Mapping the landscape of leadership in Agricultural Extension: A Bibliometric Review

Khushi Mishra[1*], Bhawana Rathore[2], Dr. Sonal Sidana[3], Dr. Vidya Jha[4]

[1*]Research Scholar, Department of Commerce, Sarala Birla University, Ranchi,
khushimishra010@gmail.com
[2]Research Scholar, Department of Management, Manipal University, Jaipur,
bhawana.rathorez@gmail.com
[3]Assistant Professor, Department of Management Manipal University, Jaipur,
sonal.sidana@jaipur.manipal.edu
[4]Assistant Professor, Faculty of Business Administration Sarala Birla University, Ranchi
vidya.jha@sbu.ac.in

*Corresponding Author: Khushi Mishra
[*]Research Scholar, Department of Commerce, Sarala Birla University, Ranchi,
khushimishra010@gmail.com

Abstract
Agricultural extension services have a great role in enhancing the knowledge and creating an innovation in the community of farming. This paper studies the Bibliometric review that maps on the landscape of leadership that is in the agricultural extension. The paper is written by analysing trends in publication, important research areas and the important work in this field. This paper studies the leadership evolution and various approaches within the extension, which shifts from the hierarchical traditional model to the transformational and participatory styles. There is a growth seen on the role of extension workers as knowledge brokers and facilitators, thus highlighting the development of skills and adaptable leadership styles in tackling with the complex challenges that has been faced by the modern agriculture. This review paper shows and identifies the gap in the literature that are existing and gives suggestions for the future research that emphasise the string need to study and explore the impact of leadership on the effective extension and good adoption of the agricultural practices that are sustainable. Thus, this research shows and contributes to a deeper understanding leadership dynamics that are used in the agricultural extension and thus which helps in informing the strategies which helps in enhancing the performance of extension services worldwide.

1. Introduction

Agricultural extension services play a vital role in bridging the gap between agricultural research and practical implementation of innovative agricultural technologies. They serve as a conduit for the dissemination of knowledge and technologies to farmers, thereby improving agricultural productivity and promoting sustainable agricultural development. The essence of agricultural extension is its ability to facilitate the exchange of knowledge, ensuring that farmers have access to the latest advances in agricultural science and are equipped to address their specific challenges and needs (Ndem et al., 2020). Extension professionals have a multifaceted role that goes beyond technology transfer; they are responsible for facilitating learning, forming farmer groups, and handling the complexities of marketing, while also addressing broader public interest issues such as resource conservation, food security, and rural development (Saryam & Jena, 2019). Technology transfer is not done merely by the agricultural extension; it is a human procedure aimed to empowering rural populations by showing them the information and support to realize their full potential (Behera & Das, 2020). The historical evolution of the agricultural extension shows a shift from traditional, approaches of top-down to participatory & demand-driven models, focusing the importance of

2008

tailoring extension services to the specific needs & contexts of diverse farming communities (Xu et al., 2023).

Leadership has long been recognized as a key catalyst for driving agricultural innovation, improving rural livelihoods and ensuring sustainable development. In the context of agricultural extension, leadership plays an even more critical role by mediating the transfer of knowledge, facilitating community engagement, and driving institutional change (Kelsey & Hearne, 2020). Agricultural extension systems around the world are undergoing rapid transformation, moving away from a linear model of technology transfer towards a more diversified, participatory and demand-driven approach. (Rivera & Alex, 2004). In the dynamic settings, leadership not merely a managerial function but a strategic & relational process which influences the knowledge flows, how stakeholders collaborate, and innovations are scaled (Anderson & Feder, 2007)

Despite the growing importance of agricultural extension, its academic leadership remains fragmented. Research scope includes exploration of the concept of expanded leadership styles (Ladewig & Rohs, 2000) to empirical assessments of leadership effectiveness in farmer-led organizations (Suvedi & Kaplowitz, 2016However, a systematic synthesis of this literature—particularly one that charts the structure of knowledge, the evolution of topics, and research trends—has yet to be comprehensively conducted. Bibliometric analysis is a powerful quantitative tool that can reveal hidden patterns, influential works, and collaboration networks within a particular field (Donthu et al., 2021).

1.1. Role of the agricultural extension as Leaders

In facilitating the development of agriculture and empowering the farmers, agricultural extensions play a very important role as leaders. Let's go in detail some key functions of leadership:

● Knowledge transfer and education: Extension workers act as information conduits, disseminating the latest agricultural research, technology, and best practices to farmers (Ndem et al., 2020). They teach farmers improved farming techniques, crop management and permaculture practices, bridging the gap between research and actual implementation, as highlighted in your document.

● Facilitating Learning and Skill Development: Modern agricultural extension studies beyond transferring technology (Behera & Das, 2020). Extension workers shows learning, helping farmers develop the skills in areas like production, post-harvest management, natural resource management, and marketing (Behera & Das, 2020).

● Group formation and social mobilization: Extension workers often play a key role in forming and supporting farmer groups (Jamil et al., 2021). These groups are able to take collective action, improve their bargaining power, and facilitate the sharing of knowledge and resources.

● Problem Solving and Decision Making: They help farmers to identify & address the specific challenges, sharing guidance & support for the informed decision-making (Ndem et al., 2020).

● Linkages and Coordination: Extension professionals relate farmers to the markets, credit institutions & other players in agricultural value chain (Behera & Das, 2020).

● Empowerment and Capacity Building: As mentioned in your paper, the ultimate goal of agricultural extension is to empower rural people by providing them with the information and support they need to achieve their full potential.

Technical knowledge, communication skills and the ability to respond and understand the need for diverse communities in farming, extension workers need a range of competencies to become an effective leader (Jamil et al., 2021). They also need to take to the changing agricultural landscape, which includes the increasing use of digital technologies & growing importance of sustainable practices (Sulaiman & Ban, 2000).

Therefore, this study attempts to fill this gap by conducting a bibliometric review of leadership research in the field of agricultural extension. Drawing on peer-reviewed literature from renowned index repositories, this review aims to answer the following key questions: How has the volume of

research changed over time? What are the dominant themes and emerging trends? Which authors, institutions, and countries have made the most influential contributions to the field? How do citation and co-authorship networks influence discussions of agricultural extension leadership?

Mapping the intellectual landscape, this review not only contributes to the consolidation of the knowledge also serves as a strategic guide for scholars, practitioners, and policy-makers navigating the complexities of the agricultural development and extension leadership in the 21st century.
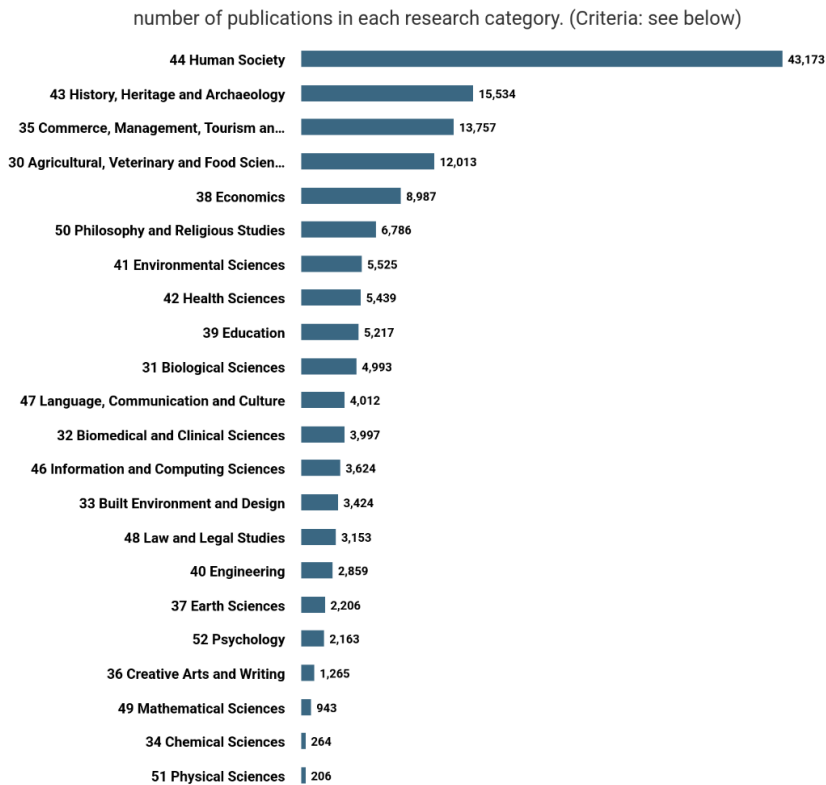
2. Methodology
2.1. Bibliometric Analysis

Bibliometric analysis is an approach that examines the research documents and trends in research in a particular given area and which shows the statistical approach. The main use of bibliometric analysis is to search for the trends in research, gaps in research, directions for the future, database of publication, co-authorship analysis, publications in past years, etc. In the analysis provided, we have studied the various aspects of analysis through DimensionsAI and VOSviewer, through which the study shows the publication analysis and per year analysis, author analysis, co-authorship analysis, citation analysis, etc. The database for this research work has been collected by the Dimensions.ai, VOVviewer was also used from DimensionsAI for the graph of co-authorship analysis and citation analysis.

2.2. Publication Output
1. No. of publication in each category:

number of publications in each research category. (Criteria: see below)

Category	Number of publications
44 Human Society	43,173
43 History, Heritage and Archaeology	15,534
35 Commerce, Management, Tourism an...	13,757
30 Agricultural, Veterinary and Food Scien...	12,013
38 Economics	8,987
50 Philosophy and Religious Studies	6,786
41 Environmental Sciences	5,525
42 Health Sciences	5,439
39 Education	5,217
31 Biological Sciences	4,993
47 Language, Communication and Culture	4,012
32 Biomedical and Clinical Sciences	3,997
46 Information and Computing Sciences	3,624
33 Built Environment and Design	3,424
48 Law and Legal Studies	3,153
40 Engineering	2,859
37 Earth Sciences	2,206
52 Psychology	2,163
36 Creative Arts and Writing	1,265
49 Mathematical Sciences	943
34 Chemical Sciences	264
51 Physical Sciences	206

Source: https://app.dimensions.ai
Exported: April 22, 2025
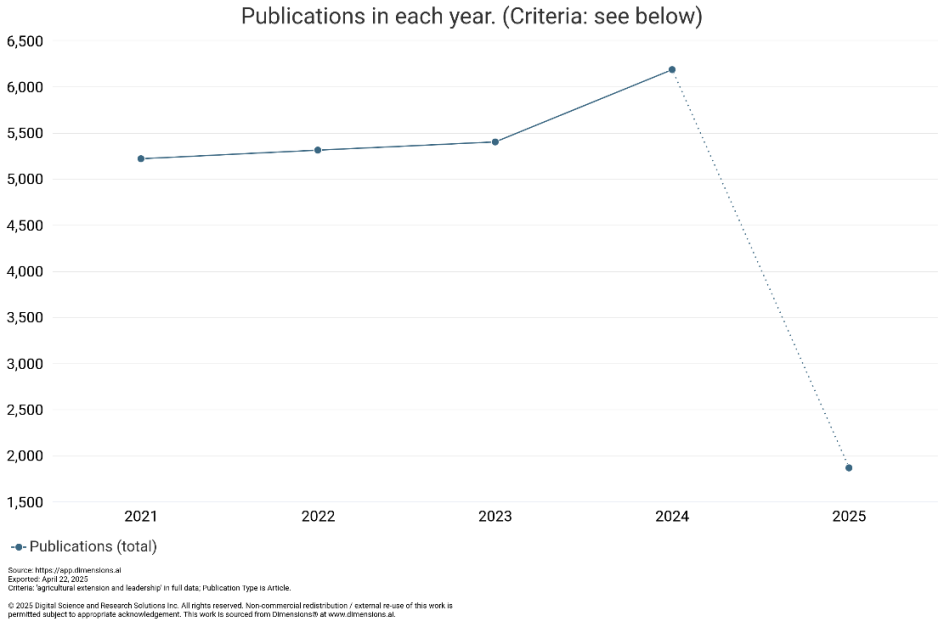Criteria: 'agricultural extension and leadership' in full data; Publication Type is Article.

Table 1
Source: Dimensions.ai

Table 1 reflects analysis in detail for the publication output through the various domains of the research from Dimensions.ai, Thus the focus is mainly on agricultural extension and leadership. Mainly journal articles were taken for the analysis of this bibliometric analysis. Total number of publications recorded 43,173 under the domain of Human Society, which makes it the dominant part of the output of scholar. This gives a strong interdisciplinary intersection on leadership and agricultural extension that is studied with social science disciplines. With this, the domain that has substantial number of publications is "History, Heritage and Archaeology" (15,534) which is attributed to the evolution of leadership and agricultural extension practices. The next 13,757 publication in "Commerce, Management, Tourism and Services" gives a great emphasis on the organisational and managerial role of the services of agricultural extension which includes the rural development, leadership and optimization of value chain. Thus the core domain of agriculture ranked fourth i.e., "Agricultural, Veterinary and Food Sciences". This shows the topic relevance in the core of agricultural sciences showing the broad appeal interdisciplinary. Some other key categories included the Economics (8,987), Philosophy and Religious studies (6,786), Health sciences (5439) and Environmental sciences (5,525). The presence of agricultural extensions in this field shows a multifaceted nature of the agricultural extension, in which the central themes are ethics, sustainability, environmental stewardship and public health.

There are some other disciplines that contributed significantly and which also shows a hint on increasing the integrating the technology, smart systems in extension and data analysis in extension practices are Information and Computing Services (3,624) and Engineering (2,859). There were fewer publications given in categories such as Psychology (2,163) and creative arts and writing (1,265). The minimum publications were recorded in the domains such as Mathematical sciences (943), Chemical sciences (264) and physical sciences (206).

Overall, the pattern distribution of the diagram shows that the study of leadership and agricultural extension is not confined to the Traditional agricultural sciences and is very deeply associated with the wide spectrum of disciplines- ranging from the social sciences, humanities to engineering and health. This reinforces the need for a multidisciplinary approach in both research and policy development in this area.

2. Publication per year (2021-2025)

Publications in each year. (Criteria: see below)

- Publications (total)

Graph 1
Source: Dimensions.ai

The graph shows the distribution of agricultural extension and leadership from the year 2021 to 2025, which is shown from the dimensions.ai (source), Which shows a valuable insights into the evolving of research interest activity under this domain. The trend shows a steady rise in the output from 2021-2024, but a decline in 20205 (shows that 2025 data was extracted in April and is likely to be incomplete). In 2021, the number of publications were at approximately 5,237, which increased to 5,309 in 2022. This consistent grow continued through 2023, reaching 5,430, which suggests a sustained research interest and policy relevance of the subject. The great significant increase was recorded in 2024, with publications up to at 6,341. This surge attributed to several global & regional developments, which includes an increase in focus on food systems resilience post-pandemic, expansion of sustainable agriculture programs, and growing funding support of the rural leadership development, especially in emerging economies. However, the great drop in 2025, where publications plummet to 1,806, must be interpreted cautiously. Given that this data reflects only the first quarter (as it was extracted in April 2025), it does not represent the complete research activity for the year. Assuming a linear growth pattern, it is plausible that the final publication count for 2025 will align with or surpass the preceding years.

This year-wise analysis confirmed that *agricultural extension and leadership* continuues to be a dynamic and growing research field, attracting increased attention from scholars, policymakers, and practitioners alike. The spike in 2024 underscores its rising strategic importance in addressing complex rural and agrarian challenges through knowledge systems and leadership frameworks.
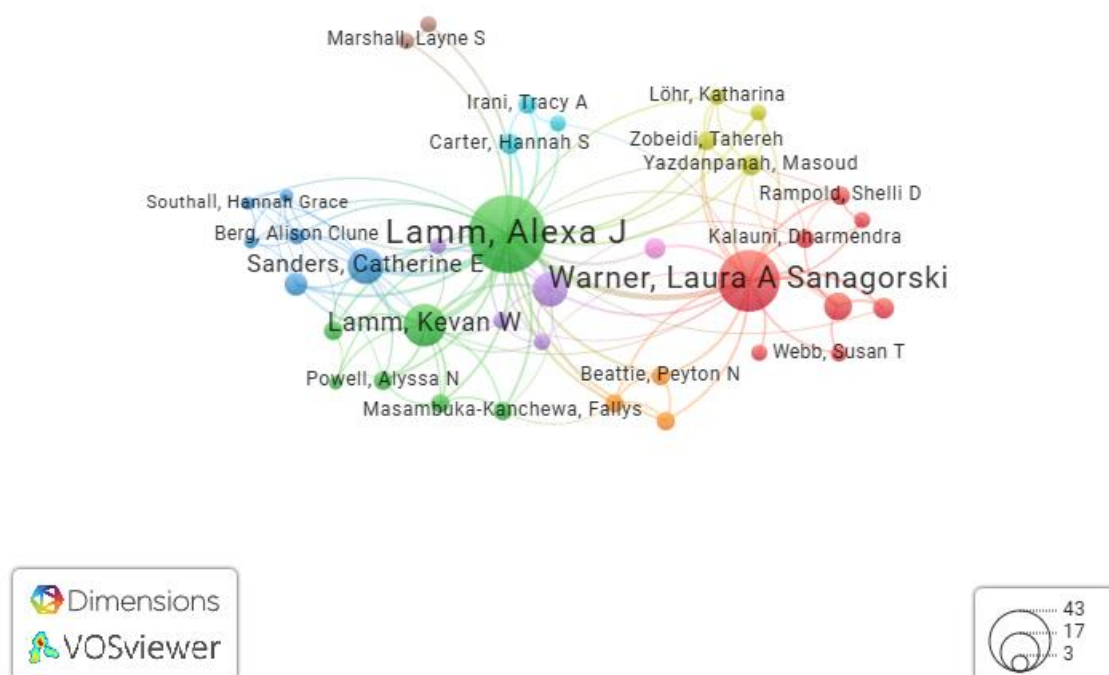
3. Co-authorship analysis

Figure 1
Source: Dimensions.ai

To understand the landscape in the research domain of *"agricultural extension and leadership,"* a co-authorship network visualization was generated through **VOSviewer**. This bibliometric map shows patterns of scholarly collaboration among authors globally, based on joint authorship of research articles indexed in Dimensions.ai. The visualization in general, each node is represented by an author, while the links among them indicate instances of co-authorship. The **size of the node** shows the author's publication volume, whereas the **thickness of the connecting lines** reflects the strength & frequency of collaboration. The analysis shows the several **distinct clusters**, each of which representing collaborative group of researchers actively publishing in this field. These clusters shows the formation of **region-specific or theme-specific research groups**, often centred around prominent academic institutions or funded research consortia.

A few key observations include:

- The presence of **highly centralized nodes**, reflecting that certain authors play a **hub-like role**, acting as the key collaborators among multiple projects or institutions.
- Some clusters are tightly knit, which indicates **strong intra-group collaborations**, while others shows looser linkages, which suggests **interdisciplinary & cross-institutional partnerships**.
- The network structure shows a balanced mix of **international & national collaborations**, reflecting the global nature of research in agricultural extension—particularly of sustainable development, rural capacity building & technology transfer.

Such co-authorship analysis is instrumental which identifies **influential authors**, **collaborative hubs**, as well as **emerging research networks** under the field. It serves as the valuable guide for early-career researchers seeking to search potential collaborators and institutions with strong publication footprint in agricultural leadership & extension studies.
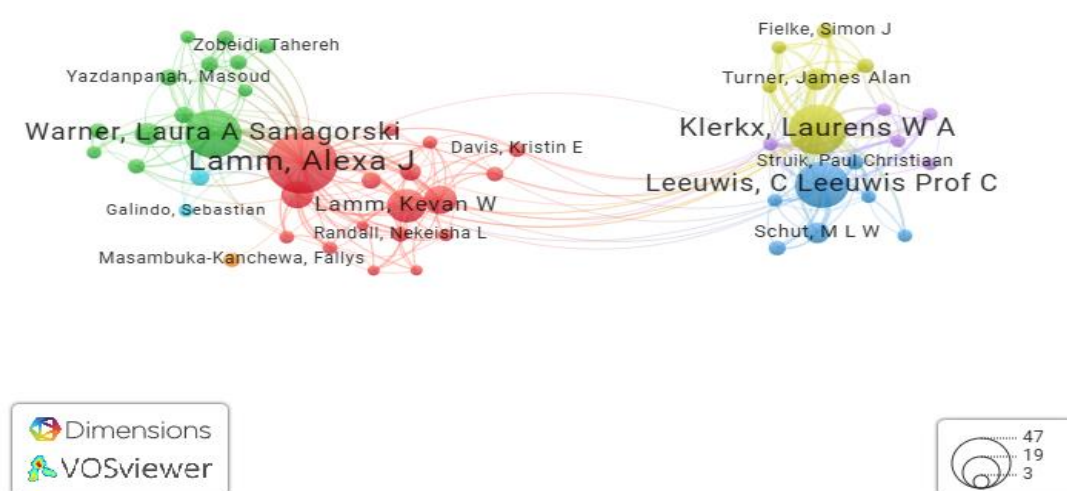
4. Citation analysis per author

Figure 2
Source: Dimensions.ai

Most influential contributions is shown in the field of leadership and agricultural extension, Dimensions.ai was used for the citation analysis, and shows by VOSviewer. The network map displays cluster of authors which is done on the no. of times they were cited & relationship of citation with other researchers. No. of citations received by authors is shown by the size of the circles(nodes), in which the proximity and connections between them indicate shared citations or the close thematic work. From the map, it is clear that Alexa J. Lamm reflects as a highly cited & central author, strong citation connect to other researchers such as Laura A. Warner, Kevan W. Lamm, and Nekeisha L. Randall. These authors appear to be closely connected cluster, which shows a group of scholars cited together — possibly working on likely themes or within the same academic network. On the other side, Struik, who also show significant citation impact. These researchers are likely contributing from a different regional or thematic perspective, possibly focusing more on innovation systems and policy-level agricultural extension. There are visible citation bridges between these two clusters, suggesting that while the groups may focus on different subtopics or geographical contexts, their work is interconnected and contributes collectively to the advancement of the field.

5. Total number of article published in UGC- Journal List Group-I (Influential journal)
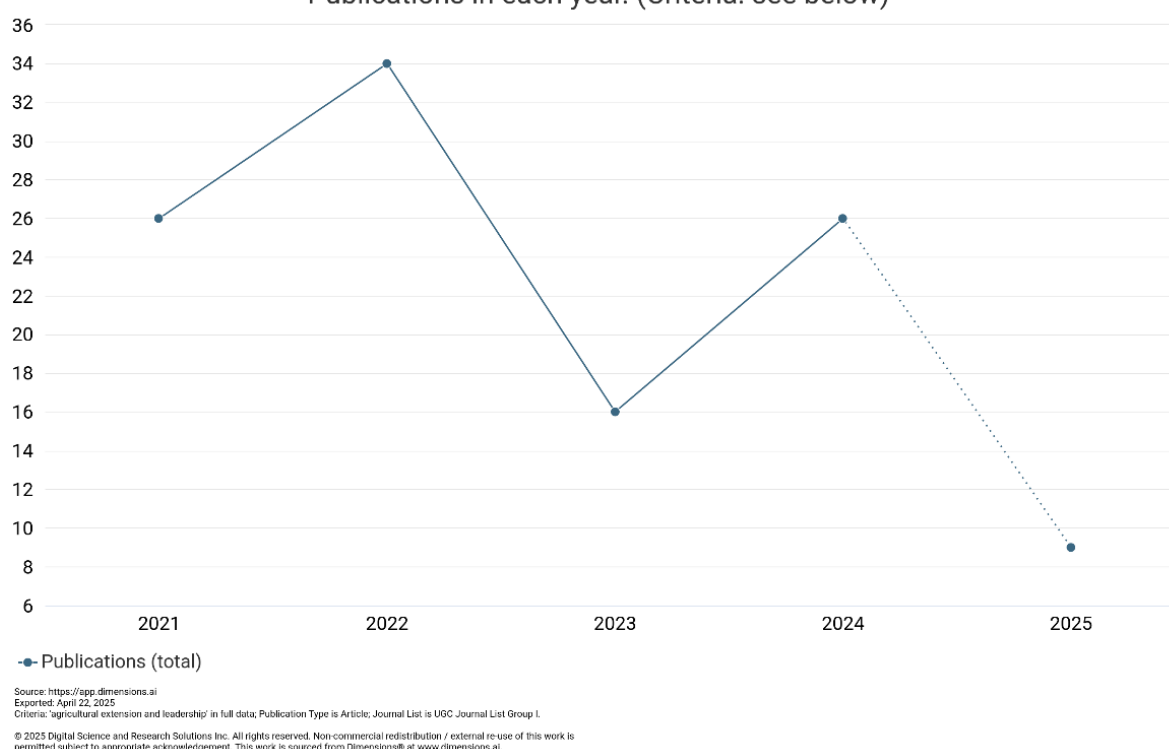
Graph 2
Source: Dimensions.ai

The graph shows the articles published in UGC Group I listed journal on *agricultural extension and leadership* from 2021 to 2025. This subset shows a great view of how the topic has evolved within journals that meet UGC's quality benchmarks for Indian academic research. There was a moderate no. of publications (26 publications) in 2021, which increased to 34 publications in 2022 and this was the highest output in 5 years period. This shows a rise in the research interest and activity of scholars, which was driven by the post pandemic development of rural strategies, policy updates and funding support. Thus, it was declined in the 2023 publications and it was dropped to 17. This could have happened due to the shift in research, funding constraints or narrow the UGC Group I acceptance journal criteria. Despite this drop, there was a rebound increase in 2024 with 26 articles- which is

matching with the output of 2021. There was a decline to only 8 publications in 2025 as it was collected till April 2025, thus causing the decline in 2025 as the data was limited to 2025. This research is still going on and the final count is likely to increase by the end of this calendar year.

This trend shows the interest in topic is consistent, there is a fluctuation rate in the UGC Group which is being potentially reflected by academic externally, administrative or policy-related factors. This pattern shows the increasing the target of high quality journal, even when the volume is varied annually. This insight is important for the future research planning — researchers be consider not only thematic relevance for their work but also align the submissions with journals in consistent visibility & credibility under UGC-approved listings.

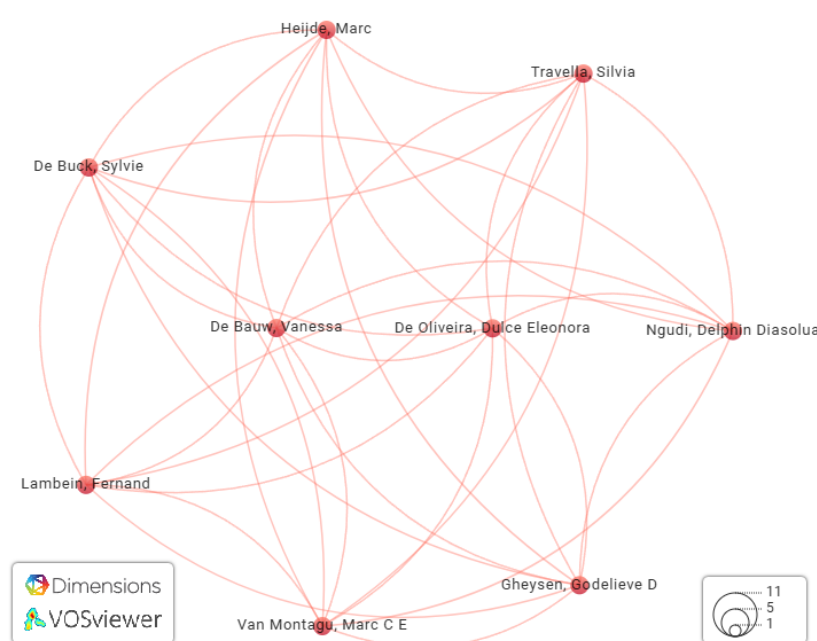## 5.1. Co-authorship analysis of UGC GROUP I

Figure 3
Source: Dimensions.ai

This figure shows the co-authorship analysis of researchers publishing in the UGC Group I journals in the field of leadership and agricultural extension. The figure shows the VOVviewer network map on different authors collaborate on articles of research. Each circle is represented as an author and the co-authorship is indicated by the lines. The collaboration is stronger as the authors are closer and more connected. The size of circle shows number of publications by author, and thickness of lines reflects how frequently they co-authored with others. The map clearly reflects a tight-knit collaboration cluster of the prominent authors, including:
- Marc Heijde,
- Silvia Travella,
- Vanessa De Bauw,
- Dulce Eleonora De Oliveira,
- Delphin Diasolua Ngudi,
- Godelieve Gheysen,
- and Marc C. E. Van Montagu.

A well-coordinated group has been created by the researchers, which might be the part of the same institution or projects internationally. Dense web of connections reflects strong internal collaboration, which shows a focused & possibly interdisciplinary research team. Such networks are important in 2015

bibliometric studies because they reflects the research driving groups in journals, manual influence and productivity of research and help in identifying the institutions or collaborators to connect.

3. Findings And Conclusion of the bibliometric analysis

The study analyses a number of factors, such as publishing trends, annual analysis, author analysis, co-authorship analysis, and citation analysis, using DimensionsAI and VOSviewer. "Human Society" is the most prevalent domain, according to the study of publishing outputs, suggesting a strong multidisciplinary convergence between social sciences, leadership, and agricultural extension.The Sphere of "History, Heritage and Archaeology" and "Commerce, Management, Tourism and Services" also have significant numbers of publications, Bring attention to the evolution and organizational roles within agricultural extension

The co-authorship analysis identifies influential authors and collaborative hubs, highlighting both tightly-knit and loosely-linked clusters that represent different research groups. These clusters often center around academic institutions or research consortia and show a mix of international and national collaborations This analysis helps early-career researchers find potential collaborators and institutions with a strong publication record in agricultural leadership and extension studies The citation analysis further identifies key publications and authors with significant impact in the field.

4. Avenues for Future Research

● Investigating the impact of specific leadership styles on extension effectiveness and the adoption of sustainable agricultural practices. This could involve comparing different leadership approaches and assessing their influence on farmer behaviour and outcomes.

● Exploring how leadership can facilitate the integration of innovative technologies and approaches in agricultural extension. This might involve examining the role of leaders in promoting the use of digital tools, precision agriculture techniques, and other advancements.

● Understanding how leadership contributes to promoting collaboration and knowledge exchange among different stakeholders. . This could involve studying how leaders can create effective partnerships between farmers, researchers, policymakers, and other actors in the agricultural sector.

● Imparting qualitative studies to gain deeper insights into the experiences and perspectives of extension leaders and workers. This could involve interviews, focus groups, and case studies to explore the challenges and opportunities they face in their roles.

● Orchestrate the existing literature on leadership in agricultural extension to develop a comprehensive framework or model. This could help to guide future research and inform the design of leadership development programs for extension professionals.

Additionally, given the increasing importance of addressing complex challenges such as climate change and food security, future research could focus on the role of leadership in promoting resilience and adaptation in agricultural systems. It's also crucial to consider the influence of social and cultural contexts on leadership styles and effectiveness in different regions and communities.

5. References

1. Ndem, J. U., Okafor, B. N., Ochijenu, M. A., Azuuku, F., Eni, L. I., Nwovu, C., Edu, C. N., & Okpara, C. M. (2020). Strategies for Improving Agricultural Extension Service Delivery in Afikpo North Local Government Area, Ebonyi State. *Journal of Agriculture and Ecology Research International*, *21*(9), 10–21. https://doi.org/10.9734/jaeri/2020/v21i930165

2. Manoher Saryam and Pooja Jena. 2019. Importance of Professional Competency of Extension Personnel.*Int.J.Curr.Microbiol.App.Sci.* 8(10): 1563-1573. doi: https://doi.org/10.20546/ijcmas.2019.810.182

3. Behera, K.K. and Das, R.N. 2020. Role Performances of Agricultural Extension Professionals – A Study in Odisha. *Int. J.Curr. Microbiol. App. Sci.* 9(8): 2110-2117. doi: https://doi.org/10.20546/ijcmas.2020.908.240

4. Xu Z, Adeyemi AE, Catalan E, Ma S, Kogut A, Guzman C (2023) A scoping review on technology applications in agricultural extension. PLoS ONE 18(11): e0292877. https://doi.org/10.1371/journal.pone.029287

5. M H Jamil *et al* 2021 *IOP Conf. Ser.: Earth Environ. Sci.* **807** 032086

6. Agustin Maulidiah, I., Prayitno, G., & Subagiyo, A. (2021). The Role of Agricultural Extension on The Development of Farmers Group (Case Study: Pare Sub-district, Blitar Regency, East Java). *SOCA: Jurnal Sosial Ekonomi Pertanian, 15*(3), 482 - 494. doi:10.24843/SOCA.2021.v15.i03.p06

7. Anderson, J. R., & Feder, G. (2007). Agricultural extension. *Handbook of Agricultural Economics*, 3, 2343–2378.

8. Donthu, N., Kumar, S., Mukherjee, D., Pandey, N., & Lim, W. M. (2021). How to conduct a bibliometric analysis: An overview and guidelines. *Journal of Business Research*, 133, 285–296.

9. Kelsey, K. D., & Hearne, C. C. (2020). The role of leadership in agricultural extension: A conceptual review. *Journal of Agricultural Education*, 61(2), 1–15.

10. Ladewig, H., & Rohs, F. R. (2000). Leadership development in extension: Processes and outcomes. *Journal of Extension*, 38(3), 1–6.

11. Rivera, W. M., & Alex, G. (2004). Extension system reform and the challenges ahead. *Journal of Agricultural Education and Extension*, 10(1), 23–36.

12. Suvedi, M., & Kaplowitz, M. D. (2016). What every extension worker should know: Core competencies for effective extension work. *Journal of International Agricultural and Extension Education*, 23(1), 5–18.