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Global Trends and Transformative Insights in Artificial Intelligence (AI) Research: A Bibliometric Analysis of the Dynamics of Education, Ethics, and Innovation

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Abstract:
Artificial intelligence (AI) research has grown significantly in the last decade, playing a crucial role in education, healthcare, and industry. This study explores global AI research trends using a bibliometric approach, analyzing geographical contributions, key themes, and temporal dynamics. Keyword network visualization highlights dominant themes such as "machine learning," "digital transformation," and "ethical AI," along with their interconnections reflecting AI's evolution. The United States leads with 38% of global AI publications, followed by China and India, reinforcing their roles as innovation hubs. Leading institutions, including the University of California and Beijing Normal University, significantly contribute to machine learning and generative AI research. A surge in AI publications in 2023 indicates the growing influence of generative tools like ChatGPT. This study enriches the literature on AI trends while providing insights for policymakers to guide research investments. Understanding inter-topic relationships and cross-country collaborations offers new interdisciplinary and international cooperation opportunities. The findings provide a comprehensive AI research map to guide future studies and technological advancements.

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Artificial Intelligence, Bibliometric Analysis, Research Trends, Machine Learning

INTRODUCTION

Over the past decade, research on artificial intelligence (AI) has seen rapid growth, highlighting the crucial role of this technology in various sectors, including health, education, and industry. The initial period between 2014 and 2018 marked the emergence of interest in AI with a steady increase in citations, albeit at a low level (Herlina, 2024). The following years showed a significant surge, especially in 2019–2020, with the widespread adoption of AI through technologies such as machine learning and deep neural networks. However, this trend also faced fluctuations, including a decline in 2021–2022, reflecting a shift in focus to new research areas (Putri, 2024)

The peak surge in 2023 was driven by the popularity of generative technologies, such as ChatGPT, which attracted significant attention from academics and practitioners. This study aims to map the geographic contributions and key topics in AI research, represented through bibliometric analysis, data visualization, and clustering approaches. The focus of this study is to understand the dynamics of the development of AI research

globally and highlight the factors that influence the distribution of contributions by country and institution (Crompton, 2023).

This study offers a unique approach using bibliometric analysis to map inter-topic relationships and temporal trends in AI research. Using keyword network visualization, this study can reveal dominant themes and patterns of relationships between different research fields (Zubaidi, 2024). In addition, the geographic map of researchers' contributions provides new insights into the global distribution of AI research, especially in identifying countries and institutions that are innovation centers. Using temporal scales to analyze research trends is also an innovative approach that provides a dynamic view of AI developments.

Despite the growing body of literature on bibliometric analysis and topic mapping in AI research, there remains a gap in understanding how these insights can be systematically utilized to shape research and development (R&D) investments, particularly in emerging AI fields (Zubair, 2024). While previous studies have explored AI trends and thematic developments, limited research has focused on translating these findings into actionable strategies for policymakers, academics, and industry practitioners. This study addresses this gap by mapping AI research topics and identifying key areas with high potential for innovation and interdisciplinary collaboration.

The novelty of this study lies in its dual contribution: first, it enriches the existing literature by providing a comprehensive bibliometric analysis of AI research trends, and second, it bridges the gap between theoretical insights and practical applications by offering a framework for R&D investment prioritization. Unlike previous studies focusing solely on thematic trends, this research provides a strategic perspective on optimizing AI development through cross-disciplinary and cross-country collaborations. The findings serve as a crucial reference for policymakers, guiding the allocation of resources to maximize AI's impact in various sectors.

This research contributes to the academic literature and encourages the development of more targeted policies to support the AI innovation ecosystem. In this context, some of the main issues studied include global trends in the evolution of AI research regarding citation contributions, main topics, and geographic distribution. In addition, this research explores central themes in AI research and relationships between topics that reflect the direction of development of this technology. Differences in contributions to AI research between countries are also the focus of the study, including the factors that influence the dominance of several countries in AI research. The role of leading universities in encouraging innovation and development of AI research globally is also analyzed, along with the impact of AI implementation in various sectors such as education, health, and industry based on existing research focus.

RESEARCH METHOD

This methodology uses a bibliometric analysis to identify trends, geographic contributions, and key topics in artificial intelligence (AI) research. The research stage begins with data collection from various scientific publications, including academic journals, international conferences, and research institution reports (Crismono, 2024; Fatimah et al., 2024). In addition, data visualizations such as bar and pie charts represent the distribution of contributions by country and institution. Recommended bibliometric and science mapping workflows (Crismono, 2023; Donthu et al., 2021; Gao et al., 2022).

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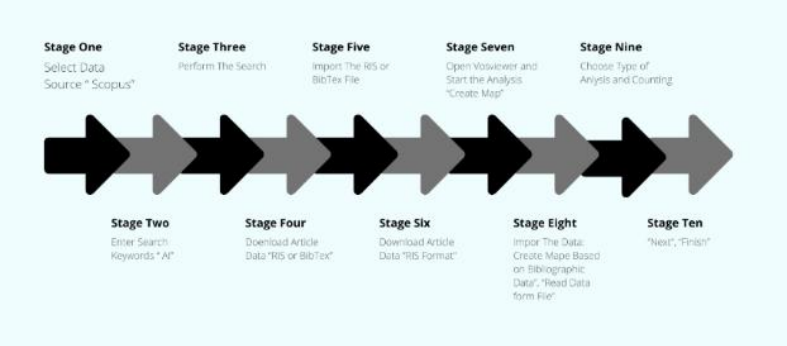

Figure 1. Bibliometric and Science Mapping Workflow

Figure 1 shows that the bibliometric analysis was applied to measure the frequency of citations, key keywords, and relationships between topics in the AI literature (Tekdal, 2021). This technique is complemented by clustering, where keywords frequently occurring together are identified and grouped based on conceptual proximity. Each cluster represents a specific theme, such as industrial applications, AI ethics, or technology-based education.

Next, a temporal scale is used to identify research trends over time. Rapidly developing topics are marked with a specific color, such as yellow for recent research, to map the temporal dynamics in the AI literature. Geographical analysis is also conducted to map researchers' contributions by country. Countries with the highest contributions, such as the United States and China, are further analyzed to explore the factors that support their contributions.

In addition, the institutional affiliation analysis highlights universities with the most significant contributions to AI research, such as the University of California, Stanford University, and Beijing Normal University. Their research focus is analyzed to understand the main areas of concern. Finally, the data generated from the various analyses are verified through cross-checks with relevant literature to ensure the validity and reliability of the results. This methodology is designed to provide a comprehensive overview of global AI research trends, helping to identify dominant themes, geographic dynamics, and significant institutional contributions. This approach also allows mapping future AI research directions based on the identified findings and topic relationships.

RESULT AND DISCUSSION

The bibliometric analysis reveals global AI research trends, focusing on education, ethics, and innovation. Keyword network visualization highlights dominant themes such as machine learning, digital transformation, and ethical AI. The U.S. leads AI publications (38%), followed by China and India, solidifying their roles as innovation hubs. Major contributors include the University of California and Beijing Normal University, particularly in machine learning and generative AI. A surge in 2023 publications reflects the growing impact of tools like ChatGPT. This study underscores the link between education, ethics, and innovation, offering insights for policymakers on research investment and interdisciplinary collaboration.

Result

AI Quote Trends: Growth, Surge, and Future Challenges

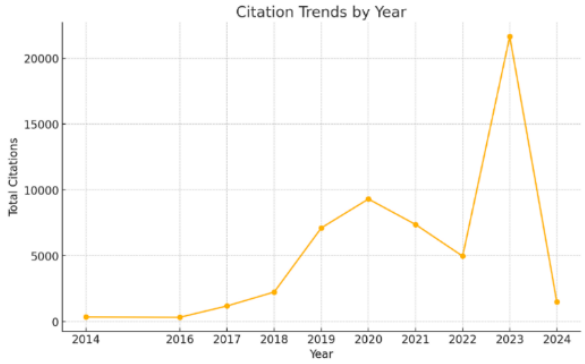

Figure 2. Citation Trends by Year

Figure 2 above shows that the trend of AI-related research citations shows an interesting development from year to year. The initial period from 2014 to 2018 reflects a steady increase in citations, although at a relatively low level. This shows that AI research is starting to attract attention but has not yet reached its peak. This increase shows the emergence of early interest in AI technology and its implementation. The period 2019 to 2020 marked a significant surge in citations. In recent years, AI has been widely applied in various fields, including health, education, and industrial technology. Publications on machine learning and innovations such as deep neural networks have become the focus of academics and practitioners. The rapid development of these technologies has driven an increase in publications and citations.

However, 2021 to 2022 shows a slight decline in citations. This decline could be due to the shift in research focus to new areas or a reduction in interest in previously mature research. However, it could also indicate that significant publications that attracted many citations were released in previous years. The remarkable peak in 2023 indicates that AI research is again reaching a very high level of relevance. This sharp spike is likely due to the popularity of AI-based generative tools such as ChatGPT, which has brought significant attention to the technology among academics and the general public. Publications on AI's societal impact and practical applications may also have contributed to this sharp increase.

Finally, the sharp decline in 2024 appears to be temporary, given that data available for this year is likely incomplete. This decline reflects the need to observe trends throughout the year to see how citation patterns evolve. Overall, these trends show rapid growth in AI research with some fluctuations that may reflect research cycles or dynamics in academia and technology. The decline in artificial intelligence (AI) research trends from 2023 to 2024 could be caused by several interrelated factors. One of the leading causes is the shift in research focus to new technologies or more specific fields, such as quantum computing or AI applications in specific sectors, after the popularity of generative tools such as ChatGPT peaked in 2023. In addition, mature AI topics such as Machine Learning and Deep Learning may begin to lose traction for new research as significant innovations in these fields are considered to be approaching their optimal limits.

Central Themes in Artificial Intelligence (AI) Research

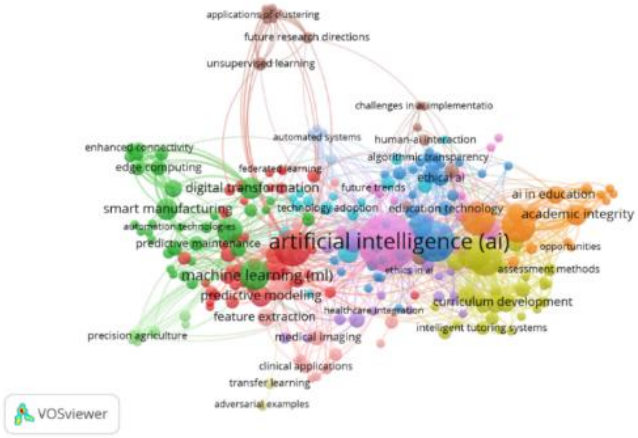

Figure 3. Global Topic Network Map in Artificial Intelligence

Figure 3 shows that the visualization results from a bibliometric analysis that reveals patterns of relationships between topics in artificial intelligence (AI) research based on keywords that frequently appear together in the literature. Each node or point in the visualization represents a specific keyword or topic, such as "artificial intelligence (AI)," "machine learning (ML)," "digital transformation," "ethical AI," "academic integrity," and others. The size of the node indicates the level of significance or frequency of its occurrence in the literature, whereas larger nodes indicate more widely discussed or influential topics. The lines connecting the nodes reflect the relationships or correlations between the topics, indicating that the two topics frequently appear together in the same research context.

The colors divide the visualization into clusters, each representing a group of closely related topics based on conceptual proximity. In this visualization, various key themes in artificial intelligence (AI) are grouped into several color clusters based on conceptual proximity. The green cluster highlights the application of AI in industry, including intelligent manufacturing, predictive maintenance, edge computing, and enhanced connectivity to support digital transformation. Meanwhile, the red cluster focuses on the core technologies of AI and machine learning, with key concepts such as artificial intelligence, feature extraction, predictive modeling, and digital transformation forming the foundation of AI technology in various fields.

Additionally, the blue cluster raises issues of ethics, algorithm transparency, human-AI interactions, and AI implementation challenges, highlighting the importance of a responsible approach in developing this technology. On the other hand, the orange cluster focuses on the application of AI in education, including intelligent learning systems, data-based curriculum development, and more objective evaluation methods. The purple cluster highlights research in deep learning and transfer learning systems, with key applications in healthcare, such as medical imaging and automated diagnosis; this visualization illustrates the close connections between key themes in AI, providing insight into developments and research directions in the artificial intelligence ecosystem. This visualization shows how key themes in AI are interconnected in color clusters that depict specific research focuses, providing a clear view of the developments and relationships between different fields in the artificial intelligence ecosystem.

Keyword Relatedness Analysis Based on Overlay in Visualization

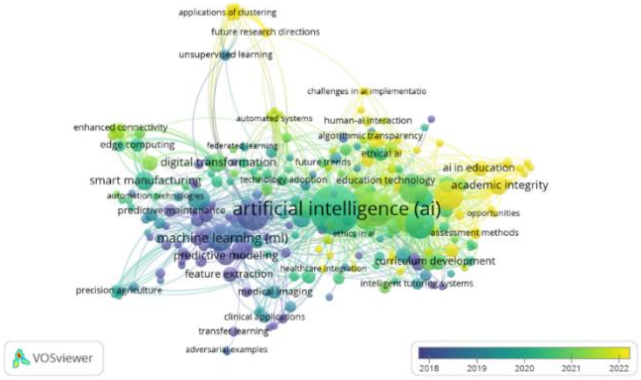

Figure 4. Evolution of Artificial Intelligence: Trends and Topics Map 2018–2022

Figure 4 is a bibliometric visualization that illustrates the relationship between topics or keywords in artificial intelligence (AI) research based on co-occurrence analysis in the literature. Each node in the visualization represents a specific topic, such as "artificial intelligence (AI)," "machine learning (ML)," "ethical AI," and others. The node's size indicates the significance level or frequency of its occurrence in the research. In contrast, the line connecting the nodes represents the relationship or correlation between the two topics. The colors on the nodes indicate the time dimension based on the color scale at the bottom of the figure, with blue indicating older studies (around 2018) and yellow indicating more recent studies. Green nodes represent topics that developed gradually during the period.

The topic “artificial intelligence (AI)” is located at the center of the visualization and has a large node size, reflecting that it is a significant topic with a high level of relevance across research. Large green nodes such as “machine learning (ML),” “digital transformation,” and “predictive modeling” indicate core topics that are stable and evolving. On the other hand, topics in bright yellow, such as “academic integrity,” “AI in education,” and “challenges in AI implementation,” reflect newer research themes that are gaining increasing attention. In contrast, nodes in blue, such as “transfer learning,” “adversarial examples,” and “feature extraction,” represent long-standing research areas that are the foundation of today’s AI technology. The lines connecting these topics reflect the close relationship between the foundation of AI technology and its evolving applications.

Overall, this visualization shows the evolution of AI research, highlights the relationships between key topics, and provides insight into recent research trends and areas of focus in recent years. This helps to understand the development of research in artificial intelligence both temporally and conceptually.

Keyword Relatedness Analysis Based on Density in Network Visualization

Figure 5 is a bibliometric visualization that shows the density or intensity of relationships between topics in artificial intelligence (AI) research using a heatmap approach. Each point or keyword in this visualization is represented in a color spectrum that reflects the level of density or significance of a topic in the literature. Yellow indicates areas with high density or the most frequently discussed topics, green indicates medium density, and dark blue or purple areas indicate lower density. The topic “artificial intelligence (AI)” is at the center of the visualization and has a bright yellow color,

indicating that it is the main topic with the highest density in research. Around this central node, there are other significant topics such as “machine learning (ML),” “predictive modeling,” and “digital transformation,” which also have high intensity, indicated by the yellow-green color. This topic reflects the core theme or foundation of AI technology, which is a significant focus in various studies.

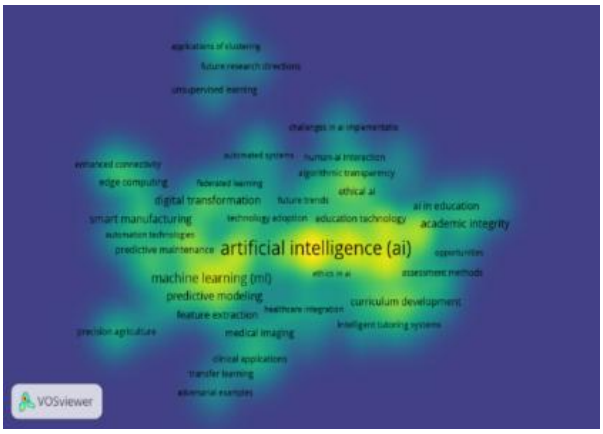

Figure 5. Global Trend Concentration Map in Artificial Intelligence

Medium-intensity topics, represented by the color green, include “smart manufacturing,” “ethical AI,” and “AI in education.” These topics describe specific applications or aspects of artificial intelligence, such as the application of AI in industry, the ethics of its development, and its role in supporting modern education. The color green indicates that while these topics are significant, they are not as dense as core topics such as “AI” or “ML.”In the low-density areas, indicated by dark blue or purple, are topics such as “adversarial examples,” “transfer learning,” and “precision agriculture.” While these topics make smaller contributions, they are still relevant in specific research contexts, especially in more specialized or technical application domains.

This visualization provides important insights into the distribution and research of artificial intelligence based on topic density. The figure shows that research in AI has very dominant core themes (such as AI and ML) supported by various applications and ethical aspects that are gradually developing, as well as some specific areas that are starting to gain attention in certain contexts. This heatmap helps researchers understand research concentration trends and map priorities or potential collaborations between fields.

AI Research Trends by Country

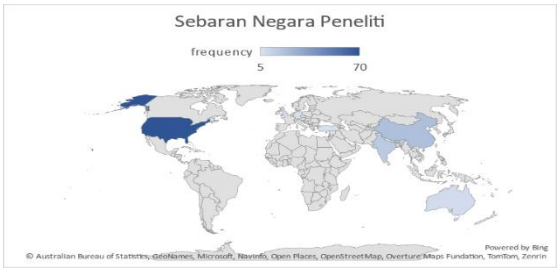

Figure 6. Distribution of Researcher Countries

Figure 6 shows the geographic distribution of researchers by country, with the intensity of the blue color reflecting the frequency of the number of researchers from each country. Countries with the highest researcher contributions are indicated by darker

blue, while lighter blue colors reflect lower numbers. The United States emerges as the most dominant country, indicated by the darkest blue color, with a frequency of 70 researchers. This underscores the United States' important role in developing and researching artificial intelligence (AI). In Asia, countries such as China and India contribute significantly, albeit in smaller numbers than the United States, reflecting the growing interest and investment in AI research in the region.

Meanwhile, Europe shows a relatively even distribution of contributions, with countries such as Germany and the UK having moderate numbers of researchers, as seen by the relatively light blue color intensity. In other regions, such as Australia and Hong Kong, contributions are also identified at moderate levels, indicating active involvement in AI research, although not as large as in other dominant countries. However, there is an apparent regional disparity, with researchers from Africa, South America, and parts of Southeast Asia underrepresented. This may reflect challenges regarding access to research resources or infrastructure support in these regions. Overall, the map shows a dominant concentration of AI research in developed countries, while other regions are still lagging, highlighting the need for equal access and opportunity in AI research globally.

Table 1. Top 10 Countries in Article Contributions: Global Dominance

No.	Country	Article
1	USA	70
2	China	21
3	India	16
4	UK	14
5	Germany	12
6	Australia	12
7	Hong Kong	11
8	Taiwan	10
9	Canada	9
10	Turkey	8

Table 1 above shows how the United States leads global AI research with 70 articles, positioning itself as a key innovation hub. Universities like the University of California and Stanford University drive research in machine learning, deep neural networks, and generative AI technologies such as ChatGPT. Beyond technological advancements, the U.S. actively applies AI across healthcare, education, and industry sectors. Strong cross-disciplinary collaboration solidifies its leadership in AI research. China follows with 21 articles, highlighting its rapid AI growth. Beijing Normal University is crucial, focusing on industrial technology, education, and digital transformation. With substantial investments and infrastructure, China continues establishing itself as a dominant force in AI research and applications.

India contributes 16 articles emphasizing AI applications in education and healthcare. Institutions such as Dhaka University of Engineering & Technology play a significant role in advancing AI solutions for personalized learning and healthcare efficiency. The UK, producing 14 articles, focuses primarily on AI ethics and education, with key institutions like University College London and Swansea University. Algorithmic transparency and ethical AI development are significant themes, alongside the integration of AI into public services and education. Germany and Australia each

contributed 12 articles, with Germany prioritizing AI-driven medical technologies and automation. At the same time, Australia focuses on AI in education and healthcare, particularly in developing learning tools and healthcare innovations.

Hong Kong, Taiwan, Canada, and Turkey also contribute to global AI research, albeit on a smaller scale. With 11 articles, Hong Kong emphasizes AI in education and ethics, led by The Education University of Hong Kong. In producing 10 articles, Taiwan focuses on machine learning and educational technology, particularly interactive AI-based learning. With nine articles, Canada advances machine learning and generative AI applications, exploring AI's role in thoughtful city planning and energy efficiency. With eight articles, Turkey concentrates on AI applications in education and industry, with Bartin University leading efforts to enhance technology-driven learning and industrial management. These contributions reflect a global effort to advance AI across multiple disciplines and sectors.

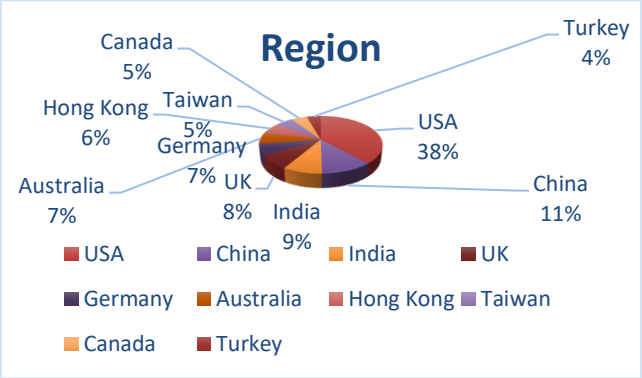

Figure 7. Regional Distribution: Percentage of Global Contribution

Figure 7 shows that the pie chart illustrates the distribution of AI research contributions by country, with the United States (USA) dominating the global contribution at 38%. This dominance reflects the United States' leading role in AI development and research, supported by leading universities and a focus on generative technologies such as ChatGPT. China ranks second with 11% contribution, indicating strong government support and focus on digital transformation, especially in the industrial and education sectors. India contributes 9%, reflecting its increasingly significant role in integrating AI into education and healthcare, signaling growing investment and interest in this technology.

The UK contributed 8%, focusing on AI research in ethics and education. With 7%, Germany focused on practical applications of AI in medical technology and education. Australia also contributed 7%, reflecting its efforts to integrate AI in education and healthcare. With 6%, Hong Kong demonstrated its strengths in education technology and algorithmic transparency. Taiwan contributed 5%, focusing on machine learning and innovation in education technology. Canada also contributed 5%, highlighting machine learning and generative technologies as its primary focus. Lastly, Turkey contributed 4%, demonstrating the great potential of AI in the education and industry sectors. Overall, this diagram shows the dominance of developed countries such as the United States, China, and the United Kingdom in AI research but also reflects significant contributions from developing countries such as India and Turkey. This illustrates AI research's diverse global dynamics and importance in different countries.

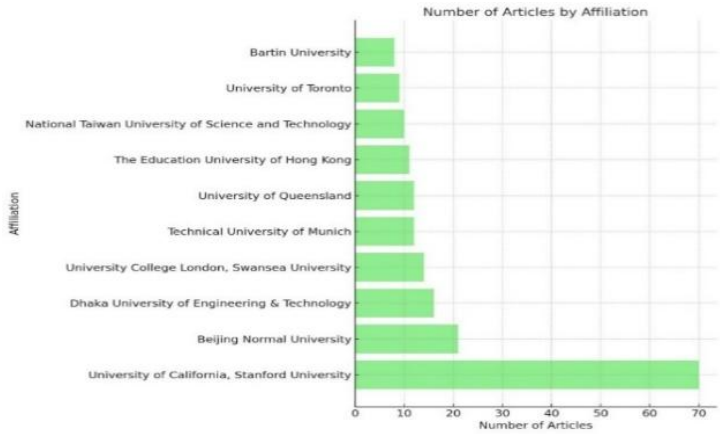

Figure 8. Number of Articles by Affiliation

Figure 8 shows that the bar chart above shows the contributions of the top ten universities based on the number of articles produced in artificial intelligence (AI) research. The University of California, Stanford University dominates with 70 articles, reflecting the United States' critical role as a global AI research and innovation hub. Their research spans many areas, including machine learning, deep neural networks, and generative technologies like ChatGPT. Second place went to Beijing Normal University China, which had 21 articles showing its contribution to the development of AI, especially in education and digital transformation. Dhaka University of Engineering & Technology from India contributed 16 articles, focusing on practical solutions to improve the education and healthcare sectors in the country.

University College London and Swansea University in the UK each produced 14 articles. Their research focused on algorithmic ethics and transparency, demonstrating the UK's commitment to responsible AI development. Germany's Technical University of Munich contributed 12 articles, highlighting its contributions to AI-based medical technology and automation. The University of Queensland in Australia, with 12 articles, focused on integrating AI in the education and health sectors. Meanwhile, The Education University of Hong Kong produced 11 articles that focused heavily on adaptive learning technology and the development of AI-based education systems.

National Taiwan University of Science and Technology in Taiwan recorded 10 articles, demonstrating their commitment to developing AI-based educational technology. The nine articles at the University of Toronto in Canada focused on machine learning algorithms and AI applications in thoughtful city planning. Bartin University in Turkey contributed eight articles focusing on AI applications in education and industry. Overall, this diagram reflects the distribution of contributions from leading universities across countries, illustrating their research focus and essential role in driving AI progress globally.

Discussion

The study found that the AI citation trend increased significantly from 2019 to 2020 before declining in 2021–2022 and peaking again in 2023. This is consistent with research by Husni et al. (2021), who noted that attention to AI technologies is growing as they begin to be applied at scale, such as machine learning and deep neural networks. The surge in 2023 fueled by generative tools like ChatGPT is supported by The Case (2023), showing that the tool has significantly impacted education and healthcare and

has increased researchers' interest in generative AI. This surge is also supported by advances in deep learning architectures and transfer learning techniques, which make it easier to train AI models with smaller datasets while still achieving high performance (Abdullah & Java, 2024). In addition, significant investment from industry and academia, especially in countries such as the United States and China, has accelerated the innovation process.

Dominant themes such as machine learning, ethical AI, and digital transformation reflect global research focuses previously identified by Erma Nurdaningsih et al. (2023); the widespread application of ML technology has accelerated digital transformation in key sectors such as education and healthcare. In education, ML is used to create adaptive learning systems and automated assessments that enable a more personalized and efficient approach to learning. In the healthcare sector, ML helps in data-driven diagnosis, disease prediction, and the development of more precise treatment solutions. This shows how the integration of ML has transformed traditional processes into smarter and technology-driven ones, emphasizing that digital transformation is driven by the integration of AI technology in the education and healthcare sectors. In addition, the theme of ethical AI is in line with Nguyen (2023), which highlights the importance of ethics in developing AI technologies to ensure their positive impact.

The United States' dominance in AI research, contributing 38% of the global publications, shows how it has positioned itself as a major center for AI technology innovation and development. This is supported by the active role of leading universities, such as the University of California and Stanford University, pioneers in cutting-edge technology research. As stated by Crompton, this success is inseparable from the strong research infrastructure, abundant funding, and supportive collaboration ecosystem between academia, government, and industry (Faisol, 2024). As expressed by Cao, China's focus on developing AI-based technologies reflects the country's commitment to becoming a leader in AI adoption and innovation in the industrial, education, and healthcare sectors. Despite being a developing country, India has shown significant growth in AI research contributions at 9% (Bukar et al., 2024). This contribution reflects the pragmatic approach of the Indian government that encourages AI development as a solution to local challenges, such as efficiency in the healthcare and education sectors. Universities such as Dhaka University of Engineering & Technology actively lead research toward practical applications.

As noted by Perkins, AI research in India is often geared towards creating immediate impact, such as using AI to diagnose diseases in remote areas or improving access to education through technology-based learning. The three countries, the United States, China, and India, demonstrate different approaches to driving AI research (Sain, 2025). The United States relies on cross-sector collaboration with a strong academic base, while China focuses on national strategies with significant investments, and India emphasizes research based on local needs (von Gerich et al., 2022). This combination of approaches reflects the diverse global dynamics in AI research while highlighting the importance of supporting infrastructure, policies, and collaboration to achieve excellence in technological innovation.

The study highlights universities such as Stanford and Beijing Normal University as global leaders in AI innovation. The findings align with Alexopoulos, who emphasizes that leading universities are often at the center of international collaboration in developing AI technologies. The contributions of these institutions also reflect the

importance of investing in higher education to support AI research, as emphasized by (Hidayah, 2024). In 2020, universities played a central role in artificial intelligence (AI) innovation, acting as hubs for advanced technology development and platforms for global collaboration. Leading institutions such as Stanford University and Beijing Normal University drove the research and development of advanced AI models, including deep learning, which underlies transformer model architectures such as GPT-3.

Academics at these universities contributed significantly to the scientific literature supporting AI applications in natural language processing and computer vision. In addition, cross-disciplinary collaborations at these universities demonstrated how AI technology can address real-world challenges, such as the COVID-19 pandemic. Beijing Normal University, for example, led the development of AI applications for medical image analysis to detect COVID-19, while Stanford University supported vaccine research through AI-based simulations. In education, universities such as Beijing Normal University implemented AI-based adaptive learning systems that personalize students' learning experiences, helping the transition to online learning during the pandemic (Synekop et al., 2024).

The gap in research contributions between developed and developing countries confirms the findings (Putri, 2023), which note that lack of access to infrastructure and financing is a major challenge in many regions. However, countries like India have shown significant growth, as Perkins notes, the rise in AI research directed at solving local challenges, such as in the health and education sectors. The gap in AI research contributions between developed and developing countries reflects fundamental differences in access to resources, infrastructure, and funding. Developed countries such as the United States, the United Kingdom, and Germany tend to dominate AI research due to strong support from governments, academic institutions, and the industrial sector. These countries have sophisticated research laboratories, access to large datasets, and abundant research funding. In addition, universities in developed countries are often hubs for global collaboration, accelerating the development of AI technologies and implementation in various sectors. For example, Stanford University and the Technical University of Munich lead AI innovation and research on ethical issues and algorithmic transparency, ensuring responsible AI adoption.

In contrast, developing countries such as India and Turkey face limitations in technological infrastructure and research funding, which are significant barriers to competing globally. Liakos (2022) noted that these countries often lack access to cutting-edge AI labs and hardware technologies, such as supercomputers, which are crucial for developing advanced algorithms. Perkins (2023)highlighted that India focuses on AI research to solve local challenges, such as AI-based medical diagnosis in rural areas and adaptive learning systems for community-based education. Partnerships with international organizations and global technology companies often support these initiatives. However, the disparity in the contribution level is also due to the lack of international collaboration involving developing countries. With collective efforts to narrow this gap, developing countries have the potential to make more significant contributions to the global AI ecosystem, not only to address local challenges but also to enrich technological innovation universally.

CONCLUSION

The study reveals that artificial intelligence (AI) has emerged as one of the most transformative areas of technology, with dominant themes such as machine learning, ethical AI, and digital transformation reflecting global research trends. The dominance of the United States, which has a 38% contribution, supported by universities such as Stanford University, demonstrates the importance of collaboration between academia, government, and industry in advancing AI. Meanwhile, China and India contribute significantly, reflecting a strategic approach to supporting relevant research locally and globally.

However, the gap in contributions between developed and developing countries remains a challenge, mainly due to limited access to infrastructure and funding in developing countries. However, significant growth in countries such as India demonstrates the potential of AI as a practical solution to local challenges in the health and education sectors. The research surge in 2023, fueled by generative technologies such as ChatGPT, marks a new chapter in the widespread adoption of AI across industries, reflecting the critical role of collaboration across countries and disciplines to drive sustainable innovation. With the proper policy support, human resource capacity building, and strategic investment, AI has the potential to shape an inclusive, ethical, and sustainable technology future globally.

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