

Investigating Good Agricultural Practices (GAP)

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ABSTRACT

Using Scopus data, this study provides a thorough bibliometric assessment of research on Good Agricultural Practices (GAP), analysing the field's thematic and temporal development between 1964 and 2024. GAP, which was created to guarantee food safety, environmental sustainability, and economic viability in agriculture, has become well-known around the world. However, research in this area is still dispersed over fields including food safety, environmental science, and agronomy. Addressing global issues like food security and climate change requires an understanding of GAP. It provides a paradigm for increasing sustainable agricultural output, mitigating environmental effects, and bolstering production systems' resistance to growing global challenges. This paper emphasises the critical significance of GAP in forming a sustainable future for global agriculture by examining research trends. Key contributions to GAP research were compiled and visualised using bibliometric tools like VOSviewer and Biblioshiny. To find prominent writers, important contributing nations, and noteworthy topic patterns, 1,732 articles were examined. The findings show a growing emphasis on food safety laws, sustainable agricultural management, and the incorporation of cutting-edge technology like precision agriculture into GAP. The results also show that the majority of the data on GAP's ability to reduce food processing waste is found in developed areas. On the other hand, poor infrastructure, insufficient financial resources, and inadequate information transmission are major obstacles that prevent successful implementation in developing areas. To achieve fair and sustainable agricultural growth globally, it is imperative to address these socioeconomic barriers.

agriculture practices worldwide, this study

highlights research gaps and emerging trends. Nevertheless, there are certain drawbacks, such as the dependence on the Scopus database, which leaves out pertinent research that are listed in other sources. Additionally, the predominance of English-language publications may mask important research carried out in non-English-speaking areas, thereby missing significant worldwide trends.

Keywords: farmers, bibliometric analysis, sustainable agriculture, and economic sustainability.

INTRODUCTION

Food safety, environmental preservation, and rural development are only a few of the significant agricultural issues that the idea of Good Agricultural Practices (GAP) has developed into a comprehensive approach (Siebrecht, 2020a). The Food and Agriculture Organization (FAO) and other international organisations first proposed GAP standards, which are now extensively used to standardise agricultural practices in both developed and developing nations (Amekawa et al., 2022). Based on four key pillars—economic viability,

environmental sustainability, social equality, and food safety—GAP aims to create a balanced agricultural system that can adapt to external challenges like market volatility and climate change.

Agronomy, food safety, economics, and environmental sciences are all included in the vast and interdisciplinary body of literature on GAP (Sparling et al., 2021). As a consequence, researchers often struggle to integrate data from other sectors, which leads to fragmented information and a limited comprehension of GAP's overall impact on agricultural systems (Pervez et al., 2016). By offering a methodical evaluation of previous research, monitoring academic production, and charting the development of GAP investigations over time, bibliometric analysis provides a solution to this problem (Zhao et al., 2023). Because of its wide coverage of peer-reviewed journals, conference proceedings, and abstracts, Scopus is a suitable platform for bibliometric research.

proceedings as well as other scholarly materials. In order to comprehensively map research outputs on GAP, identify top authors, institutions, and nations, and assess citation patterns to gauge the significance of important articles, this study makes use of Scopus data. The study attempts to identify new trends and research gaps by looking at important keywords and thematic clusters, providing a path for further studies. Understanding the development of GAP research is crucial given the global issues confronting agriculture, including population expansion, resource constraint, and climate change (Viana et al., 2022). This bibliometric study supports policymakers, practitioners, and academics in promoting sustainable agricultural development by providing insightful information on the creation and use of GAP across diverse agricultural systems globally. In the end, the research advances knowledge of GAP's function in advancing sustainability and resolving issues with global food security.

LITERATURE REVIEW

As a strategy for promoting agricultural sustainability, environmental preservation, and food safety, the idea of Good Agricultural Practices (GAP) has gained broad international recognition (Bertola et al., 2021). According to a number of studies, GAP frameworks provide organised instructions that help farmers implement techniques that reduce environmental degradation while increasing output. Integrated pest management (IPM), effective water use, and soil fertility management are important GAP components that support sustainable agriculture systems. The research that is now available shows that while GAP has been effectively implemented in affluent nations, its acceptance in underdeveloped areas is still inconsistent (Eriksen et al., 2021). Farmers are unable to completely adopt GAP due to a number of factors, including poor infrastructure, insufficient financial resources, and a lack of technical expertise. According to research, resolving these issues might greatly increase agricultural output and livelihoods, especially in areas where subsistence farming predominates (Khatam et al., 2013). Furthermore, GAP is essential to raising food safety standards, which are becoming more and more significant in terms of export regulations and worldwide

commerce.

The literature extensively discusses the significance of GAP-related certification methods. GAP certification gives farmers a competitive edge, particularly when it comes to gaining access to high-end markets that have stringent quality requirements (De Lima et al., 2023). However, owing to high prices and complicated administrative processes, smallholder farmers often struggle to secure such certificates, underscoring the need for government assistance to guarantee fair access to GAP advantages. In order to increase the efficacy of GAP frameworks, recent research has investigated the combination of digital technology with precision agriculture (Onyango et al., 2021). Farmers can more effectively apply GAP thanks to digital solutions that make real-time monitoring, data collecting, and decision-making easier. Research on these technologies' potential to enhance GAP adoption and results is quickly growing, especially in light of climate change and its effects on agriculture. In general, research highlights how important GAP is to advancing sustainable agriculture and guaranteeing food security (Chouhan et al., 2021). It also draws attention to the technical and socioeconomic obstacles that need to be overcome in order to facilitate the wider and more equal adoption of GAP, especially in developing nations. The long-term effects of GAP on smallholder farmers, environmental sustainability, and global food systems deserve further investigation (Beck-O'Brien & Bringezu, 2021).

3. METHODOLOGY

Scholarly literature has been analysed by scholars using thorough scientific mapping approaches in a variety of academic areas. Advanced tools are available in addition to conventional statistical and graphical methods; one prominent open-source R package with an easy-to-use online interface is Biblioshiny. Additionally, bibliometric networks are constructed and mapped using VOSviewer, a powerful visualisation program (Khanam et al., 2023).

The major data source for this research was chosen to be the Scopus database, which covers the years 1964 to 2024. Researchers generally agree that Scopus is a trustworthy bibliographic database (Kabir et al., 2024). Using the term "Good Agricultural Practices," 1,755 publications were found in the first stage. A total of 1,732 documents, comprising complete records and referenced references, were kept for in-depth bibliometric analysis after duplicate data were eliminated. On September 21, 2024, the data extraction procedure was carried out.

The thorough five-step research framework used in this study, which describes the methodical procedure of data collecting, screening, analysis, and interpretation, is shown in Figure 1.

4. RESULTS AND DISCUSSION

4.1 Description of the Data

The descriptive features of the dataset, which covers the years 1964 through 2024, are compiled in Table 1. The collection includes contributions from 867 sources, including books and scholarly journals, for a total of 1,732 articles. Despite the dataset's broad coverage, the average age of the documents is 8.23 years, and the yearly growth rate is 0%. A total of 71,684 references have been made, with an average of 17.71 citations per article. A wide variety of topic areas are represented by the dataset's 6,496 Keywords Plus (ID) and 4,605 Author Keywords (DE). The dataset contains contributions from 6,079 writers in total, of whom 206 people generated single-authored articles totalling 221 publications. With 20.55% of publications incorporating international cooperation and an average of 4.36 co-authors per document, there is a considerable degree of international research partnership. The collection contains a wide range of document kinds, including 1,159 research articles, 195 book chapters, 196 conference papers, 154 review articles, and smaller categories including editorials, data papers, and brief comments.

In order to provide a thorough understanding of the development of research on Good Agricultural Practices (GAP), the time period of 1964–2024 was chosen to span six decades of academic activity. The early introduction and subsequent development of GAP principles in response to global agricultural and environmental concerns correspond with this time frame. The oldest known publication in this field dates back to 1964, and the most recent endpoint is 2024, which guarantees the inclusion of contemporary findings and continuing progress. The discovery of long-term trends, significant transitions, and new research patterns within GAP investigations is made easier by this longer time frame. Additionally, it makes it possible to thoroughly assess how GAP has changed in response to shifting goals in global food security and sustainable agriculture.

Table 1. Descriptive statistics for the data

Description	Results
Main Information About Data	
Timespan	1964:2024
Sources (Journals, Books, etc.)	867
Documents	1732
Annual Growth Rate %	0
Document Average Age	8.23
Average citations per doc	17.71
References	71684
Document Contents	
Keywords Plus (ID)	6496
Author's Keywords (DE)	4605
Authors	
Authors	6079
Authors of single-authored docs	206
AUTHORS COLLABORATION	
Single-authored docs	221
Co-Authors per Doc	4.36
International co-authorships %	20.55
Document Types	
article	1159
book	8
book chapter	195
conference paper	196
conference review	2
data paper	2
editorial	5
letter	3
note	5
review	154
short survey	3

4.2 Publication Progression

A line graph showing the yearly number of publications from 1964 to 2025 is shown in Figure 2. The x-axis shows the chronology across the chosen years, while the y-axis shows the total number of articles. From 1964 until the mid-1990s, there were few publications, and the general tendency remained mostly unchanged over this time.

After this stage, a discernible increasing tendency appears, with a consistent rise in publications starting about 2000. After 2010, this trend becomes more noticeable, suggesting a substantial increase in Good Agricultural Practices (GAP) research activities. The number of articles peaks in 2021 and then sharply declines by 2025.

Overall, the graph shows a significant increase in academic production over the last several decades, followed by a noticeable decline in the most recent years, which might be explained by continuing publishing procedures or inadequate indexing.

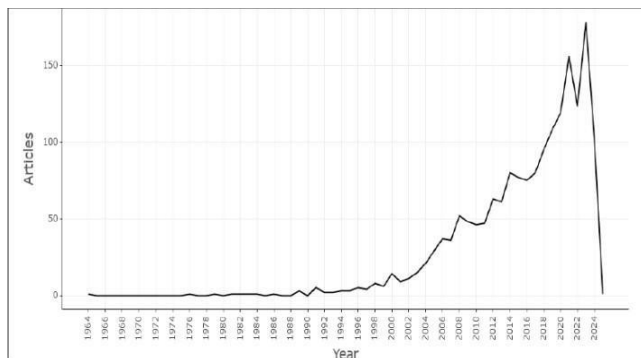


Fig. 2. Annual progression of publications (1964-2024)

4.3 Influential Journals

The cumulative publishing patterns of six significant sources from 1964 to 2025 are shown in Figure No. 3. *Acta Horticulturae* (red) has grown the greatest of them, starting around 2000 and reaching around 100 total publications by 2025.

Around 2008, the EFSA Journal (yellow) starts to become more well-known, exhibiting a consistent growth trend and reaching around 50 publications. In a similar vein, Food Control (green) began contributing in 1996 and has grown steadily, especially after 2006, reaching around 60 articles.

Around 2010, the IOP Conference Series: Earth and Environmental Science (blue) is added to the dataset. It shows steady expansion, surpassing 40 publications by 2025. The Journal of Food Protection (cyan), which started contributing in 1996, has over 40 articles and has a similar development tendency.

Last but not least, Sustainability (Switzerland) (purple), which first appeared around 2016, has a slower pace of growth than the other journals, with comparatively fewer articles by 2025. Overall, the picture shows that different journals have different patterns of publishing, with *Acta Horticulturae* showing the most significant and steady increase throughout time.

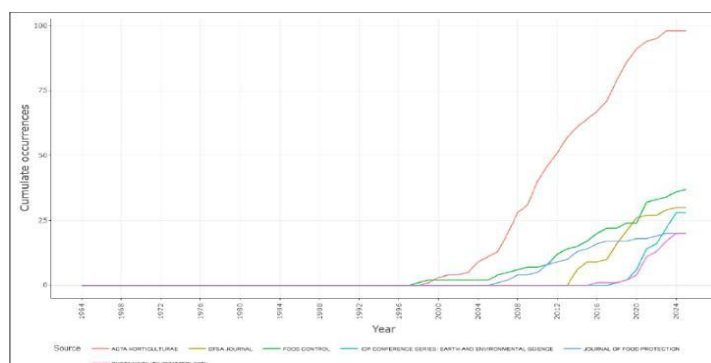


Fig. 3. Influential journals

4.4 Authors’ Outputs

A horizontal bar chart showing the most prolific writers according to the quantity of articles they have written is shown in Figure 4. The x-axis shows how many papers each researcher has contributed overall, while the y-axis identifies the authors.

With 19 publications, Hu J is the top contributor, followed by Santos M with 17. Greco L, Jarrah S, Leuschner R, Miron I, Pedersen R, Reich H, and Theobald A were among the writers who each contributed 16 papers. Brancato A comes in second with fifteen papers. The volume of publications is graphically represented by the size of the circular markers at the end of each bar; bigger circles indicate more contributions.

Overall, Hu J emerges as the most prolific author in the area of Good Agricultural Practices (GAP), and the figure successfully identifies the major contributions within the dataset.

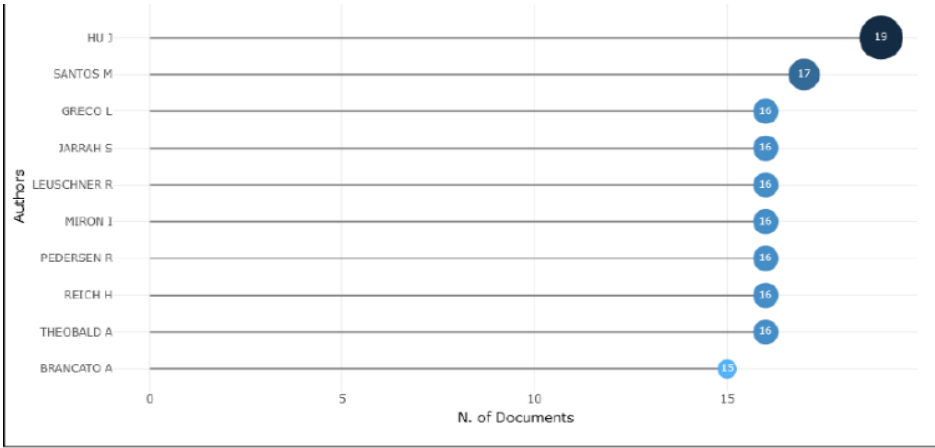


Fig. 4. Most relevant authors in good agricultural practice

4.5 Author Efficiency Using Lotka’s Law

Displays a curve that shows how writers are distributed according to the quantity of articles they have written. The y-axis shows the percentage of contributors, while the x-axis shows the total number of papers produced. The bulk of writers have only produced a few articles, as seen by the sharp starting decrease in both the solid and dashed curves. Eighty percent of the writers have written one to three articles. The graph eventually levels out after this, indicating that very few researchers have written more than five articles. This distribution is consistent with Lotka's Law, which shows that although the bulk of contributors have relatively low publication counts, a small number of very prolific writers account for a significant portion of the overall production.

4.6 Countries of Corresponding Authors

The distribution of publications by cooperation type—MCP (Multiple Country Publications) and SCP (Single Country Publications)—is shown in Figure 6. In terms of overall publications, China comes in first, followed by the US and India. SCPs and MCPs are shown in the illustration as blue and red bars, respectively. SCPs predominate in the majority of nations, indicating that a significant amount of research is carried out locally without international cooperation. Nonetheless, a significant percentage of MCPs are found in nations like the US, China, and India, indicating robust international research collaborations. Although SCPs predominate in their

production, other nations like Brazil, Thailand, and Indonesia also make substantial contributions. Overall, the graph illustrates how research contributions are distributed around the world, with China and the US emerging as major contributors to both domestic and collaborative research outputs.

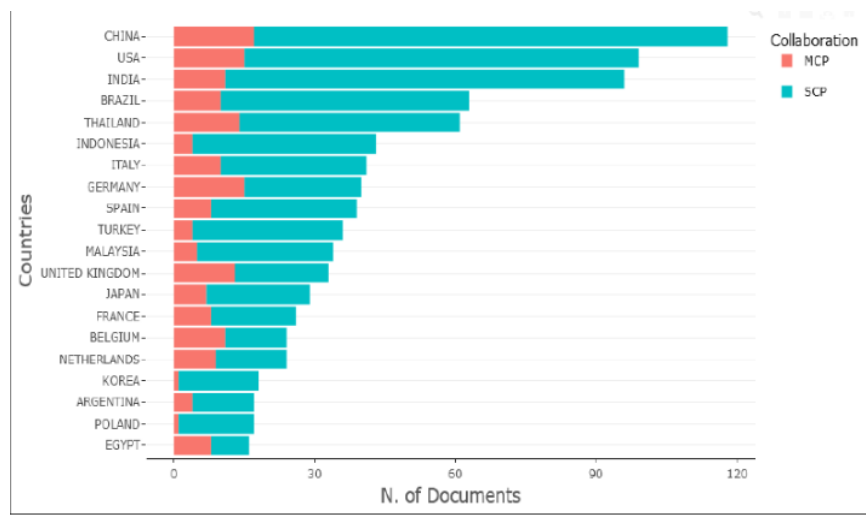


Fig. 6. Corresponding 'authors' countries

4.7 Scientific Production by Countries

The map shows the distribution of scientific production worldwide, with nations coloured according to their respective contributions. Higher research production is indicated by darker blue hues, whilst lesser output is shown by lighter hues. According to the graphic, the United States and China are the top producers of science, with India, Japan, Germany, the United Kingdom, France, South Korea, Canada, and Italy following closely after. Significant scientific effort is also shown by countries like Brazil, Russia, Australia, Spain, and Mexico. On the other hand, certain areas show very low levels of scientific production, especially in Africa and some parts of Asia. This discrepancy draws attention to the unequal distribution of research resources and ability throughout the world.

4.8 Country Collaboration

A worldwide network of research partnerships is shown in Figure 8. Connecting lines between nations on the globe indicate the scope of cooperative research endeavours. Each line's thickness shows how strong these alliances are. As key nodes in this network, the US, China, and a number of European nations maintain close cooperative ties with other countries. With partnerships increasingly spanning many continents and regions, this visualisation highlights the rising interconnection of worldwide scientific research.

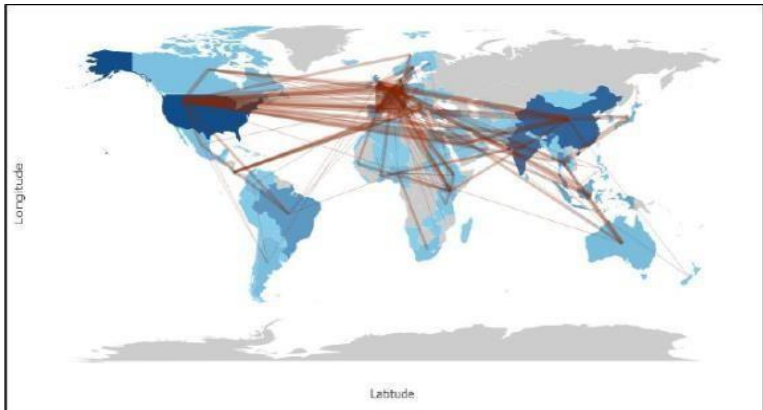


Fig. 8. Collaboration among the countries

4.9 Active Institutions

shows a bar graph of the top 10 universities according to the quantity of research publications they have published. The number of publications is shown on the horizontal axis, while the institution names are listed on the vertical axis.

With 67 publications, Ghent University is in first place, followed by the University of Science and Technology Beijing with 54. Chiang Mai University, China Agricultural University, Anand Agricultural University, Kasetsart University, the Agricultural Research Center, Wageningen University, and the University of Nairobi are among the other notable universities in the top 10. A comparative overview of institutional contributions is shown in the figure, which highlights the top institutions influencing Good Agricultural Practices (GAP) research output.

4.10 Network Analysis and Trend Word Analysis

4.10.1 Co-occurrence Network of Keywords

A network visualisation of academic papers for Sustainable Development Goal (SDG) 2: Zero Hunger is shown in Figure 10. Keywords taken from the literature are represented as nodes in this network, and their co-occurrence within the same articles is shown by connecting edges. Each node's size reflects the frequency of the corresponding term, while its colour (hue) indicates its semantic categorisation or thematic grouping. The primary topic of the study domain is highlighted by the center node, "agriculture." It is surrounded by similarly related phrases that create significant theme clusters, such as "pesticide residue," "risk assessment," "chemistry," and "human." The network also displays a variety of related subjects related to SDG 2, such as "food contamination," "non-human," "microbiology," and "food handling." All things considered, this visualisation offers a thorough depiction of the knowledge structure found in SDG 2 research, highlighting important theme areas and the connections between different study disciplines.

4.10.2 Trend Topics

A word cloud showing the most often recurring phrases related to rising trend subjects is shown in Figure 11. Larger terms indicate greater frequency within the dataset, and the words are sorted based on their relative significance. Each piece of the word cloud represents a different sub-theme within the larger field of study. "Germany," "Greece," "United Kingdom," "Triticum aestivum," "herbaceous agent," "Bos taurus," "World Health Organization," "drug contamination," "drug products," "drug quality," "Europe," "herbicides," "standard," "safety," "Netherlands," "Eastern Hemisphere," "Western Europe," and "manure" are among the prominent terms found.

This visualisation offers insights into the changing emphasis areas within the discipline by providing an efficient graphical overview of prevailing themes and new research paths.

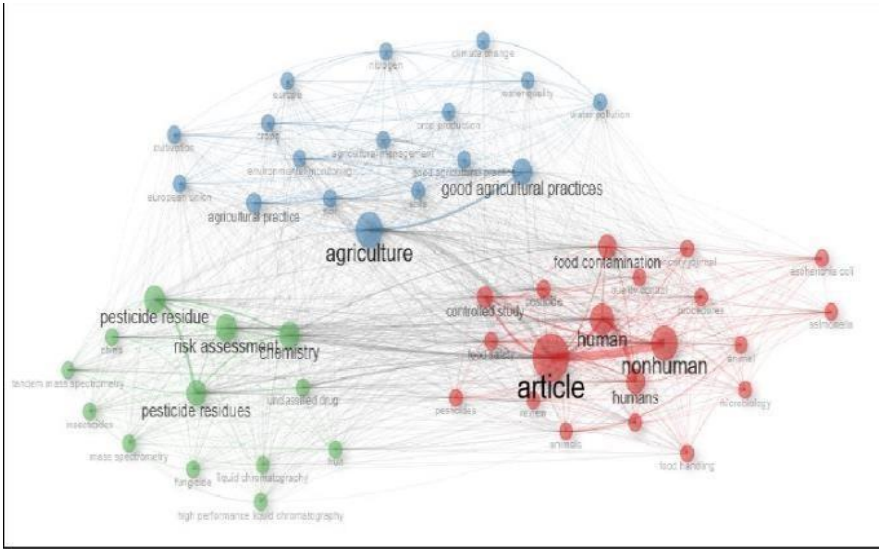


Fig. 10. Co-Occurrence network of the keyword



Fig. 11. Trend topic in good agricultural practices

5. RESEARCH GAPS AND FUTURE DIRECTIONS

Despite the large amount of research on Good Agricultural Practices (GAP), there are still a number of gaps in the literature that need to be filled in order to fully comprehend GAP and apply it more successfully (Siebrecht, 2020b). The regional distribution of research is one such discrepancy. Research from developing regions, especially in Africa, South Asia, and Latin America, is still scarce despite the vital role that agriculture plays in guaranteeing food security and livelihoods in these regions. In contrast, developed countries with sophisticated agricultural systems contribute a significant amount of research.

The development of localised GAP solutions that may address the particular environmental,

socioeconomic, and cultural issues encountered by farmers in these locations is hampered by the paucity of region-specific research (Mojid & Mainuddin, 2021). Additionally, the majority of current research is on the technical and environmental advantages of GAP, with relatively little attention paid to the socioeconomic obstacles influencing its adoption, particularly among smallholder farmers. These difficulties include limited market access, budgetary limitations, a lack of knowledge and training, and the expensive price of GAP certification.

Improving GAP's accessibility and long-term sustainability among small-scale farmers requires better understanding of the socioeconomic factors driving its adoption. Future studies should focus on the long-term effects of GAP on rural livelihoods, agricultural production, and environmental preservation. There is a dearth of information on its long-term impacts, especially when it comes to climate resilience and economic sustainability, despite the fact that many research emphasise its short-term advantages.

Furthermore, not enough research has been done on how new technology might improve GAP's efficacy and efficiency. GAP implementation and monitoring might be greatly enhanced by digital technologies like data analytics, mobile-based advising systems, and precision agriculture. They are still in the early stages of being integrated with conventional agricultural methods, however.

Future research should concentrate on institutional processes and policy frameworks that facilitate the implementation of GAPs (Kanger et al., 2020). Research is required to assess how well international efforts, government policies, and subsidy programs support GAP. Furthermore, examining how public-private partnerships support GAP adoption—especially in environments with limited resources—can provide insightful information on scalable and long-lasting solutions.

6. CONCLUSION

Based on Scopus data, the bibliometric study of Good Agricultural Practices (GAP) literature offers a thorough summary of research trends, important areas of attention, and current gaps in the field. The results show that GAP is becoming more and more popular among academics, especially in response to rising worries about agriculture's economic viability and environmental sustainability.

Nevertheless, the research also identifies significant shortcomings in the corpus of existing literature. There is still little research on the socioeconomic obstacles to GAP adoption, especially for smallholder farmers. Further comprehensive research on the long-term effects of GAP on rural livelihoods, agricultural production, and climate change adaptation is also required

(Pervez et al., 2024). Further evidence that many areas where GAP adoption is most crucial are under-represented in scholarly discourse comes from the unequal geographic distribution of research.

Therefore, by incorporating technical advancements, tackling socioeconomic issues, and creating supporting regulatory frameworks that enable broader use of GAP, future research should give priority to these understudied regions. By doing this, researchers may aid in the creation of more potent, situation-specific GAP techniques that boost agricultural output while advancing socioeconomic well-being and environmental sustainability. To sum up, bibliometric analysis is a useful technique for understanding the development and present status of GAP research. In the end, it supports the development of sustainable agriculture and global food security by offering crucial insights that may direct future research toward the most significant areas.

REFERENCES

1. Amekawa, Y., Bumrungsri, S., Wayo, K., Gebre, G. G., & Hongsisong, S. (2022). Pesticide use under public good agricultural practices standard: A comparative study in Thailand. *Agriculture*, 12(5), 606. <https://doi.org/10.3390/agriculture12050606>
2. Beck-O'Brien, M., & Bringezu, S. (2021). Biodiversity monitoring in long-distance food supply chains: Tools, gaps and needs to meet business requirements and sustainability goals. *Sustainability*, 13(15), 8536. <https://doi.org/10.3390/su13158536>
3. Bertola, M., Ferrarini, A., & Visioli, G. (2021). Improvement of soil microbial diversity through sustainable agricultural practices and its evaluation by omics approaches: A perspective for the environment, food quality and human safety. *Microorganisms*, 9(7), 1400. <https://doi.org/10.3390/microorganisms9071400>
4. Chouhan, G. K., Verma, J. P., Jaiswal, D. K., Mukherjee, A., Singh, S., De Araujo Pereira, A. P., Liu, H., Abd_Allah, E. F., & Singh, B. K. (2021). Phytomicrobiome for promoting sustainable agriculture and food security: Opportunities, challenges, and solutions. *Microbiological Research*, 248, 126763. <https://doi.org/10.1016/j.micres.2021.126763>
- De Lima, F. A., Neutzling, D. M., Seuring, S., Kumar, V., & Bossle, M. B. (2023). Analysing the implications of organic standardisation and certification in alternative food networks: The capability approach. *Business Ethics, the Environment & Responsibility*, 32(4), 1547–1562. <https://doi.org/10.1111/beer.12561>
5. Eriksen, S., Schipper, E. L. F., Scoville-Simonds, M., Vincent, K., Adam, H. N., Brooks, N., Harding, B., Khatri, D., Lenaerts, L., Liverman, D., Mills-Novoa, M., Mosberg, M., Movik, S.,

Muok, B., Nightingale, A., Ojha, H., Sygna, L., Taylor, M., Vogel, C., & West, J. J. (2021). Adaptation interventions and their effect on vulnerability in developing countries: Help, hindrance or irrelevance? *World Development*, 141, 105383. <https://doi.org/10.1016/j.worlddev.2020.105383>

6. Forster, J., Vaughan, N. E., Gough, C., Lorenzoni, I., & Chilvers, J. (2020). Mapping feasibilities of greenhouse gas removal: Key issues, gaps and opening up assessments. *Global Environmental Change*, 63, 102073. <https://doi.org/10.1016/j.gloenvcha.2020.102073>

7. Kabir, M. S., Pervez, A. K. M. K., Jahan, M. N., Khan, M. T. A., & Kabiraj, U. K. (2024). Unmanned aerial vehicles in agricultural sciences: A bibliometric analysis study based on Scopus database. *African Journal of Biological Sciences*, 6(15), 14335–14357. <https://doi.org/10.48047/AFJBS.6.15.2024.14335-14357>

8. Kanger, L., Sovacool, B. K., & Noorkõiv, M. (2020). Six policy intervention points for sustainability transitions: A conceptual framework and a systematic literature review. *Research Policy*, 49(7), 104072. <https://doi.org/10.1016/j.respol.2020.104072>

9. Khanam, M., Pervez, A. K. M., Haque, M. A., Rahman, M. M., & Kabir, M. S. (2023). Bibliometric analysis of farmers' rural-urban migration based on the Scopus platform. *South Asian Journal of Social Studies and Economics*, 20(3), 93–103. <https://doi.org/10.9734/sajsse/2023/v20i3715>

10. Khatam, A., Muhammad, S., Ashraf, I., & Pervez, A. K. M. K. (2013). Effectiveness of group contact methods in diffusion of agricultural technologies among the farming community. *Journal of Biodiversity and Environmental Sciences*, 3, 264–268.

11. Mojid, M. A., & Mainuddin, M. (2021). Water-saving agricultural technologies: Regional hydrology outcomes and knowledge gaps in the Eastern Gangetic Plains—A review. *Water*, 13(5), 636. <https://doi.org/10.3390/w13050636>

12. Onyango, C. M., Nyaga, J. M., Wetterlind, J., Söderström, M., & Piikki, K. (2021). Precision agriculture for resource use efficiency in smallholder farming systems in Sub-Saharan Africa: A systematic review. *Sustainability*, 13(3), 1158. <https://doi.org/10.3390/su13031158>

13. Pervez, A. K., Ishida, A., Kabir, M. S., & Tang, L. (2024). Migration intention of rural farmers to urban areas in Bangladesh and its determinants: A partial least squares structural equation modelling approach. *Societies*, 14(7), 99. <https://doi.org/10.3390/soc14070099>

14. Pervez, A., Gao, Q., & Uddin, M.-E. (2016). The management of agricultural risk in Bangladesh: A proposed process. *Asian Journal of Agricultural Extension, Economics & Sociology*, 12(1), 1–

13. <https://doi.org/10.9734/AJAEES/2016/27057>

15. Siebrecht, N. (2020a). Sustainable agriculture and its implementation gap—Overcoming obstacles to implementation. *Sustainability*, 12(9), 3853. <https://doi.org/10.3390/su12093853>

16. Siebrecht, N. (2020b). Sustainable agriculture and its implementation gap—Overcoming obstacles to implementation. *Sustainability*, 12(9), 3853. <https://doi.org/10.3390/su12093853>

17. Sparling, T. M., White, H., Boakye, S., John, D., & Kadiyala, S. (2021). Understanding pathways between agriculture, food systems, and nutrition: An evidence and gap map of research tools, metrics, and methods in the last 10 years. *Advances in Nutrition*, 12(4), 1122–1136. <https://doi.org/10.1093/advances/nmaa158>

18. Viana, C. M., Freire, D., Abrantes, P., Rocha, J., & Pereira, P. (2022). Agricultural land systems importance for supporting food security and sustainable development goals: A systematic review. *Science of the Total Environment*, 806, 150718. <https://doi.org/10.1016/j.scitotenv.2021.150718>