharjah demonstrates a significant preference for Scopus, with 13 of its 16 documents indexed in this database. This discrepancy highlights the differing indexing criteria of each database and suggests potential biases in publication strategy. Several other institutions show a relatively even distribution of publications across the two databases. The National University of Singapore, Sun Yat-Sen University, and the University of Johannesburg each contribute 15 publications, demonstrating a strong, balanced research presence. Notably, the Indian Institute of Technology System (IIT System) exhibits a unique trend with all 12 of its publications exclusively indexed in WoS. This specialization suggests a strategic focus on WoS-indexed journals, possibly due to regional or institutional preferences. Similarly, Rheinisch-Westfälische Technische Hochschule Aachen, Universidade do Minho, British University in Dubai, and Technische Universiteit Eindhoven appear only in Scopus, reinforcing the notion of database bias in publication strategies.

Another interesting observation is the dominance of certain institutions within their geographic regions. The University of Jordan leads in the Middle East, while UCSI University and the University of Sharjah represent Southeast Asia and the United Arab Emirates, respectively. The global distribution of institutions in Table 4 reflects a growing international interest in technology acceptance and artificial intelligence, encompassing universities from Europe, Asia, Africa, and the Middle East.

4.2. Keyword analysis

Figure 7 presents two word clouds, (a) from WoS and (b) from Scopus, visualizing the frequency of Keywords Plus extracted from both databases from 1999 to 2023. The analysis was performed using RStudio software and Bibliometrix libraries. In a word cloud, the size of each word corresponds to its frequency of occurrence; thus, larger words represent more commonly occurring terms within the analysed literature. Figure 7.a shows the WoS data. Here, words like «information technology» (Park et al., 2022; Röcker, 2010), «user acceptance» (Jen-Hwa Hu et al., 2005; Johnson et al., 2014), and «artificial intelligence» appear with higher frequency, indicating that they are among the most prominent terms in the WoS dataset. Figure 7.b depicts the Scopus data. The terms «technology acceptance model» (Chocarro et al., 2023; Go et al., 2020; Mohr & Kuhl, 2021), «artificial intelligence» and «technology acceptance» are among the most frequent Keywords Plus in the Scopus dataset.

Table 3. Authors with at least six publications in the field (1999–2023), based on WoS and Scopus data

Author	Institution	Country	Number of publications on the topic in both databases	Total number of documents in Scopus (S)/ WoS (W)	Total number of citations in Scopus (S)/ WoS (W)	Total h-index in Scopus (S) / WoS (W)
SALLOUM, Said A.	University of Sharjah	United Arab Emirates	12	172 (S) /53 (W)	5,768 (S) / 1,341 (W)	44 (S) /19 (W)
DWIVEDI, Yogesh K.	Swansea University	United Kingdom	9	685 (S) /529 (W)	39,805 (S) /28,412 (W)	103 (S) /90 (W)
AL KURDI, Brween	Hashemite University	Jordan	6	136 (S) /29 (W)	4,136 (S) /537 (W)	39 (S) /8 (W)
AL-EMRAN, Mostafa.	British University in Dubai	United Arab Emirates	6	139 (S) /82 (W)	5,812 (S) / 2,864 (W)	41 (S) /29 (W)
ALSHURIDEH, Muhammad Turki	University of Sharjah	United Arab Emirates	6	330 (S) /20 (W)	7,168 (S) /715 (W)	51 (S) /14 (W)
CHATTERJEE, Sheshadri	Indian Institute of Technology Kharagpur	India	6	189 (S) /173 (W)	4,513(S) / 3,487 (W)	46 (S) /39 (W)
PORTELA Filipe	Universidade do Minho	Portugal	6	203 (S) /121 (W)	1,181 (S) /470 (W)	18 (S) /11 (W)

Table 4. Total number of documents by affiliation (1999–2023), based on WoS and Scopus data

Affiliation	Scopus	WoS
The University of Jordan	15	11
UCSI University	8	8
University of Sharjah	13	3
National University of Singapore	7	8
Sun Yat-Sen University	7	8
University of Johannesburg	6	9
State University System of Florida	4	10
Swansea University	6	8
Indian Institute of Technology System IIT System	0	12
University of Salford	9	1
Chinese University of Hong Kong	2	7
Rheinisch-Westfälische Technische Hochschule Aachen	8	0
Universidade do Minho	8	0
British University in Dubai	8	0
Technische Universiteit Eindhoven	7	0
Beijing Normal University	0	6

Note: Affiliations are reported as indexed in Scopus and WoS, which may include both institution-level and system-level entities. No post-hoc harmonization was applied, in order to preserve consistency with the source databases.

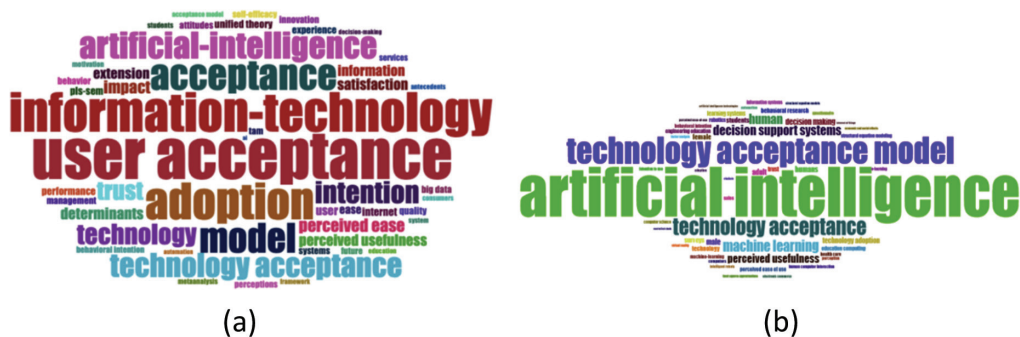


Figure 7. Word cloud of Keywords Plus extracted from WoS (a) and Scopus (b) for the period 1999–2023

Comparing the word clouds, both databases contain a high frequency of the term «artificial intelligence», as reflected by its large size in the word clouds. Scopus shows a higher relative frequency of «technology acceptance model» compared to WoS. Conversely, WoS data contain a higher relative frequency of the term «information technology» compared to Scopus. The term «user acceptance» is prominent in WoS data, reflecting greater representation of this topic in the indexed literature. Terms related

to sustainability and energy were found to be very infrequent in the keyword data. In the WoS-based dataset, terms containing «energy» appeared only 12 times out of 6,713 keyword occurrences (0.18 %), while in the Scopus-based dataset they appeared only once out of 3,387 occurrences (0.03 %). These figures show that sustainability and energy-related issues remain marginal within the AI acceptance literature.

Figure 8 showcases two cumulative line graphs, (a) for Web of Science (WoS) and (b) for Scopus. These graphs illustrate the frequency of specific terms over time within the respective databases as analysed using R-studio software and Bibliometrix libraries. In both graphs, the x-axis represents the years, while the y-axis indicates the cumulative occurrences of each term. Each line, differentiated by colour, corresponds to a term used in scientific literature. The number-of-words parameter is set from 1 to 10. For this analysis, we applied both a stop-word file and a thesaurus file to improve the quality and interpretability of the results. The stop-word file was used to exclude generic or non-informative terms that do not contribute to the conceptual structure of the field but may dominate frequency counts. The thesaurus file was employed to merge synonyms and variants, thereby avoiding fragmentation of conceptually identical terms. This preprocessing step ensured that the frequency trends reflect meaningful research topics rather than artefacts of lexical variation. The corresponding files are included in the supplementary material for transparency and reproducibility. Figure 8.a details the frequency of terms in the WoS database. Terms such as «acceptance», «adoption» and «user acceptance», among others, show an increasing trend, with «technology acceptance» and «user acceptance» displaying particularly steep climbs, reflecting their growing prominence in the literature. Figure 8.b reflects the Scopus data, where terms such as «artificial intelligence», «decision support systems», (Jeng & Tzeng, 2012; Jen-Hwa Hu et al., 2005; Johnson et al., 2014; Shibl et al., 2013) and «human» are tracked. Here, the frequency of «artificial intelligence» shows a dramatic increase over time, suggesting a surge in research and discussions surrounding AI. Comparing the two graphs, the term «technology acceptance model» is notable in both databases. Still, the term «artificial intelligence» shows a sharper increase in Scopus compared to WoS.

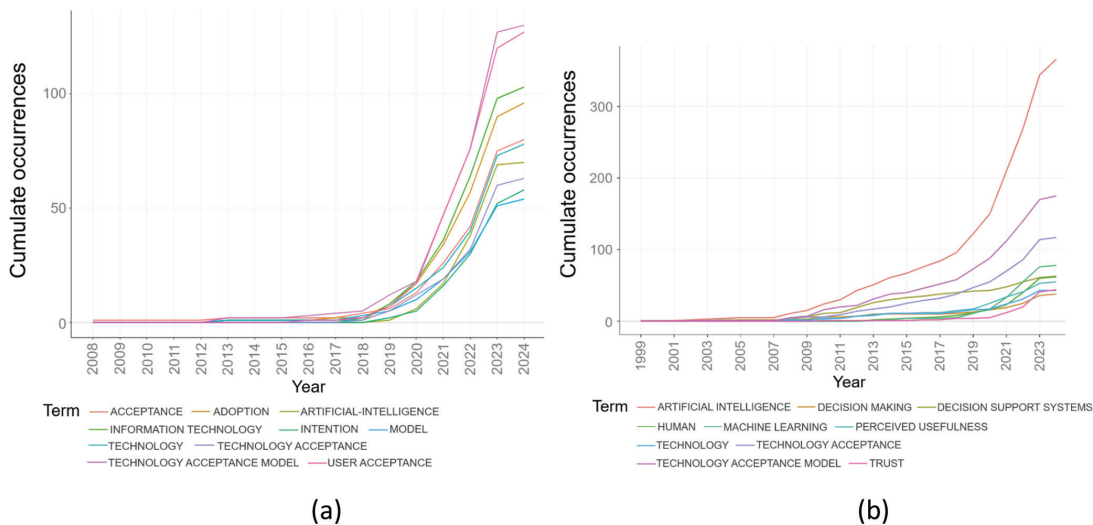


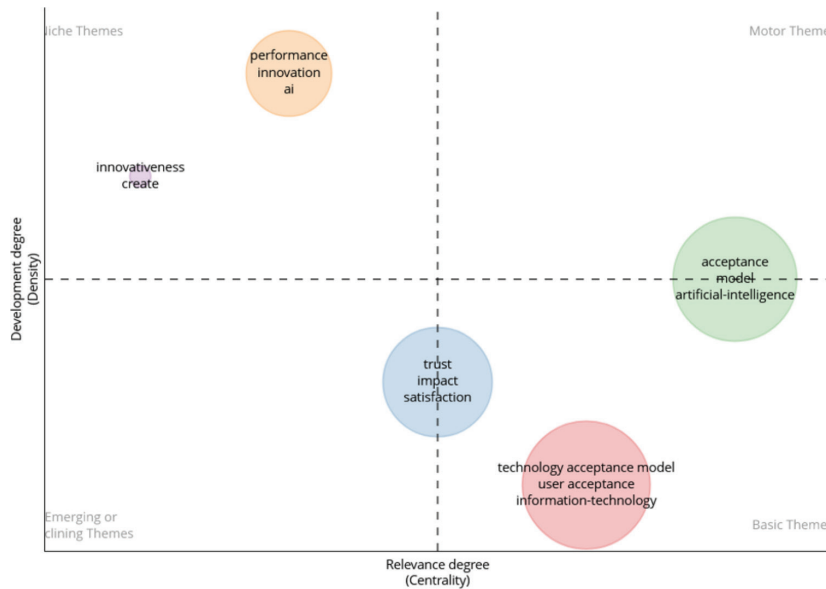
Figure 8. Cumulative frequency of selected keywords over time in WoS (a) and Scopus (b), generated with R and the Bibliometrix package

Figure 9 depicts a thematic map where the x-axis, labelled «Relevance degree (Centrality)», represents the centrality of a theme within the research field; the y-axis, labelled «development degree», indicates the evolution or growth of the theme over time, with higher values corresponding to more developed themes and lower values for declining or niche themes. The analysis was based on Keyword Plus, considering the 250 most frequent words. We set the minimum cluster frequency to 5 per thousand documents, and extracted 3 labels per cluster (with label size = 0.3). The map was constructed with a community repulsion value of 3, and clusters were identified using the Fast Greedy clustering algorithm. Quadrant boundaries were defined using the median centrality and density values, which is the default procedure in Bibliometrix. It should be noted that sectoral stratification (e.g., by health, education, energy) was not applied in this analysis; the observations reported here are based on keyword frequencies and co-occurrence patterns.

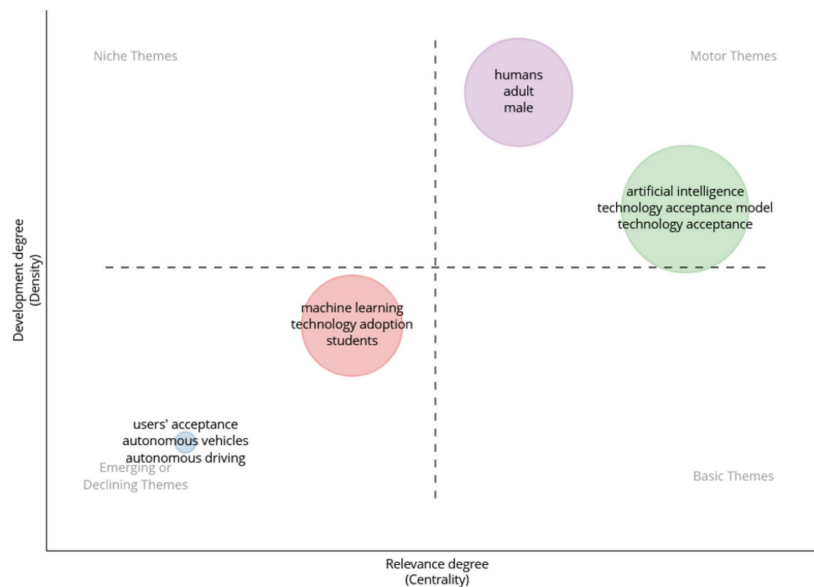
Figure 9.a states that Motor themes are well-developed and central to the field. The bubbles «acceptance» and «artificial intelligence» are in this area, indicating these are well-established and pivotal themes. It determines as Basic themes—central but less developed or possibly declining—«technology acceptance model», «user acceptance», and «information technology», suggesting they are foundational to the field but not currently emerging. It shows as Niche themes, which are less central and highly specialized, the terms «performance», «innovation», and «AI» appear here, possibly indicating focused research areas that are not extensively central to the field. Lastly, emerging or declining themes, which are not central and which might be gaining or losing traction in current research, are the keywords «trust», «impact», and «satisfaction» (Choi et al., 2023; Du et al., 2021; Eren, 2021; Hengstler et al., 2016; Seo & Lee, 2021). Figure 9.b locates «artificial intelligence», «technology acceptance model», and «technology acceptance» in Motor themes as well-developed and central to the field, indicating these themes are robust and form the core of the research field according to Scopus data. Niche Themes are themes that are less central and highly specialized, those include «humans», «adult», «male», and «students», suggesting these are specialized areas of study that have seen some development but are not widely central to the field. Lastly, Emerging or Declining Themes indicates keywords such as «acceptance», «users», «vehicles», «autonomous driving», «machine learning», and «technology adoption», which could indicate that these themes are either upcoming areas of interest in the research community or ones that are decreasing in focus (Buckley et al., 2018; Buteau & Lee, 2021; Foroughi et al., 2023; Meyer-Waarden & Cloarec, 2022; Panagiotopoulos & Dimitrakopoulos, 2018). A comparison of Figures 9.a and 9.b reveals differences in the themes that each database identifies as central and developed. For example, «artificial intelligence» and «technology acceptance» are motor themes in both, but «machine learning» and «technology adoption» appear to be emerging or declining in Scopus while not visible in part (a).

Although the classification of ‘technology acceptance model’ as a basic theme and ‘artificial intelligence’ as a motor theme derives from bibliometric clustering, these patterns align with theoretical developments in technology acceptance research. TAM and its extensions (e.g., UTAUT) remain foundational in structuring the field, while AI-related constructs represent motor themes driving novel applications. Recent work has also highlighted the role of trust, ethics, and human–AI interaction, indicating that the bibliometric patterns observed here are consistent with both established theory and the ongoing expansion of acceptance research into new socio-technical domains.

Figure 10 shows two horizontal timeline graphs, part (a) representing data from WoS and part (b) from Scopus. These graphs display trend topics within both databases, as analysed using R Studio and Bibliometrix libraries. In both (a) and (b), the horizontal axis represents the year, and the vertical axis lists various research topics or keywords. The bubble size for each topic within the database indicates the term’s frequency in that particular year. The analysis of thematic evolution over time was performed using the trendTopics function of the Bibliometrix package. The visualization was based on the ‘Keyword



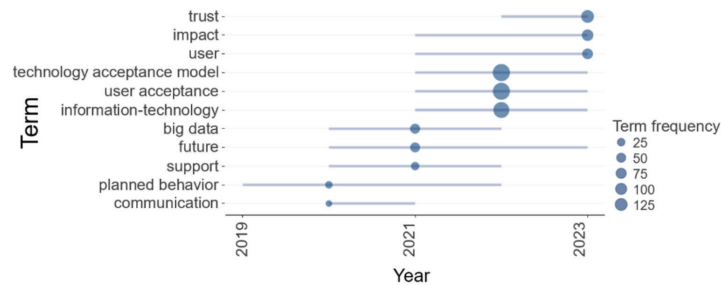
(a)



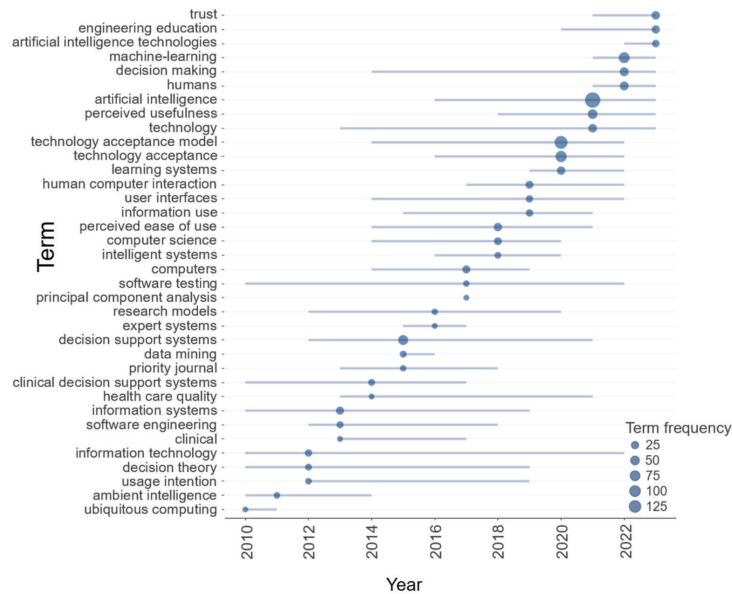
(b)

Figure 9. Thematic maps generated from WoS (a) and Scopus (b) using R and the Bibliometrix package

Plus' field, with a minimum word frequency set to 5 and a maximum of 3 terms per year displayed. These parameters ensured that only the most frequent and representative terms were included, allowing for a clear visualization of longitudinal trends in the corpus. The larger bubbles across the timeline in Figure 10.a show that topics such as «technology acceptance model» and «user» appear more frequently and consistently over the years. Figure 10.b reveals a different set of topics that include «engineering education», «machine learning» and «artificial intelligence» (Kurilovas, 2019; Miranda Veiga & Valente de Andrade, 2021) with larger bubbles appearing in more recent years, suggesting an increasing trend or surge in popularity. Comparison shows that while there is some overlap in research topics, each database exhibits distinct trends with varying frequencies. For example, «machine learning» shows a more significant presence in the Scopus data, and «technology acceptance model» is more prominent in the WoS data.



(a)



(b)

Figure 10. Trend topics in WoS (a) and Scopus (b), generated with R and the Bibliometrix package

Mercè Teixidó, Emiliano Borri, Manel Díaz, Carles Mateu, and Luisa F. Cabeza

Bibliometric Mapping of Technology Acceptance in Artificial Intelligence, Machine Learning, and Neuronal Networks: A Comparative Analysis of WoS and Scopus (1999–2023)



Figure 11 presents an analysis of keyword co-occurrence using VOSviewer. This analysis has been constructed by examining the metadata of WoS (a) and Scopus (b). The co-occurrence network has been generated with a threshold of a minimum of four occurrences of a keyword, so that only terms with this number of occurrences are included. The counting method was set to «full counting», and normalization was performed using the association strength method (default in VOSviewer and recommended for co-occurrence analysis). Clusters were identified with VOSviewer's modularity-based algorithm (resolution = 1.00; minimum cluster size = 8; number of keywords to be selected = 29). A stop-word list and a thesaurus file were applied, both of which are provided as supplementary material. Lines between the circles represent the co-occurrence or association between keywords. The colours signify different clusters of keywords that are more closely associated with each other than keywords in other parts of the map.

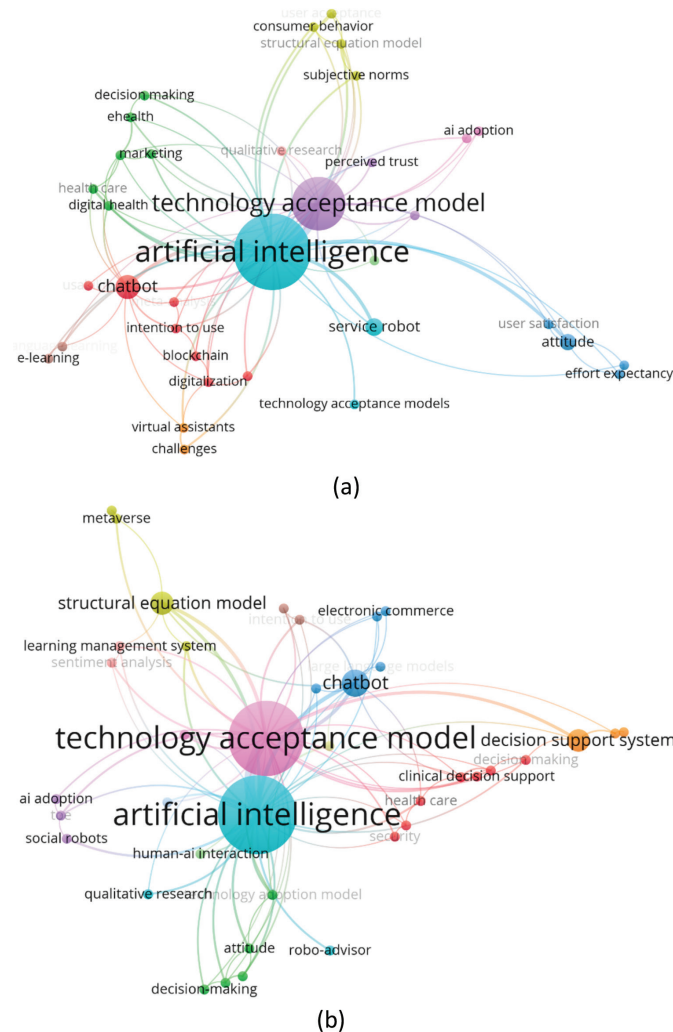


Figure 11. Keyword co-occurrence networks for WoS (a) and Scopus (b), generated with VOSviewer

In the WoS visualization (Figure 11a), ‘artificial intelligence’ appears as the largest node, co-occurring with terms such as ‘chatbot’ (Chen et al., 2021; Eren, 2021), ‘e-health’ (Eiam-o-pas et al., 2022; Huq et al., 2022), and ‘blockchain’ (Abu Afifa et al., 2023; Kamble et al., 2021; Wong et al., 2020). The strong presence of ‘decision-making’ and ‘marketing’ alongside ‘technology acceptance model’ suggests an interdisciplinary approach that combines AI with business and healthcare strategies. The Scopus visualization (Figure 11b) also places ‘artificial intelligence’ at the centre, highlighting its importance. However, it includes a distinct array of keywords, such as ‘metaverse’ (Aburayya et al., 2023; Almarzouqi et al., 2022; Salloum et al., 2023), ‘social robots’ (de Kerve-noael et al., 2020; Korn et al., 2018), and ‘robo-advisor’ (Aw et al., 2023; Figa-Talamanca et al., 2022; Sabir et al., 2023), indicating a slightly different focus. The term ‘health care’ has a strong presence, along with ‘human-ai interaction’ and ‘clinical decision support’, pointing towards a more pronounced emphasis on AI’s role in clinical settings and user-centered research (Jeng & Tzeng, 2012; Johnson et al., 2014; Peleg et al., 2009). The comparative analysis suggests that, while there are commonalities in AI research themes across both databases, such as the central role of AI and its intersection with technology acceptance models, notable differences also exist. WoS appears to emphasize the decision-making aspect and practical applications in marketing and e-health, whereas Scopus shows a stronger link with health care applications, social implications of AI, and emerging concepts, such as the metaverse.

The patterns identified in the bibliometric analysis have several implications for AI acceptance theory and practice. For instance, the thematic clusters revealed in the keyword co-occurrence and thematic maps underscore how acceptance studies are increasingly branching into application domains such as healthcare, autonomous driving, and education. These clusters indicate that acceptance models, traditionally rooted in information systems, are being adapted to new socio-technical contexts where trust, ethics, and human–AI interaction play a decisive role. In practice, this suggests that future research agendas should not only refine theoretical models (e.g., TAM, UTAUT) but also account for emerging domains. The visualization of clusters also points to research gaps—for example, the limited integration of AI acceptance studies with sustainability and energy-related topics—highlighting opportunities for future inquiry.

5. Conclusions

This study conducts a bibliometric analysis of the literature on technology acceptance models related to artificial intelligence (AI), machine learning (ML), and neuronal networks (NN). This study has uncovered important insights into the changing landscape of AI integration and social acceptance. Between 1999 and 2023, there has been a marked increase in research activity, particularly in recent years, highlighting a growing interest among academic and professional communities in understanding and navigating the complexities of AI adoption.

Key findings from our study indicate that technology acceptance models play a critical role in AI, specifically emphasizing the human aspects of technology adoption. Through thematic and keyword analysis, we identified a wide range of research focuses, including the implications of AI in education, healthcare, and smart grid technology, underscoring the multidisciplinary nature of studies on the acceptance of technology.

Furthermore, the geographical and institutional distribution of publications reveals a global interest in the uptake of AI technology, with notable contributions from the United Kingdom, the United

States, China, and the United Arab Emirates. These patterns, however, are based on absolute publication counts and may partly reflect population size, R&D investment, and database coverage. They should therefore be interpreted with caution.

This study reveals that the contents of the WoS and Scopus databases significantly diverge in the fields examined, as shown in Figures 7 and 9. Research predominantly focuses on technological aspects. The comparative study reveals similarities and differences in AI research themes within the two databases. Both databases highlight the importance of AI and its integration with technology acceptance models. However, differences are evident: WoS predominantly focuses on AI's role in decision-making and its practical applications in fields such as marketing and e-health. In contrast, Scopus tends to focus more on AI's applications in healthcare, its social implications, and emerging concepts such as the metaverse. Additionally, there are weak links between research on energy and on climate mitigation and sustainability, with the latter themes being underrepresented in the literature.

The differences observed in the co-occurrence networks may reflect distinct emphases in the two databases. In WoS, frequent associations with terms such as decision-making, marketing, and e-health suggest a stronger representation of business- and management-oriented applications. By contrast, Scopus highlights terms such as health care, human–AI interaction, and metaverse, pointing to a greater representation of clinical, social, and emerging technology contexts. These distinctions should be interpreted cautiously, as they may partly stem from differences in database indexing practices and coverage. These conclusions should be validated with further analyses of the documents identified in this study. Future research could address these gaps by considering multiple databases and extending analyses to include sustainability and energy as part of the broader AI acceptance discourse.

Beyond these findings, the originality of this study lies in its generalist and cross-domain scope and its dual-database approach. Unlike sector-specific bibliometric analyses, our work provides a holistic overview that reveals overarching trends and underexplored gaps—such as the limited connection between AI acceptance, sustainability, and energy. Methodologically, the comparison of WoS and Scopus highlights how database selection shapes the research landscape, while theoretically the results illustrate how classical models of technology acceptance are evolving towards socio-technical contexts where trust, ethics, and human–AI interaction are central.

In addition, our analysis shows that sustainability- and energy-related topics are only marginally represented in the AI acceptance literature, with terms containing «energy» accounting for only 12 out of 6,713 keyword occurrences (0.18 %), while in the Scopus dataset they appeared just once out of 3,387 occurrences (0.03 %). This quantitative evidence highlights a clear research gap, suggesting that the integration of sustainability, energy, and climate considerations into technology acceptance studies remains an underexplored but highly relevant direction for future research.

6. Limitations

It should be noted that Scopus and Web of Science differ in their coverage, indexing depth, and document-type representation. As a result, direct comparisons between the two databases may reflect structural differences rather than substantive contrasts. In this study, the analyses were performed separately for each database, and the conclusions are framed as comparative tendencies rather than normalized indicators. Therefore, the findings should be interpreted with caution, acknowledging this methodological limitation.

An additional limitation concerns the query design choices. In particular, the use of the less common variant «neuronal networks» may have restricted the retrieval of publications that rely on the more standard term «neural networks» or related expressions such as «deep learning» or «DL». As a result, the apparent absence of these terms in the co-occurrence maps should not be interpreted as a substantive gap in the field, but rather as a reflection of query constraints. Future replications would benefit from expanding the query to include broader synonym sets to capture the full range of terminology used in the literature.

Another limitation concerns the search strategy. The query was deliberately restricted to the exact phrase «technology acceptance» in combination with «artificial intelligence», «machine learning» and «neural networks». This choice ensured precision and alignment with the study's objectives, but it may have excluded related works that employ alternative terminology (e.g., technology adoption, user acceptance, UTAUT). While we are confident that many such studies were still captured—given that these terms often appear alongside technology acceptance in titles, abstracts, or keywords—we acknowledge that future research could broaden the query to include synonyms and truncation, thereby covering an even wider spectrum of the field.

A further limitation relates to the estimation of annual growth. The Biblioshiny interface implements the CAGR formula but does not provide complementary statistics such as confidence intervals or regression-based goodness-of-fit measures. Although CAGR is a standard bibliometric indicator, future research could combine it with regression-based estimations to more formally assess the robustness of growth patterns.

Finally, country- and institution-level rankings are based on descriptive counts, and small differences should be interpreted cautiously. Results may also vary depending on database indexing practices and document-type classifications. While we did not compute confidence intervals or bootstrapped estimates, we acknowledge these as useful directions for future bibliometric research.

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Data Availability Statement

The datasets for this study are available at <https://drive.google.com/drive/folders/1L3Z9O2uayh-V3lAhBBNoV3TCRVNsIT3Xs?usp=sharing>

Declaration of interests

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Terminology Table: Acronyms and Definitions

Acronym	Definition
AI	Artificial Intelligence
CRedit	Contributor Roles Taxonomy
iTAM	Interactive Technology Acceptance Model
ML	Machine Learning
NN	Neuronal Networks
PRISMA	Preferred Reporting Items for Systematic Reviews and Meta-Analyses
R	R programming language
SEM	Structural Equation Modelling
TAM	Technology Acceptance Model
UTAUT	Unified Theory of Acceptance and Use of Technology
WoS	Web of Science

Author contributions: CRediT

Mercè Teixidó: Validation, Formal Analysis, Data Curation, Writing – Original Draft, Visualization, Writing – Review and Editing

Emiliano Borri: Conceptualization, Validation, Writing – Review and Editing

Manel Díaz: Validation, Formal Analysis, Data Curation, Writing – Original Draft, Visualization, Writing – Review and Editing

Carles Mateu: Conceptualization, Validation

Luisa F. Cabeza: Conceptualization, Methodology, Validation, Investigation, Writing – Review and Editing, Supervision, Project Administration, Funding Acquisition

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