

Twenty Years of Agricultural Mechanization Practices in Northern Nigeria: Bibliometric Insights into Research Trends, Productivity, Labor, and Technology

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Abstract

Agricultural mechanization significantly boosts farm productivity, reduces labor effort, and promotes rural development, especially in developing economies. This study investigated trends in mechanization, productivity, labor, and technology in northern Nigeria. A total of 735 open-access articles published in English from 2004 to 2025 were extracted from the Dimensions.ai database and analyzed using R's Biblioshiny package ver.5.0. The tools of analysis used include co-authorship networks, keyword co-occurrence, citation patterns, co-citation, and word cloud generation, etc. The results show a 20% annual growth rate and a peak in 2025 with 138 publications, reflecting increasing academic, policy interest in mechanization and agricultural modernization. The average citation count was 14.82, highlighting the relevance of the field. Collaboration involved 4,530 authors, with an average of 6.84 co-authors per-paper and 16.55% international partnerships, highlighting global cooperation. Chinese scholars dominate publication volume. With citation analysis, the distribution of research impact by region is seen to be diverse from Asia, Europe, and Africa. Mechanization's impact on sustainability and livelihoods is illustrated in the research clusters identified and the core themes of agriculture, employment and climate change. The word-cloud analysis reveals that mechanization research in northern Nigeria is multi-faceted, local, and integrative, connecting technology, socio-economics, sustainability and ecology. The results indicate the influence of mechanization in rural development in different ways, so region-specific results are necessary. It is necessary to have policies and investments in local research for effective implementation. Inclusive mechanization policies should promote smallholder farmers, dissemination of knowledge, and resource access in region for sustainable rural development.

1.0 Introduction

Agriculture is the backbone of human society which provides food, job to people and raw material to agro-based industries. This includes farming, fishing, rearing livestock, poultry or forestry activities, all contributing to a rich harvest [1]. Mechanization is the substitution of human and animal effort with machinery, for example, in agriculture, harvesters are replacing human and animal effort [2]. Agricultural mechanization is generally defined by the Food and Agriculture Organization (FAO) as the use of tools, implements and powered machinery as inputs for agricultural production. It encompasses the production, distribution, maintenance, repair, management and utilization of agricultural tools, implements and machines. It is relevant to the development of agricultural land, growing crops, mowing, harvesting, preparing for storage, on-farm processing and rural transportation [3]. This includes a range of technologies used throughout the production-processing chain, from simple tools like hoes, cutlasses and other farming implements, to motorized machinery like tractors and grain milling machines [4].

In modern times, powered machinery has increasingly replaced many tasks that were traditionally performed by human labour or draft animals such as oxen, horses, and mules. The appropriate selection, proper use, and subsequent maintenance of farm machinery and equipment in agriculture have a direct and significant effect on achievable levels of land and labour productivity, farming profitability, the environment, and the quality of life of people engaged in agriculture [5]. According to [6], the level of farm

mechanization in the United States is 95%, in Western Europe it is 95%, in the Soviet Union it is 80%, in Brazil it is 75%, in Argentina it is 75%, in China it is 38%, in India it is 40%, and in Africa it is 20%. The corresponding values for the population engaged in agriculture are 2.4%, 3.9%, 14.4%, 14.8%, 9.4%, 64.9%, 55%, and 60%, respectively. Agricultural mechanization in Africa is gaining momentum but remains relatively low compared to other continents [7]. Mechanization practice is also low in Nigeria, with a mechanization rate of 0.27 hp/ha ($\approx$ 6 tractors/10,000 hectares), which is far below the FAO's recommended rate of 1.5 hp/ha [8, 9].

Although oil exploration in Nigeria is becoming a major economic activity, agriculture is still playing a significant role in the country's economy. This is because it has been a key factor in ensuring food security and promoting local industries throughout the country's history and current economic structure [1]. There are 70.8 million hectares of agricultural land in the country of which 34 million are Arable land. Approximately 46% of this arable land is cultivated, 6.5 million hectares are allocated to permanent crops, and 30.3 million hectares are designated as meadows and pastures. The sector employs 37.99% of the population, with more than 70% of households engaged in agricultural activities [9], while more than 90% of agricultural output is rain-fed [10]. In 2024, it accounted for about 20.97% of the total nominal Gross Domestic Product [11]. The sector is primarily driven by small-scale farmers, who depend heavily on rain-fed farming systems with average farm sizes of 0.5 ha in the southern part of the country and 4 ha in the northern part, indicating the dominance of smallholders [12, 13]. Northern Nigeria is divided into three geopolitical zones: north-east, north-central, and north-west. The majority of agricultural practices in Nigeria take place in these zones, primarily conducted by small-scale farmers with average farm sizes of 4 hectares [12].

Various mechanization studies have been conducted in these zones, mostly originating from government-established universities and research institutions, but the findings remain largely inaccessible to farmers who are meant to be the ultimate beneficiaries of these findings and policymakers responsible for implementing initiatives [14], leading to the loss of opportunities for improving the agricultural sector.

In recent years, many scholars have highlighted the importance of promoting interactions among academics, practitioners, and policymakers [15]. In this context, [16] argued that literature reviews should facilitate this process by focusing their analysis on specific topics that have direct managerial implications. Bibliometric methods have proven to be extremely useful. The method can also be used to identify research gaps, examine the direction in which a field is developing, or as a tool to help chief executive officers in decision-making [17]. Therefore, to effectively bridge the gap between academics, practitioners, and policymakers, a comprehensive bibliometric overview is essential in this domain. This approach will foster collaboration and enhance the impact of research in real-world applications.

2.0 Methodology

In the methods of literature reviews, bibliometrics is a widely used approach for collecting quantitative insights into emerging or consolidated topics [18]. Unlike traditional literature reviews, bibliometric studies adopt a quantitative approach based on the joint analysis of multiple indicators, such as co-citation, citation, and bibliographic coupling [19, 20]. In this sense, they provide insights into the field and its theoretical roots [15].

Despite the coexistence of many scientific databases, for this study, research articles were extracted from Dimensions.ai [21], selected due to its world's largest database of research insights, which represents the most comprehensive collection of linked data related to the global research and innovation ecosystem available in a single platform. Dimensions.ai is updated daily and is constantly growing, containing over 112 million linked research publications, 1.3 billion+ citations, 5.6 million+ grants worth \$1.7 trillion + in funding, 41 million+ patents, 600k+ clinical trials, 100k+ organizations, 65m + disambiguated researchers, and more, Normalized, linked and ready for analysis data [22].

To develop the data search query, topic-relevant keywords were used, covering publications from 2004 to 2025. Thus, the search query used was (agriculture OR farming OR crop production) AND (mechanization OR agricultural mechanization OR tractor OR machinery) AND (labor OR labour OR employment OR productivity) AND (Northern Nigeria OR Nigeria). The analysis considered only articles published in English. In addition, the study is restricted to published articles rather than books, conference proceedings, or book chapters, reflecting the central role of articles in the contemporary research landscape. Finally, the search was limited to only titles and abstracts and resulted in 735 documents from 458 sources.

Bibliometric analysis was employed to achieve the study's aim of providing empirical insights into agricultural mechanization in northern Nigeria. Bibliometrix and text-mining tools were used to analyze research trends and patterns in agricultural mechanization, productivity, labor, and technology in Northern Nigeria. Bibliometrix is a widely used software package for bibliometric analysis [23, 24]. Bibliometrix is an open-source tool based on R, a statistical software used by academics and data scientists for data analysis and visualization. In this sense, bibliometric analyses are also supported by graphical representations, which are useful for the evaluation made by researchers [25].

This analysis used various tools to visualize and quantify relationships in the literature (articles), including co-authorship networks, keyword co-occurrence, citation patterns, co-citation analysis, topic modeling, and word cloud generation, through the Bibliometrix package within RStudio. Additionally, graphs, tabulations, and frequency analysis were employed to summarize the findings, providing insights into the number of publications, top-performing journals, influential publishers, and leading countries in this research domain. As described by [22], a word cloud can be used to identify the most common words used in the literature and topic modeling can be used to group studies into themes or topics. Bibliometric and text-mining techniques are objective measures of research landscapes that reduce the chance of selection bias introduced by subjective reviews [26]. These are additional tools that will add depth to the analysis as they help to identify the theme of the literature [22].

3.0 Results

The results are presented from three perspectives building upon the unit of analysis: Source analysis, Author analysis and Keyword analysis.

3.1 Source Analysis

This study looks at journals which have made agricultural mechanisation in northern Nigeria a subject of study. It is crucial to analyze these sources because this information will guide the identification of the sources that have contributed the most in the developments of agricultural mechanization for 2004 to 2025. Therefore, we use the journals that have the most published articles, the most citations per year and trends in the numbers of articles published in the journals per year to understand the evolution of scientific research. There are publication records from 458 sources.

The analysis of the most prolific journal is presented in figure 1. The ten journals with the largest number of articles are: Sustainability having 23 articles, Non-Identified Journal (NIJ/NA) with 21 articles, Plos One containing 14 articles, Land with 13 articles, IOP Conference Series Earth and Environmental Science followed with 12 articles, Agronomy contributed 9 articles, Agricultural Water Management reported 8 articles, Agriculture also 8 articles, Remote Sensing again with 8 articles, and Frontiers in Sustainable Food Systems having 7 articles respectively.

The number of articles published on agricultural mechanization in northern Nigeria has been increasing year-by-year as seen from the annual distribution (Fig. 2). There were only 39 articles published between 2004 and 2011, showing that academic progress was light. But this trend reversed from 2012 onwards, as there was a significant number of publications and flow. The research output jumped significantly after 2017, notably so in 2023 (83) and 2024 (98). This steady trend reflects increasing research interest and emphasis on this topic. Research activity has been greatest in the year 2025 (138 publications). This is a positive trend indicating increased awareness in the academic field and a growing body of knowledge on the subject.

There is a considerable variation in the number of citations, as illustrated in Figure 3. The average number of citations per document was 14.82, suggesting scholarly relevance in the field. Specifically, the average number of citations per document for the period 2004-2007 were 32.33 and 2.2, suggesting a new research area or a small number of publications. A steady rise (36.82) in 2014 showed a high impact of the citations and indicated the strengthening of research visibility and a proliferation of scholarly interest in this research area. Moreover, the time frame between 2017 and 2019 indicates the development and maximum influence of the research production. This is the time when important breakthroughs, methodological innovations or increased global interest in the area of the subject took place. Conversely, the years 2023 to 2025 show inherently lower averages due to the time-dependent accumulation of citations; thus, the observed decline may partly reflect incomplete citation cycles.

3.2 Author Analysis

At the author level, the analysis shows distinct steps. The first identifies the most relevant authors (Figure 4), the second identifies the most locally cited authors (Figure 5), and the third presents results on authors' countries' scientific production (Figure 6), and finally, the most relevant countries by corresponding authors (Table 1).

In recent years, research on agricultural mechanization has expanded considerably, resulting in a substantial body of literature. The analyzed dataset comprises 4,530 authors across 735 publications. Owing to the prominence of the agricultural sector in China, most highly productive authors are Chinese, including Zhang X, Li X, Zhang Y, Li Z, and Wang J. Other notable contributors from Argentina, the United Kingdom, and Brazil are Julio Montaner, James Hughes, and Beatriz Grinsztejn. Zhang X is distinguished by his 13 articles published as a single author over the study period.

Figure 5 shows that the highly cited authors were Zhou S, Li X, Panagos P, Waha K, and Jethva H. Citation counts are indicators of research impact rather than productivity alone. Although Chinese scholars lead in publication volume, the most influential contributions are geographically diverse, with representation from China (Zhou, Li), Europe (Panagos, Waha), and Asia (Jethva).

The country with the most citations was China (1,433) with the United States (1,169), Australia (900), Ghana (722), and Italy (655). The prestigious position reflects China's rising global influence in agricultural mechanization and environmental research. The large number of citations for the United States and the Australia demonstrates their robust research ecosystems, and the presence of citations from Ghana suggests that Africa is taking its place in the research world.

The geographical distribution of scientific production is shown in figure 6, giving valuable insights into scientific production. Most scientific publications came from Asia, of which China had 325 publications and India had 84. The importance of agriculture in the USA and its emphasis on mechanization is reflected in the large number of studies published (164). Africa also contributed significantly with papers from Ghana (79) and Ethiopia (74). This geographical distribution reveals that agricultural research is not restricted to the traditional big powers like China and the USA, but is also gaining input from a number of countries including India, Ghana and Ethiopia.

Data for the country shows the scientific visibility at national and international level in Table 1. The highest number of articles is from China with 77 articles (10.5%), with high Single Country Publication (62 articles) but the number of Multi Country Publications was relatively low (14 articles). This indicates national autonomy but less reliance on international collaboration as compared to the smaller countries. Countries like Ghana, Ethiopia, Nigeria and Kenya in Africa, however, are prominent even though they do not have the highest number of publications overall. For examples, Ghana with 26 articles, 16 of which are SCP (38%) and 10 of which are MCP (38%), which means there is moderate collaboration. All of Kenya's output (5 articles) is with international partners, and thus, 100% MCP. This pattern reflects the problems of inadequate local infrastructure, but also the opportunity to gain global visibility through cooperation, at the cost of limited national control. Countries with high MCP proportions, such as Western countries like Germany (67% MCP out of 18 articles), Australia (65% MCP out of 20 articles),

Canada (60% MCP out of 20 articles) and the Netherlands (60% MCP out of 5 articles), generally have more than 60% of their articles with a MCP. This may reflect an international collaborative culture, sometimes with international funding schemes like the EU's Horizon programmes and global research groups.

Table 1: Countries by correspondence

Country	Articles	Articles %	SCP	MCP	MCP %
China	77	10.53	63	14	18.18
Ghana	26	3.56	16	10	38.46
Ethiopia	25	3.42	21	4	16.00
Australia	20	2.74	7	13	65.00
Germany	18	2.46	6	12	66.67
Usa	16	2.19	16	0	0.00
Italy	14	1.92	11	3	21.43
India	11	1.50	10	1	9.09
Brazil	10	1.37	5	5	50.00
Egypt	9	1.23	7	2	22.22
Denmark	8	1.09	3	5	62.50
Sweden	8	1.09	7	1	12.50
Nigeria	7	0.96	6	1	14.29
Russia	6	0.82	6	0	0.00
Ukraine	6	0.82	6	0	0.00
Canada	5	0.68	2	3	60.00
Indonesia	5	0.68	5	0	0.00
Kenya	5	0.68	0	5	100.00
Netherlands	5	0.68	2	3	60.00
Argentina	4	0.55	2	2	50.00

3.3 Keywords Analysis

This analysis assumes that a research specialty can be defined by the particular combinations of keywords. It has enabled us to recognize the thematic areas or clusters, which are used as the

theoretical pillars of the field under consideration [27].

The analysis revealed four main research clusters, as illustrated in Figure 7: Agriculture and Technology (blue cluster), Rural Socioeconomics and Demographics (red cluster), Farms and Biodiversity (purple cluster), and Sustainability and Climate Change (green cluster). The results of this study are important, as they represent the variety of agricultural mechanization practices. In addition, they point to goals related to environmental protection, sustainability and bettering living standards and rural development, showing the strong involvement of the scientific community in these areas.

To capture the important words for research in various aspects, three different word clouds were generated as seen in Fig. 8. These visualizations can be useful to gain insights into the focal points of the literature.

The term "northern" occurs the most of all the Title Terms in Figure 8a with 236 occurrences. This shows that the agricultural mechanization and environmental studies seem to be of interest to the researchers as they are mostly geared towards northern Nigeria. The references to "production" (133) and "agricultural" (104) also further illustrate that the main subject matter relates to the agricultural productivity and output. Other common terms, like "productivity" (87), "region" (69), "climate" (63), "farmers" (52), "study" (51) and "Ghana" (50), show links between regional agricultural productivity, climatic conditions and the presence of human participation, especially farmers.

The top two keywords in the abstracts are 'production' and 'agriculture', as can be seen in Figure 8b, with 1621 and 1524 respectively. The high prevalence suggests that the content of the abstracts is mainly about agricultural systems and production, thereby emphasizing the significance of food production and farming practices in the research. Other significant terms such as 'study' (918), 'northern' (896), and 'productivity' (877) indicate a strong attitude towards provincial studies, empirical research design, and productivity in agricultural production. Additionally, frequent references to 'farmers' (749), 'soil' (733), 'crop' (725), and 'food' (702) reveal the tangible aspects of farming, highlighting the significant interest in farmers' livelihoods, soil health, crop management, and food supply chains for ensuring food security and sustainability.

As shown in Figure 8c, 'agriculture' is the most recurring term, appearing 20 times, thus highlighting its centrality in the research domain, and importance in food production and rural livelihoods. The phrase "humans" (16 times) and "crops agricultural" (14 times) also highlight the human-nature connection, underscoring that agricultural practices are technical and social, having an impact on communities and food systems. The use of the terms "soil" (12) and "fertilizers" (7) indicates the continued controversy around land and soil fertility management. The keywords "animals" (9) and "rural population" (9) are integrated and involve issues related to livestock systems or problems related to rural livelihoods in agrarian societies. "China" (11) is an example of the keyword that exemplifies its importance in agricultural research and production and its global role in the discourse on food security. The other terms, such as "ecosystem" (7), "farms" (7) and "fertilizers" (7), all reference a systemic approach, indicating that farming operates in ecological cycles, on farms, and within technological systems. The

pattern shows that academic interest in agroecology (the study of farming in the context of a wider ecological and socio-economic system) has grown.

4.0 Discussion

The bibliometric analysis is a widely used methodological approach among academics for assessing the current state of a particular field of study. Successfully bridging the gap between theory and practice requires a scientific, systematic approach focused on deriving meaningful insights from analysis [15]. The analysis of agricultural mechanization research in northern Nigeria carried out in the period 2004–2025 highlights some of the salient academic dynamics that need to be discussed.

Important scholarly trends are identified by examining sources. The increasing visibility of journals like Sustainability, PLOS One and Land in the present press, which also cover environmental management and interdisciplinary research, shows the rise of agricultural mechanization in the multi-faceted discussion of sustainable environmental management and science research, and reflecting an alignment of the journals with SDG's 11 and 15 [28]. Other journals, including Agronomy, Agriculture and Agricultural Water Management, focus on technical issues, whereas Frontiers in Sustainable Food Systems puts a focus on socio-economic and policy issues. This approach puts agricultural mechanization not only as a technological challenge but also as a sustainability issue. Among the most prolific journals in this area were Sustainability and Agriculture, according to [15].

The high publication volume in the years after 2017, reaching 138 articles in 2025, indicating the national policies such as the Agricultural Promotion Policy (APP) and the National Agricultural Technology and Innovation Policy (NATIP) that promote agricultural modernization and food security, as well as the increased scholarly interest in this area [29]. The number of publications in the earlier years (2004–2011) is lower, though they have more citations, while recent years have more publications with lower average citations, suggesting more incremental publications. The citation trends indicate the maturity of the discipline. The maximum influence in 2017–2019 may represent a significant research or method development. The reason for the drop in the citation averages for 2023 to 2025 could suggest that the research themes are either becoming saturated or fragmented, potentially suggesting a shift toward more publications that are diverse rather than impactful and in-depth studies. Collectively, the results show that, in the early years, the publications are small but impactful; in the middle years, they are adequate but have less peak influence; and in the later years, characterized by more publications but fewer citations per article and thus less impactful.

Author level analysis differentiate between authors with high citation counts and authors with high production. The number of publications from Chinese authors is led by Zhang X, Li X and Wang J, which shows the research capability of China in agricultural innovation [30]. However, from a citation analysis point of view, scholarly influence does not always correlate with productivity in publication. The most cited authors (Zhou S, Li X, Panagos P, Waha K and Jethva H) span a wide range of countries from Asia,

Europe and Africa, indicating that the contributions of impactful research are distributed across the globe.

With regard to countries scientific production, China's distinction highlights its growing contribution to agricultural mechanization research [30]. The Indian and American correspondence shows a high level of engagement with the region and contributions from Ghana and Ethiopia demonstrate Africa's growing presence in the field. The diversity of this suggests a shift from 'traditional centers' to emerging economies with large and important agricultural challenges in a way that adds to the global knowledge base. It also demonstrates the effect of the mechanization engagement, as reported by [6], which states that the farm mechanization rates in the USA are 95%, in India 40%, in China 38% and in Africa 20%. The analysis of Single Country Publication (SCP) and the Multiple Country Publication (MCP) show that China has a high rate of SCP, which means that there is a high level of research capacity within the country, whereas it's low rate of MCPs, means that it has limited integration with international research networks. Conversely, African countries like Ghana and Kenya have higher proportions of MCP, indicating external collaboration for increased visibility, which can be problematic with regards to national ownership of research. The high rates of MCP in the West suggest a research culture where ideas and knowledge are shared and new ideas are generated through collaboration. In this context, collaboration is strategic, through innovation and enhancing the impact of citations. Having a higher MCP will be characteristic of smaller output countries, where the involvement of international partnerships will play a significant role in the country's scientific visibility.

The keyword analysis reveals the degree of agricultural mechanization research that is being conducted in northern Nigeria, as can be seen in the 4 main clusters, showing the multi-dimensionality of this research. The green cluster addresses environmental conservation and climate adaptation, the purple cluster relates to mechanization and the question of biodiversity and agroecological aspects, the blue cluster mirror technological innovation and efficiency and the red cluster reflect the socio-economic impacts on rural livelihoods. This highlights the need for mechanization as a multi-faceted socio-ecological rather than technical approach.

The word clouds of the titles show a high regional concentration on northern Nigeria, which is in line with its importance in the studies on mechanization. [12] reported that the northern region of Nigeria is where most of the country's farming operations are carried out. The words "production", "agriculture", "climate", and "farmers" highlight productivity, and the environment as well as human participation. The use of 'Ghana' and 'China' is a cross regional and global reference. The abstracts show the focus on farming practices and food systems, with many references to "farmers", "soil", "crop", and "food", revealing the concrete consequences of mechanization on the realities of farming and food security, thus meeting SDG 2 [28]. The occurrence of the keyword "agriculture" in the authors' keywords attests to the fact that most of the articles under this category are about food production and development in rural areas, whereas terms like "humans", "soil", and "ecosystem" emphasize the relation of technology with social processes. The keyword analysis combined reveals an integrative, regional and diversified agricultural

mechanization research in northern Nigeria with emphasis on technology, sustainability, socio-economics and ecology.

5.0 Conclusion

A content analysis of sources, authorship and keywords in agricultural mechanization research between 2004 and 2025 shows that agricultural mechanization research is now a strong, systematic, internationally acknowledged and an academic field of research in northern Nigeria. The number of scholarly articles has increased substantially since 2017, from important studies to a lot of publications. There are journals that link regional research efforts to international discussions, e.g., Sustainability and PLOS ONE, and specialized journals that focus on specific technical problems. China is in front with publishing, and exerts influence in Europe, Africa and North America. African writers, such as those from Ghana and Ethiopia, are taking the stage and addressing issues in their communities through strategic partnerships. Trends of keywords indicate that mechanization is perceived as a holistic rural changeover linked to farmer livelihood and adaptation to climate change. But a large number of publications may have an impact on the coherence of the research and impact of the citations. Future works should strive to achieve a balance between quality and quantity with the methodology suited to the context of northern Nigeria

6.0 Recommendations

The following key recommendations are drawn from the integrated analysis, to enhance the field. It is important to emphasize integrative, high impact studies in order to ensure a balance between quality and quantity of studies. Researchers should be able to work collaboratively between the developed and emerging regions, such as Ghana and Ethiopia. It is essential to continue the agroecological research agenda to link agroecology with mechanization. In both Africa and South Asia, policy makers need to incorporate mechanization in agriculture and strengthen capacities for research locally. Rural development is affected in many different ways by mechanization and, hence, regionally specific evidence is required. It requires enabling policies and investments in site-specific research to be effective. The inclusive nature of mechanization policies needs to be structured and designed to cater for the needs of smallholder farmers, increase knowledge sharing and increase availability of resources for sustainable rural development in northern Nigeria.

Declarations

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Ethics approval and consent to participate

Not applicable

Competing interests

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Author Contribution

Author 1 Carried the Entire Research Work and Wrote the original manuscript text. Author 2 Contributed in Conceptualization, Methodological Design, Data Analysis and revised the entire work. Author 3 Reviewed the manuscript text. Author 4. Contributed in Drafting the Manuscript text. Author 5. Contributed in Grammatical Check up. All authors read and approved the final manuscript.

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Figures

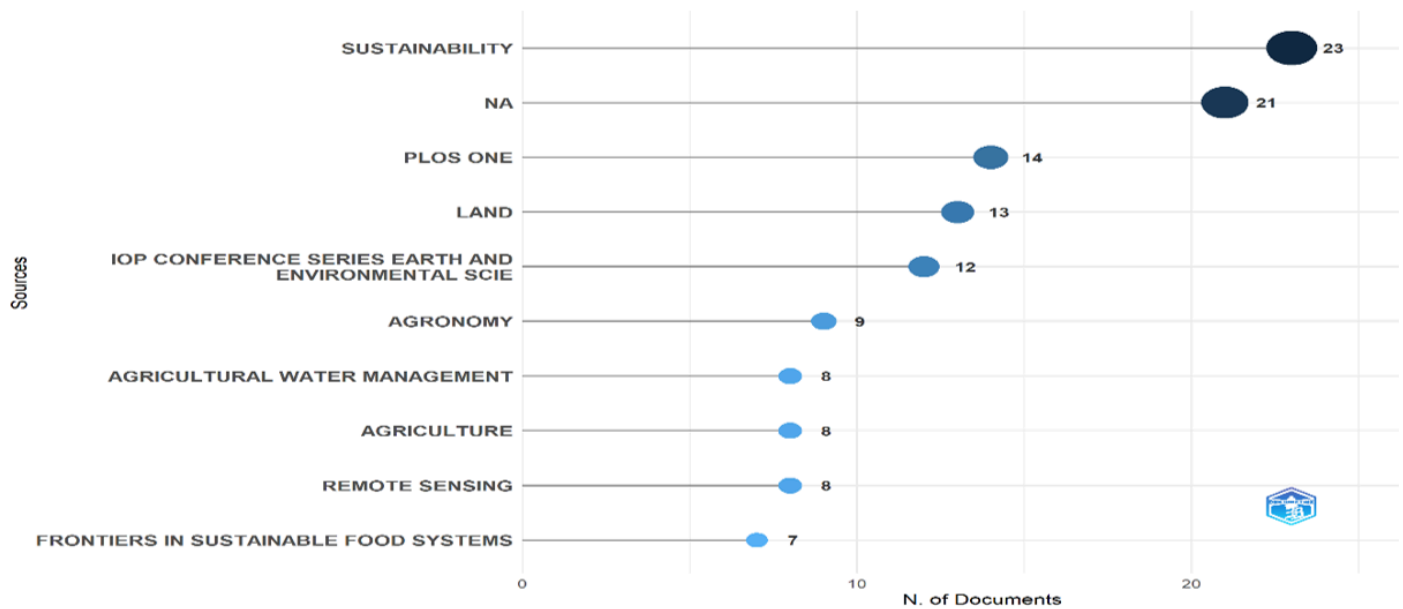


Figure 1

Most Prolific Journals

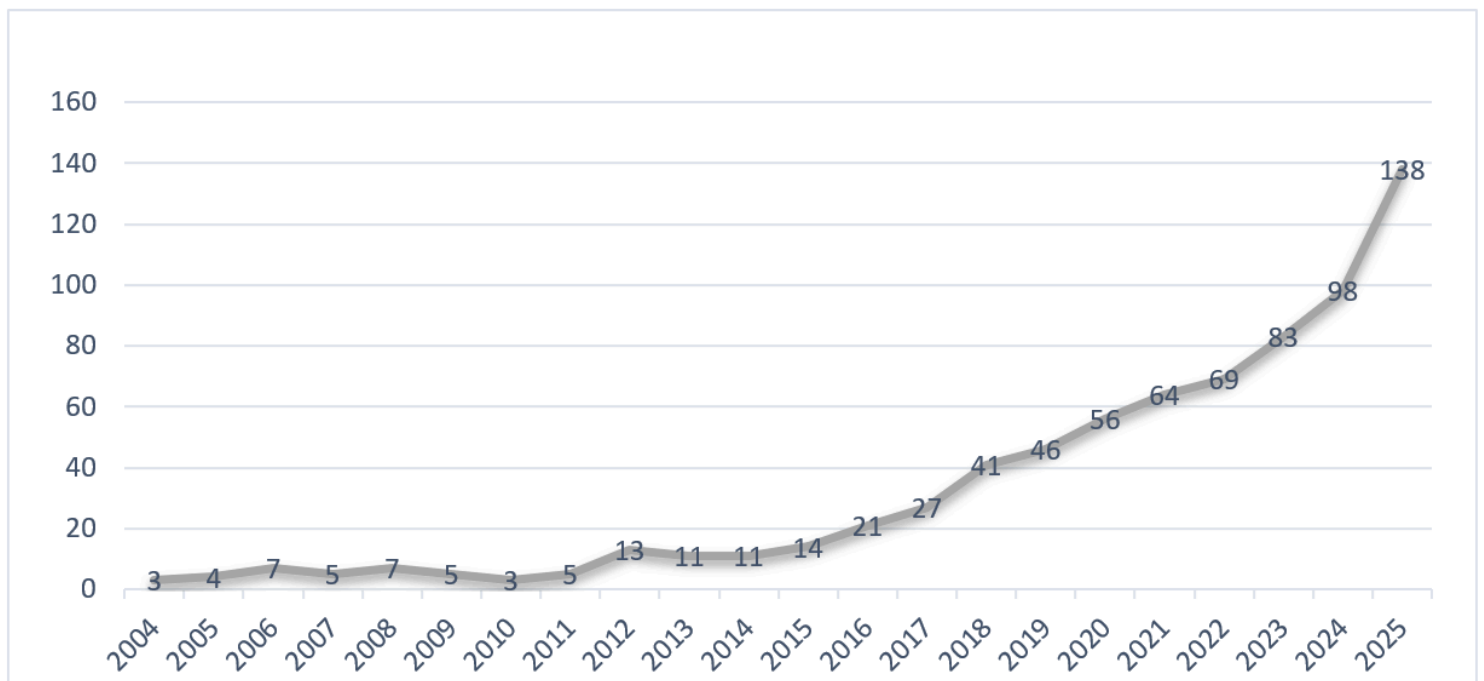


Figure 2

No. of publications per year

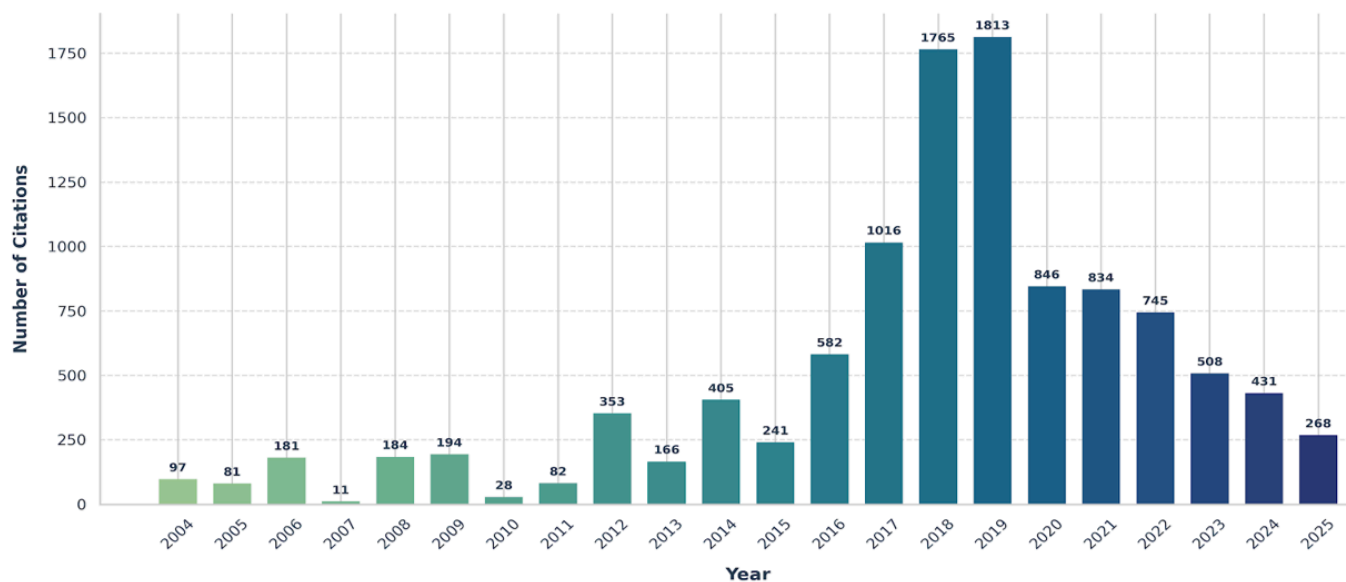


Figure 3

No. of Citations per year

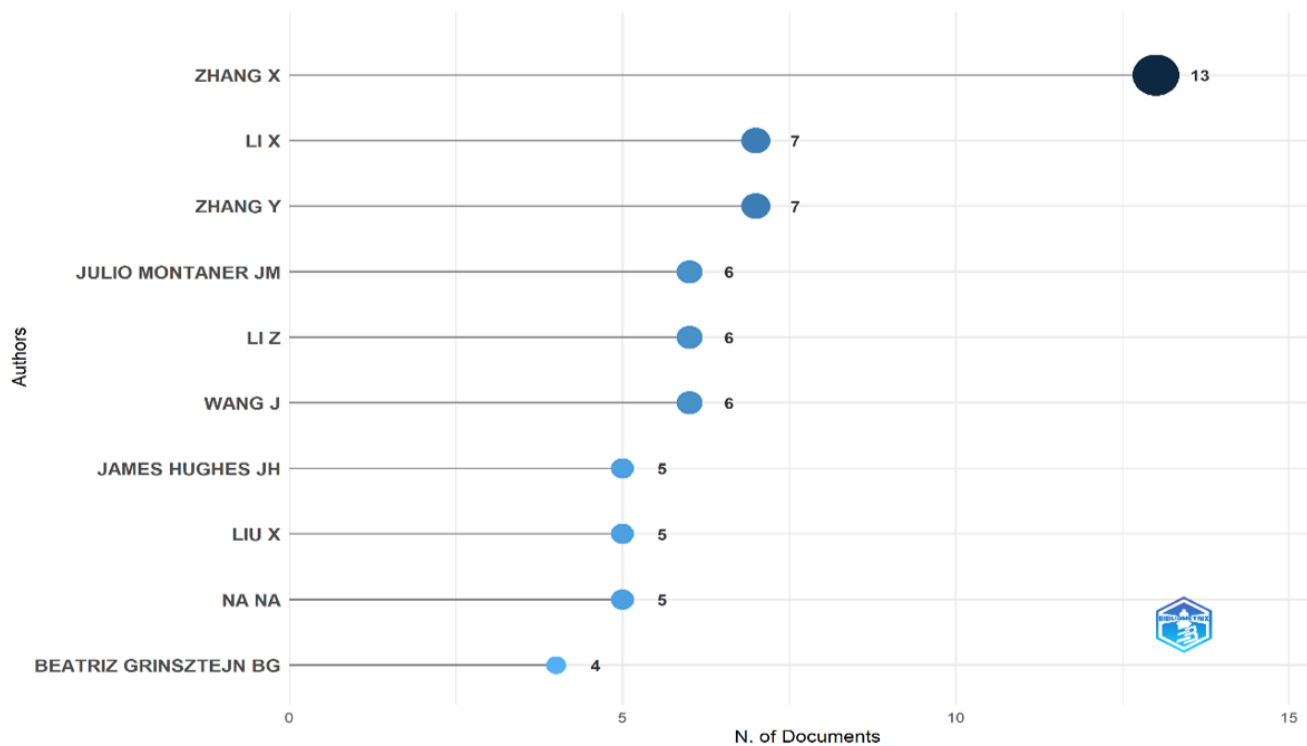


Figure 4

Most Relevant Authors

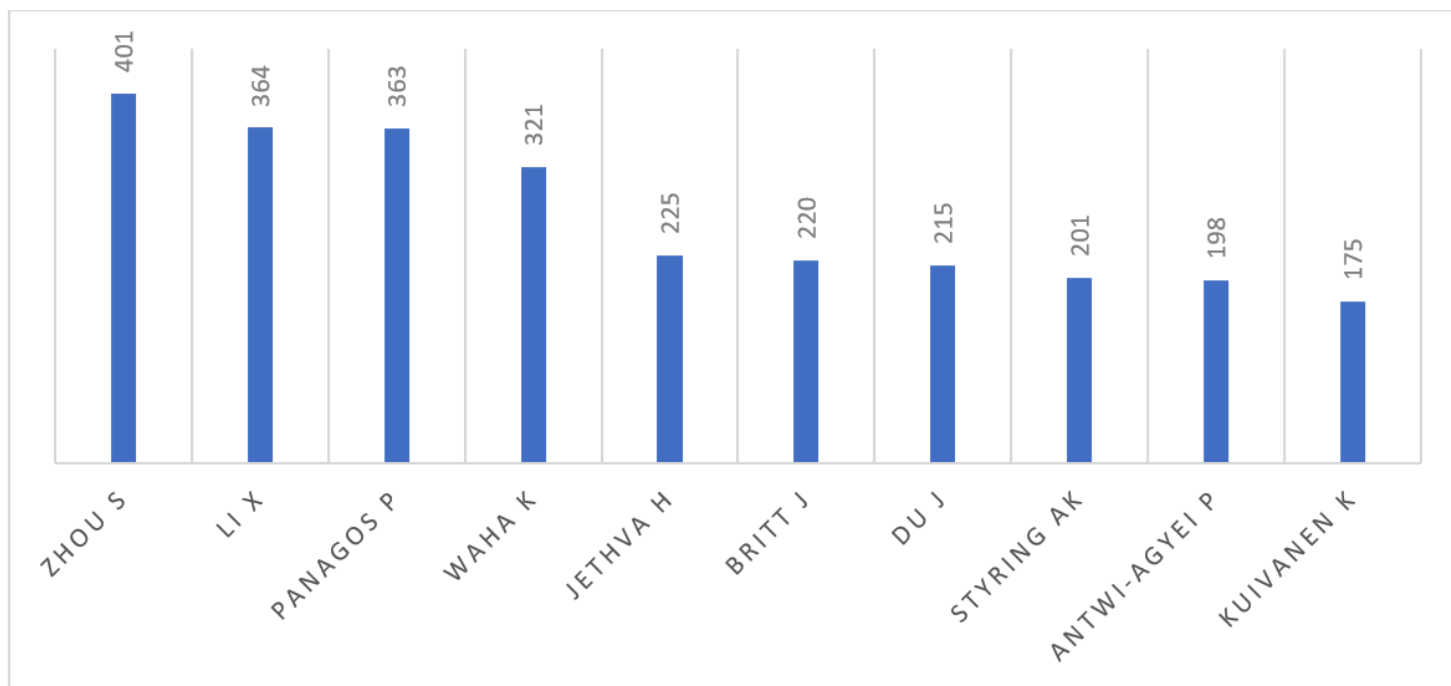


Figure 5

Most Locally Cited Authors

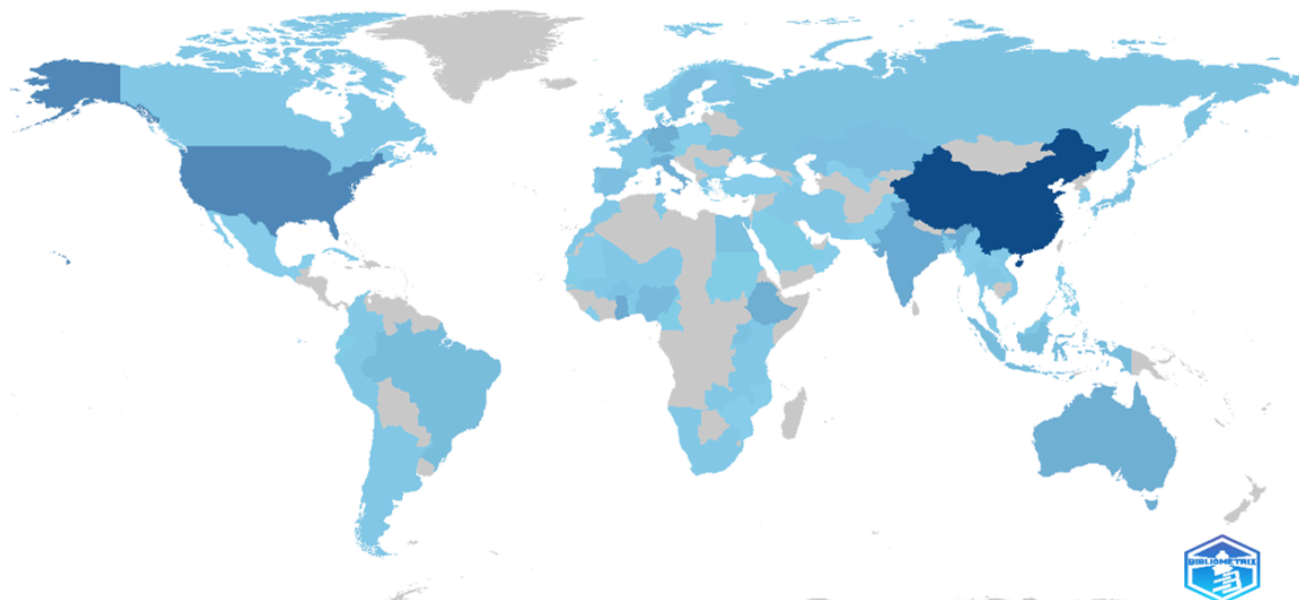


Figure 6

Country Scientific Production

