Understanding the Trends of Livestock ExtensionResearchthrough Bibliometric Analysis

ABSTRACT

This study employs bibliometric analysis to investigate trends in livestock extension research from January 2015 to June 2024, utilizing data sourced from the dimension.ai database. The analysis encompasses a comprehensive review of publication trends, research categories, influential journals, collaborative networks among authors, and the impact of seminal studies. The findings reveal a notable increase in scholarly interest and publications over the years, indicating growing attention towards enhancing livestock productivity, sustainability, and socio-economic outcomes. Key research domains such as agricultural, veterinary, and food sciences emerge as predominant areas of focus, with significant contributions observed in interdisciplinary fields like environmental sciences and human geography. Network analyses using tools like VOS viewer highlight robust collaborative relationships among researchers, identifying central figures and clusters that drive collaborative research efforts in livestock extension. The study also identifies top-cited articles and affiliations, emphasizing their pivotal roles in advancing knowledge and practices within the field. Overall, this bibliometric analysis provides valuable insights into the evolving landscape of livestock extension research, demonstrating how such analytical approaches contribute to understanding research trends, fostering interdisciplinary collaborations, and guiding future research directions in agricultural sciences.

Keywords: Livestock extension, bibliometric analysis, Research trends

INTRODUCTION

Livestock sector being an important allied sector of agriculture, has an immense capacity to narrow down economic disparities among farmers apart from its contribution to

food and nutritional security (Das*et al.*, 2020). India's livestock sector, despite being the largest globally, faces significant challenges. Low productivity, especially in milk yield, combined with high economic losses from preventable diseases, hinders growth (Singh, 2019). Inadequate infrastructure, insufficient veterinary services, and poor adoption of advanced technologies further exacerbate the problem (Damodaran,2015). Severe feed and fodder shortages, along with underdeveloped and informal markets, limit commercialization (Roy *et al.*, 2019, Robinson, T.P. & Pozzi, F. 2011). Additionally, several factors like degradation of common grazing lands, raising competition between man and animals for land, frequent occurrence of diseases, climate change, poor livestock extension was found to be straining livestock production (Birthal*et al.*,2002). Numerous efforts are being made to generate and disseminate improved technologies to livestock farmers to increase the productivity and ensure food security at both household and national levels (Moreddu, 2023).This responsibility is being taken up by Livestock extension which plays the role of dissemination of knowledge, technologies, and practices to farmers, aiming to improve their skills, productivity, and livelihoods. Despite of heavy investments in development of innovations and technologies from public and private sources, most of the research results and recommended technologies couldn't make way to farmers' fields(Rathod, 2018).

Over the years though significant efforts have been made to study and improve livestock extension methods, systematic analysis of the research trends in this field which is essential to understand its evolution, identify gaps, and direct future research efforts effectively was clearly neglected.Bibliometric analysis is a valuable tool for this purpose. It involves the quantitative analysis of academic literature to uncover patterns, trends, and insights within a specific research domain (Merigó, 2017). By examining various bibliometric indicators such as publication counts, citation analysis, keyword co-occurrence, and author collaborations, researchers can gain a comprehensive understanding of the

research landscape (Roy, 2024).This approach helps in identifying the most influential publications, prolific authors, key research themes, and emerging areas of interest. In the context of Livestock extension research in India, bibliometric analysis can provide critical insights into how the field has evolved over the past decade. It can highlight the growth in research output, the leading journals and institutions contributing to the field, and the most commonly addressed topics. Furthermore, it can identify research gaps by revealing underexplored areas or themes that require more attention. Understanding these gaps is essential for guiding future research directions, ensuring that efforts are aligned with the needs of farmers and the agricultural sector at large. This study utilizes bibliometric methods to analyse the livestock extension research from January 2015 to June 2024. By examining the number of publications by year, author linkages, research domains, leading journals, and commonly used keywords, this analysis aims to provide a comprehensive overview of the current state of research in this field. Moreover, this study employs network analysis tools such as VOS viewer to map out collaborative relationships among researchers, identifying key figures and clusters that drive collaborative research efforts in livestock extension.

MATERIALS AND METHODS

All research output was retrieved from the dimension.ai database between January 2015 and June 2024 by searching for “Livestock Extension”. The number of publications by year, the network analysis between author linkage, research domain, articles from leading journals with high citations, and commonly used keywords was all used to evaluate articles. The data were analyzed using MS Excel, Word Cloud generator, and VOS viewer. Keywords were searched in the title, abstract, and keywords. Papers were first evaluated for eligibility for inclusion as titles, and abstracts and full texts were also reviewed in case of ambiguity. Articles with their primary focus on agricultural extension or those related to

agricultural extension in India are included. Studies published only in English are included. The analysis included 720 articles discovered through a systematic search on Livestock Extension Research.

RESULTS AND DISCUSSION

Distribution of livestock extension research publications by year

Figure 1 explains the number of year-wise Publications from January 2015 to December 2024. In the year 2015, less than 50 were published in the database, whereas, in 2023, nearly 100 the articles were published. There is a substantial increase from 2015.

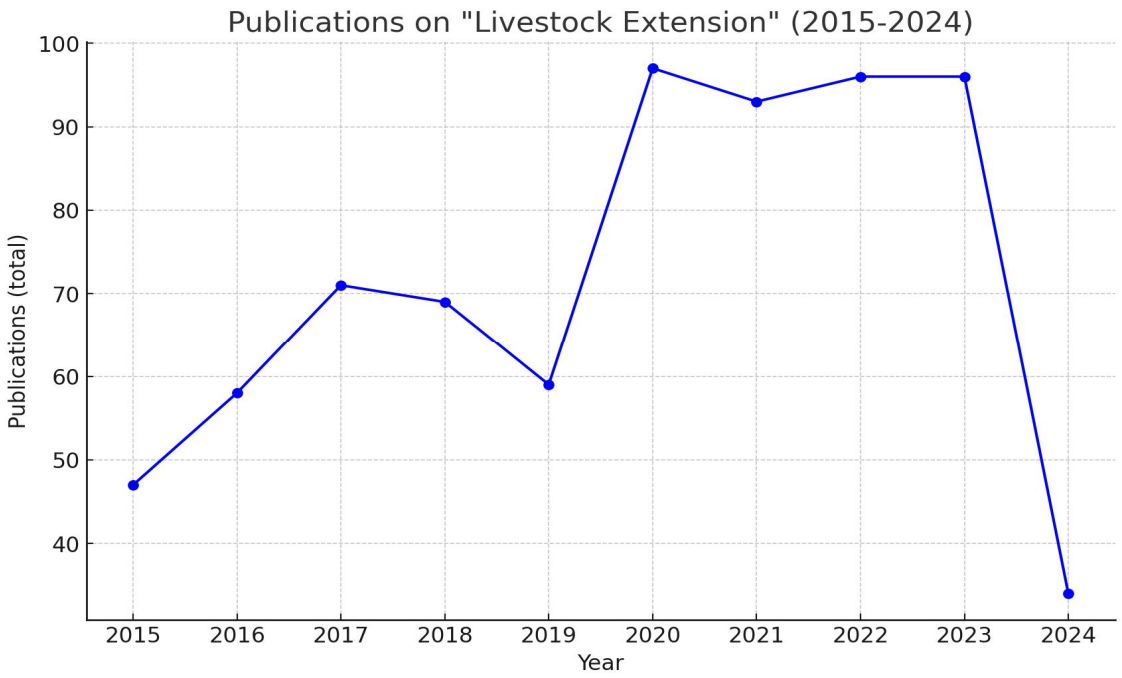

Figure 1: Year-wise distribution of Livestock Extension research publications in India, 2015–2024

From 2015 to 2023, there is a clear upward trend in the number of publications on Livestock Extension indicating growing research interest and activity in this area. Notable

increases are seen, particularly from 2019 to 2020, where publications jumped from 59 to 97, suggesting heightened focus or increased funding during that period. From 2020 to 2023, the publication count remains relatively high and stable, around the mid-90s, indicating sustained interest and productivity. The count for 2024 is currently 34, reflecting only part of the year's data.

Distribution of livestock extension research publications by research category

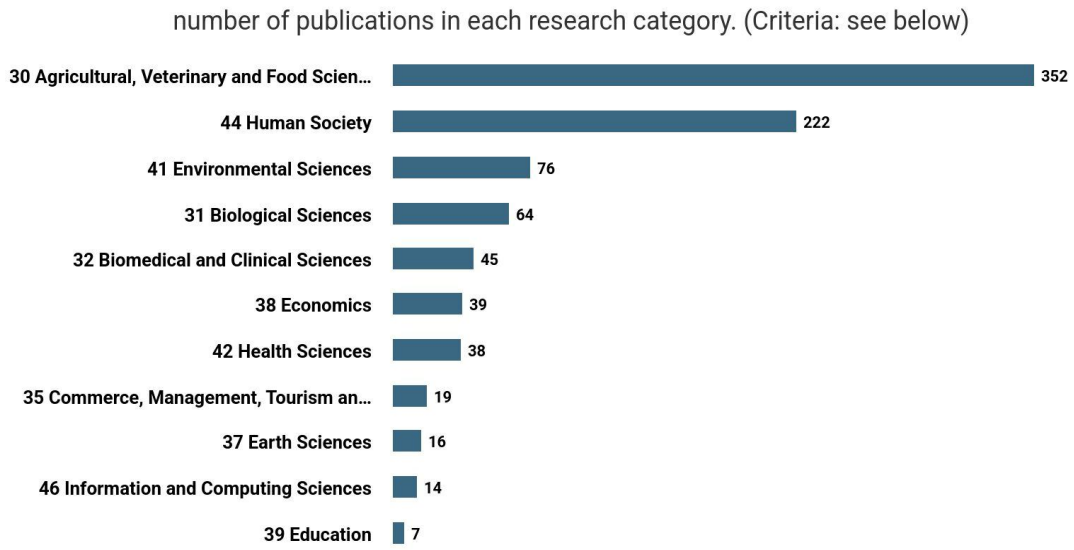

Figure 2: Subject-wise distribution of Livestock Extension research publications, 2015–2024

The bibliometric analysis reveals that the "Agricultural, Veterinary and Food Sciences" field leads with the highest number of publications (352) and total citations (3,173), indicating significant research activity and impact. While "Crop and Pasture Production" has the highest average citations per publication (26.04), suggesting a high impact per research output, other fields such as "Human Society" and "Development Studies" also show notable citation means (13.57 and 13.94 respectively), indicating impactful research despite having fewer publications. Additionally, interdisciplinary fields like

“Environmental Sciences,”“Health Sciences,” and “Human Geography” exhibit high average citations per publication (15.34, 16.63, and 17.47 respectively), reflecting their significant contributions to cross-disciplinary research and real-world applications.

Top 10 Journals on Livestock Extension Research

Analysing the bibliometric data for various journals reveals interesting patterns in research publication and impact within the field of “Livestock Extension.” The “Tropical Animal Health and Production” journal leads with the highest number of publications (25), accumulating 221 citations with an average of 8.84 citations per publication, indicating consistent contributions to the field. “PLOS ONE” stands out for its high average citations per publication (19.88) despite having 17 publications, suggesting highly influential articles. Similarly, the “Journal of Rural Studies” has fewer publications (7) but achieves the highest citations mean (20.86), indicating significant impact per article. “African Journal of Agricultural Research” and “Sustainability” both have 13 publications with average citations of 11.23 and 11.46 respectively, demonstrating their relevance and impact. In contrast, journals like “IOP Conference Series Earth and Environmental Science” and “Journal of Animal Science” show lower average citations (1.08 and 0.71), which may indicate more niche or emerging areas of research with less immediate impact. This analysis highlights the diverse landscape of journals contributing to “Livestock Extension” research, with varying degrees of influence and specialization.

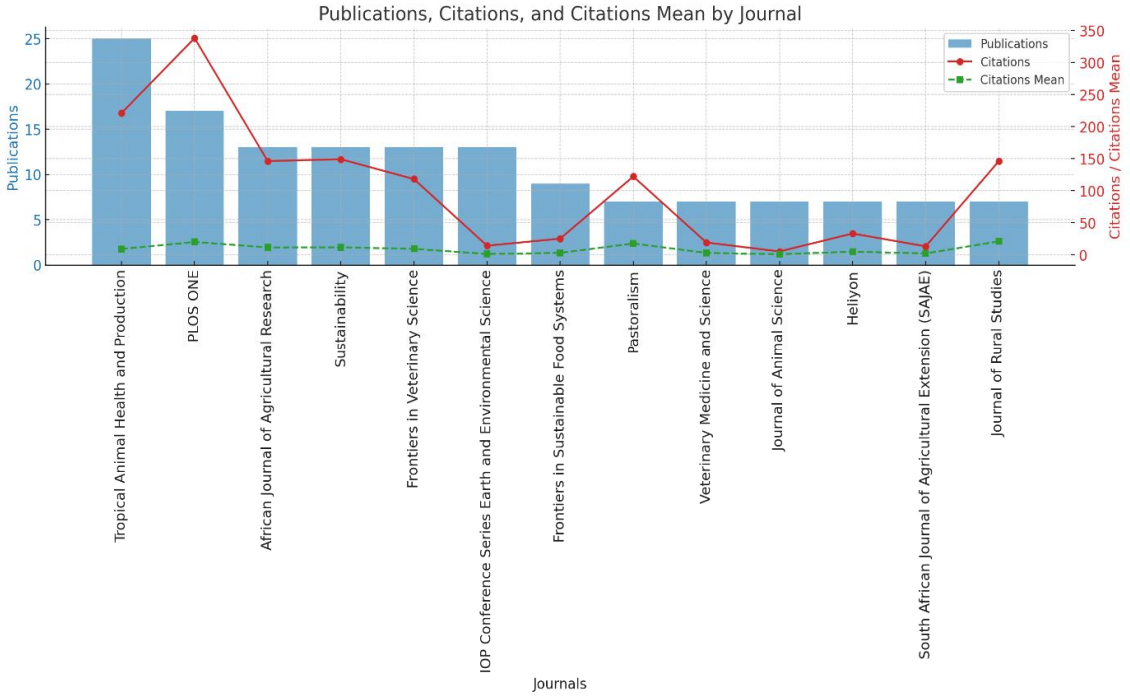

Figure 3: Top journals on livestock extension with their total citations

Network analysis based on Co-authorship

The network visualization from VOS viewer highlights significant collaborative relationships among researchers in the field of "Livestock Extension." Distinct clusters, represented by different colours, show groups of authors who frequently collaborate. Central figures, such as Helena Aminiel Ngowi and Maria Vang Johansen, are marked by larger nodes and numerous connections, indicating their substantial influence and productivity. Authors like Blandina Theophil Mmbaga and Sarah Cleaveland form a strong collaborative network within their cluster. Additionally, some authors, like Davis Alicia L., serve as bridges between different clusters, fostering inter-group collaborations.

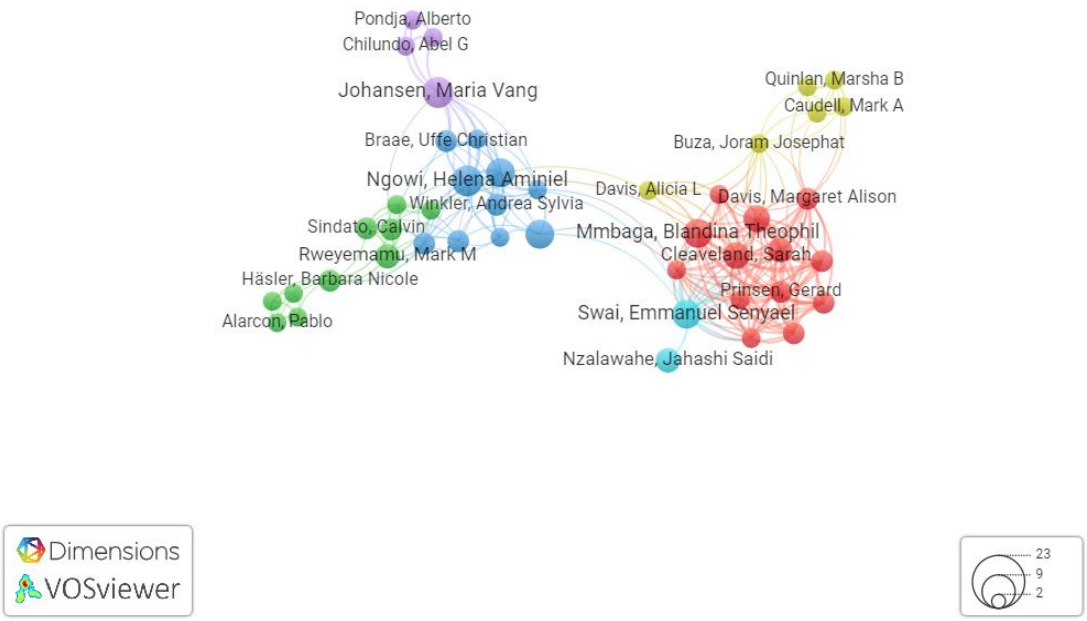

Figure 4: Network linkage between authors based on Co-authorship

*The networks between the two bubbles represent their co□occurrence of authors and the size of the bubble relates to the number of times that author has appeared in all the publications

Network analysis based on citations

The network visualization from VOS viewer showcases the collaborative relationships among researchers in "Livestock Extension." Various coloured clusters highlight different groups of researchers who frequently collaborate. For instance, the blue cluster, including prominent figures like Sarah Cleaveland and Blandina Theophil Mmbaga, signifies a strong collaboration network. The red cluster, with key researchers like Helena Aminiel Ngowi and Calvin Sindato, indicates another significant collaboration hub. Central

nodes such as Hezron Emmanuel Nonga and Alicia L. Davis, who connect multiple clusters, underscore their pivotal role in facilitating interdisciplinary collaborations. The image also reveals smaller yet active clusters, like the purple group led by Cleto Mapiye and Tawanda Marandure, reflecting specific niche collaborations. This visualization emphasizes the intricate web of interactions and the central roles played by certain researchers in advancing the field through extensive collaboration.

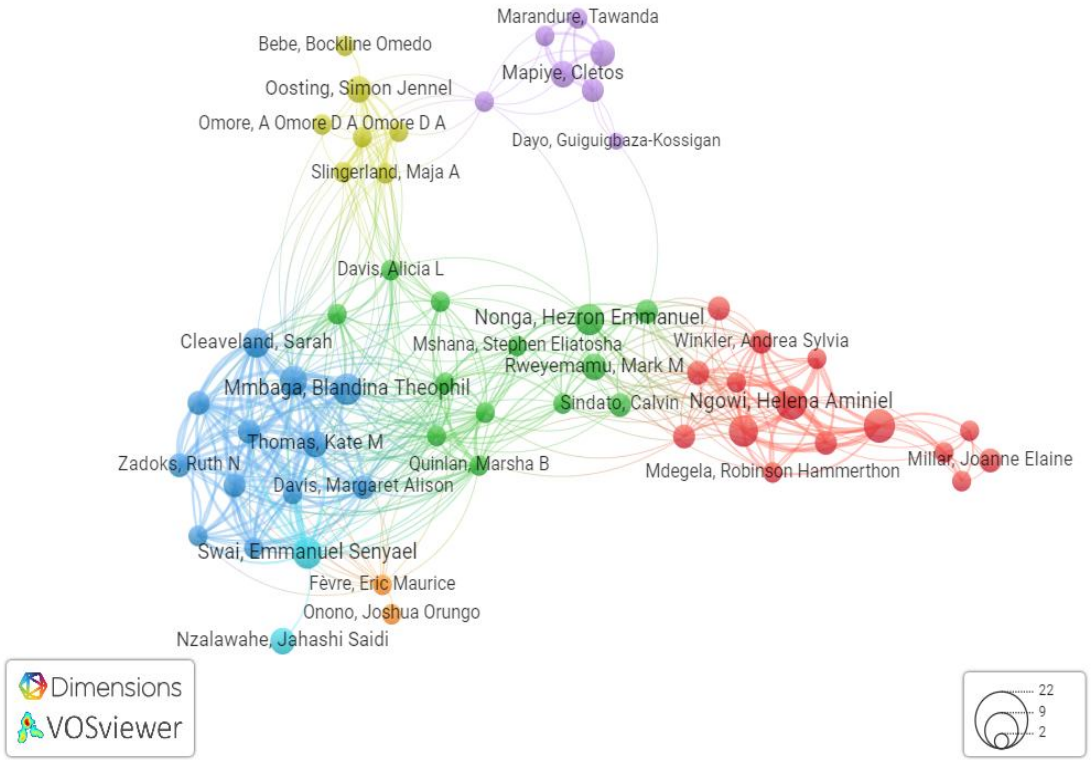

Figure 5: Network linkage between authors based on Co-authorship

Top 10agricultural extension publications in terms of total citations

Figure 4 interprets the top 10 articles in livestock extension based on the citations. The article entitled “Climate change vulnerability, adaptation and risk perceptions at farm level in Punjab, Pakistan” published in 2016, has nearly 294 citations.

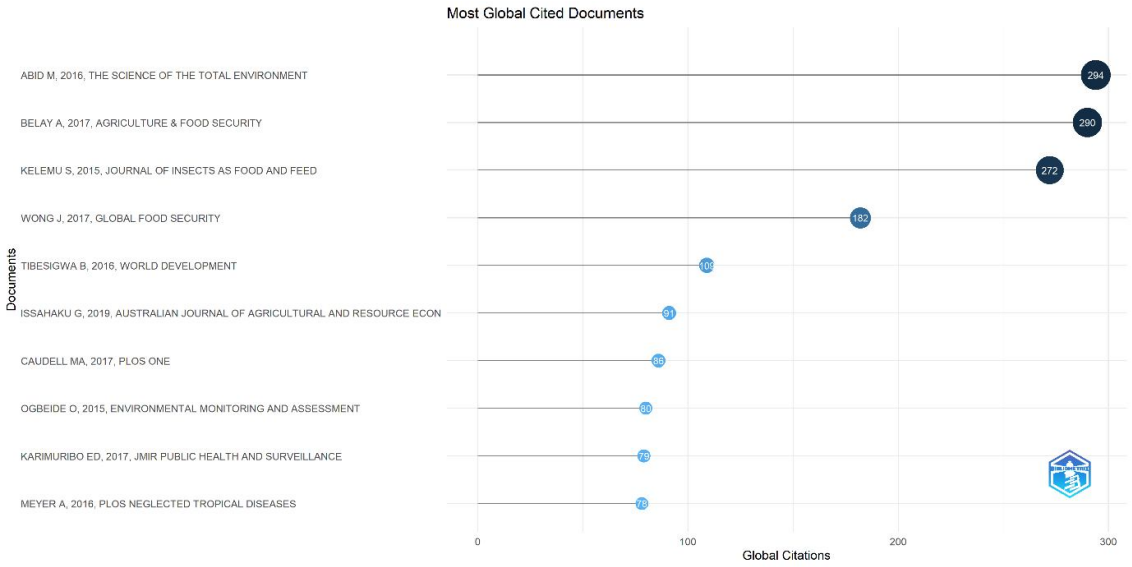

Figure 6: Top 10 articles on livestock extension with their total citations

Top 10 most relevant affiliations in terms of total citations

The chart highlights the most relevant affiliations based on the number of articles published, with the Indian Council of Agricultural Research (ICAR) leading with 13 articles, followed by the Indian Agricultural Research Institute (IARI) with 12 articles. The Central Agricultural University contributed 10 articles, while Kerala Agricultural University and the International Food Policy Research Institute published 7 and 6 articles respectively. The International Maize and Wheat Improvement Center and Tamil Nadu Agricultural University each contributed 5 articles, and Central Research Institute for Dryland Agriculture along with the Indian Council for Research on International Economic Relations contributed 1 article each. Additionally, independent researchers accounted for 8 articles, indicating a significant input from unaffiliated individuals.

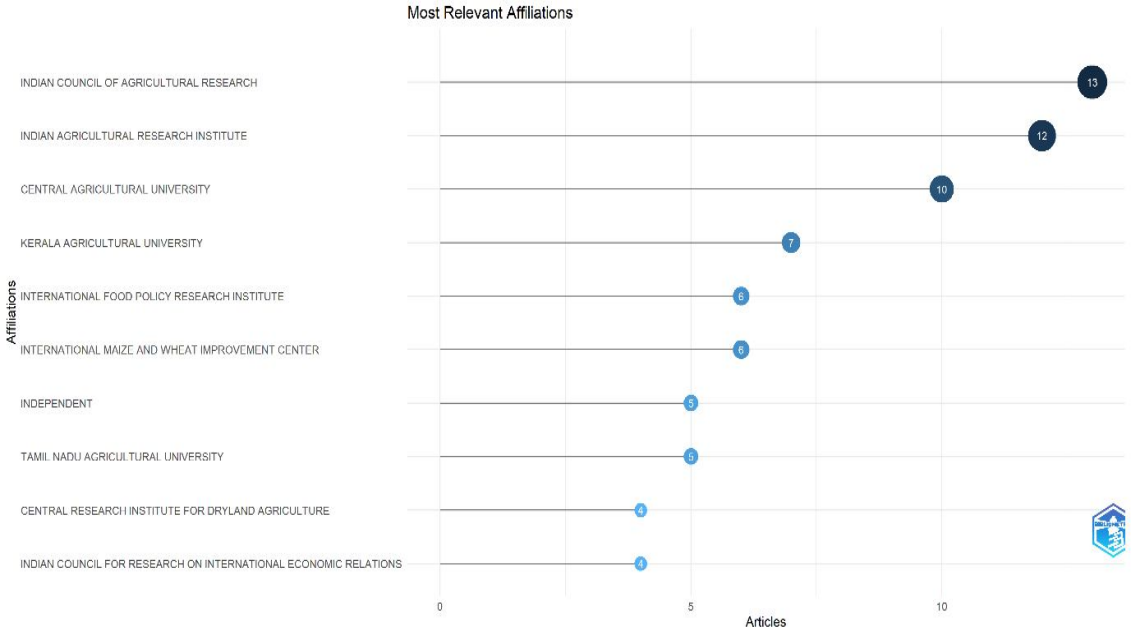

Figure 7: Top 10 most affiliated organisations in livestock extension research with their total citations

CONCLUSION

In conclusion, this bibliometric analysis provides a comprehensive overview of livestock extension research from 2015 to mid-2024, revealing significant insights into its evolution, impact, and collaborative dynamics. The study identified a robust increase in research output over the years, underscoring heightened scholarly interest and contributions towards improving livestock productivity and sustainability. Key findings highlight the dominance of agricultural, veterinary, and food sciences as primary research domains, with notable impacts observed in interdisciplinary fields like environmental sciences and human geography. The analysis of top journals and highly cited articles underscores the diverse avenues of research within livestock extension, emphasizing both the breadth and depth of contributions from various scholarly publications. Network analyses depicted vibrant collaborative networks among researchers, illustrating the pivotal roles of influential authors

and institutions in fostering interdisciplinary research and knowledge dissemination. Moving forward, continued emphasis on collaborative research efforts and interdisciplinary approaches will be crucial in addressing complex challenges and leveraging emerging opportunities in livestock extension. By fostering partnerships across disciplines and institutions, researchers can further advance sustainable practices, policy frameworks, and innovations that benefit livestock farmers and contribute to agricultural resilience in India and beyond. This study not only informs future research directions but also reinforces the importance of strategic collaborations and knowledge-sharing in advancing livestock extension practices and achieving sustainable agricultural development goals.

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