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Artificial Intelligence in Precision Poultry Farming: A Scientometric Analysis of Emerging Research Trends

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Abstract— *Artificial intelligence (AI) and digital technologies are increasingly reshaping poultry production through automated monitoring, precision management, and data-driven decision-making. This study quantitatively examines the development and emerging trends in AI-enabled poultry research using a scientometric approach. Literature was retrieved from PubMed using seven technology-focused search strategies covering AI, computer vision, IoT, sensors, robotics, precision farming, and automated disease detection. The initial search identified 3,049 records. After removing 425 duplicate records, 2,624 unique records were retained for the subsequent scientometric analysis. The results revealed a strong and accelerating growth in research, particularly after 2020, with publication output reaching approximately 500 papers in 2025. England, Switzerland, and the United States were the leading contributing countries, while Poultry Science, Sensors, and Animals were major publication journals. Author analysis revealed a concentration of research productivity among leading contributors, particularly Wang, Zhang, Liu, and Li. Overall, the findings demonstrate the rapid transition of poultry research from conventional management toward AI-driven, automated, and precision-oriented production systems. The increasing integration of AI with computer vision, IoT, intelligent sensing, and automation highlights the emergence of an interdisciplinary research frontier with considerable potential for advancing efficient, sustainable, and intelligent poultry production.*

Keywords— ***Artificial intelligence, Poultry Farming, sensors, robotics, precision farming***

I. INTRODUCTION

Poultry production is a rapidly expanding component of the global food system, driven by increasing demand for affordable animal protein, population growth, urbanization, and intensification of livestock production. However, increasing flock size and production intensity have simultaneously created challenges related to animal health, welfare, disease prevention, environmental control, feed efficiency, productivity, and resource use. Conventional management, which relies substantially on periodic manual observation, is increasingly inadequate for continuous and objective assessment of dynamic flock conditions. These challenges have accelerated the development of Precision Poultry Farming (PPF), which integrates sensors, automated data acquisition, information technologies, and analytical systems to support real-time monitoring and data-driven management (Fan et al., 2025; Naeem et al., 2025).

Artificial Intelligence (AI) has emerged as a key technological driver of this transformation by enabling the analysis of large and heterogeneous datasets generated by modern poultry production systems. Machine learning, deep learning, computer vision, predictive analytics, and AI-enabled Internet of Things (IoT) systems are increasingly being applied to bird detection and tracking, behaviour recognition, disease identification, body-weight estimation, environmental monitoring, egg-quality assessment, and welfare evaluation (Naeem et al., 2025;

Paneru et al., 2026a). In particular, computer vision has gained considerable attention because it enables continuous and non-invasive monitoring of birds, while deep-learning architectures have improved the automated detection and classification of poultry behaviour and health-related characteristics (Paneru et al., 2026b). Concurrently, integration of AI with IoT, thermal imaging, acoustic sensing, edge computing, and automated environmental control is creating opportunities for real-time prediction and increasingly intelligent farm management (Dhungana et al., 2026).

Despite these technological advances, research on AI-enabled precision poultry farming remains highly interdisciplinary and fragmented, spanning poultry science, veterinary medicine, agricultural engineering, computer science, robotics, sensor technology, and data science. Recent reviews have examined individual components of this emerging field, including machine learning applications (Naeem et al., 2025), advanced detection technologies (Fan et al., 2025), AI-enabled precision livestock farming (Distante et al., 2025), computer vision (Paneru et al., 2026b), and AI–IoT integration (Dhungana et al., 2026). However, these reviews provide limited quantitative evidence regarding the overall intellectual structure, evolution of research themes, collaboration patterns, influential knowledge sources, and emerging research fronts specifically at the intersection of AI and precision poultry farming. As the field is developing rapidly, identifying how research priorities have evolved and which technological themes are gaining prominence is increasingly important for guiding future research and innovation.

Scientometric analysis provides an effective approach for addressing this knowledge gap by quantitatively mapping the development and structure of scientific literature through publication trends, citation analysis, co-authorship, institutional and country collaboration, co-citation, bibliographic coupling, keyword co-occurrence, and thematic evolution. Such analysis can reveal not only what has been investigated but also how knowledge communities are interconnected, which research themes have become established, and where emerging scientific and technological frontiers are developing. Accordingly, this study conducts a comprehensive scientometric assessment of Artificial Intelligence and Precision Poultry Farming to: (i) characterize publication growth and research dynamics; (ii) identify influential authors, institutions, countries, journals, and publications; (iii) examine scientific collaboration networks; (iv) determine the intellectual and conceptual structure of the field; (v) identify dominant and emerging research themes and their temporal evolution; and (vi) highlight emerging technological frontiers and future research priorities.

II. MATERIALS AND METHODS

2.1. Study design and literature retrieval

A structured scientometric analysis was conducted to characterize the development, intellectual structure, thematic evolution, and emerging research trends in the application of artificial intelligence and related digital technologies in poultry production. The literature search was performed using the PubMed database, selected because of its extensive coverage of biomedical, veterinary, animal-health, and interdisciplinary research relevant to poultry science and technology. The search strategy was designed to capture the major technological domains associated with the emerging transition toward intelligent and precision poultry farming.

Seven technology-oriented search combinations were developed using Boolean operators. The search terms included “Artificial Intelligence AND Poultry,” “Computer Vision AND Poultry,” “IoT AND Poultry,” “Sensors AND Poultry,” “Robotics AND Poultry,” “Precision Farming AND Poultry,” and “Automated Disease Detection AND Poultry.” The searches were conducted using the same database and search protocol to maximize consistency and reproducibility. The retrieved records from all search combinations were subsequently consolidated into a single bibliographic dataset.

The initial search yielded 3,049 records. Because individual search strings could retrieve the same publication under more than one technological category, the records were merged and screened for duplicate entries. Following duplicate removal, 2,624 unique records were retained for the subsequent scientometric analysis, representing approximately 86.1% of the initial retrieval, while 425 duplicate records (13.9%) were excluded. The overall literature identification and dataset preparation process is presented as a sequential workflow (Figure 1).

2.2. Data preprocessing and dataset preparation

The bibliographic records retrieved from PubMed were exported in a format compatible with bibliometric analysis. The records were consolidated to generate a unified dataset containing bibliographic metadata, including publication information, authors, affiliations, journal details, publication year, keywords, abstracts, and citation-related information where available. Duplicate records were identified on the basis of bibliographic information, including combinations of article title, authorship, journal, publication year, and other available identifiers. Duplicate entries generated because of overlap

among the seven search strategies were removed before analysis. The resulting dataset of 2,624 unique publications constituted the final corpus for scientometric analysis. Data preprocessing was undertaken to improve consistency in author names, institutional names, country information, and keywords. Where necessary, equivalent terms and spelling variants were standardized to reduce artificial fragmentation of concepts in network and thematic analyses.

2.3. Scientometric analysis

The final dataset was subjected to quantitative bibliometric analysis to assess the growth, structure, evolution, and emerging directions of research on AI and precision poultry farming. The analysis comprised several complementary dimensions.

First, descriptive performance analysis was conducted to examine annual publication growth, document types, productive journals, authors, institutions, and countries. These indicators were used to identify the temporal development of the research domain and the major contributors to the literature.

Second, citation-based analysis was used to identify influential publications and knowledge sources within the field. Citation patterns provide an indication of the scientific influence of individual publications and help identify seminal studies that have contributed substantially to the development of AI-enabled poultry research.

Third, scientific collaboration analysis was performed at author, institutional, and country levels to characterize the structure and intensity of collaboration within the research community. Co-authorship networks were used to identify major research groups and collaborative clusters, while institutional and country-level networks were used to examine the geographical and organizational distribution of research activity.

Fourth, keyword co-occurrence analysis was performed to identify the major conceptual and technological themes within the literature. Frequently occurring keywords and their co-occurrence relationships were used to identify clusters representing major research areas, such as artificial intelligence, machine learning, computer vision, sensors, IoT, disease detection, animal welfare, behaviour monitoring, and precision livestock farming.

Fifth, co-citation and bibliographic coupling analyses were used to investigate the intellectual structure of the research domain. Co-citation analysis identifies publications that are frequently cited together and therefore provides insights into established knowledge bases and intellectual schools within the field. Bibliographic coupling, in contrast, identifies publications that share common references and can therefore reveal contemporary research fronts and emerging areas of investigation.

Finally, temporal and thematic analyses were conducted to identify changes in research priorities over time. The evolution of keywords and thematic clusters was examined to distinguish established research areas from emerging topics.

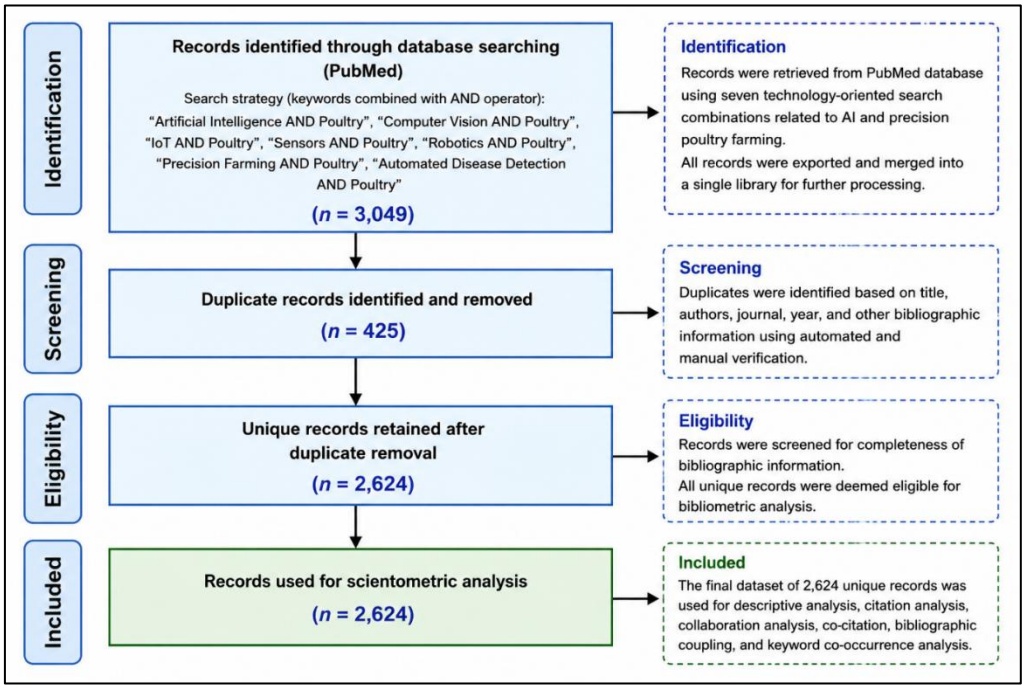

Fig.1: Methodology followed in the present study

III. RESULTS AND DISCUSSION

Scientific publications on AI in Poultry Farming from 2001 to 2026

The temporal distribution of publications reveals a marked transformation in research activity related to AI and technology-enabled poultry production between 2001 and 2026. The field exhibited very limited scholarly output during the early 2000s, with annual publications remaining below approximately 30 papers until 2008. This initial phase indicates that the application of computational intelligence and automated technologies to poultry systems was still in its formative stage. From approximately 2009 onward, publication activity began to increase progressively. The number of papers reached around 40 publications by 2010 and continued to rise, albeit relatively gradually, through 2014. This period can be regarded as a developmental phase in which advances in sensing, computational modelling, automation, and early machine-learning applications gradually expanded the technological scope of poultry research. A stronger growth trajectory became evident during 2015–2019. Annual output increased from roughly 80–90 publications to approximately 130 publications by 2019. This expansion reflects the increasing integration of digital sensing, automated data collection, image-based analysis, and computational modelling into poultry production research. The emergence of precision livestock farming concepts during this period also provided a broader framework for applying data-driven technologies to flock monitoring and management.

The most prominent change occurred after 2020, when publication activity accelerated considerably. Annual output increased from approximately 175 publications in 2020–2021 to more than 200 in 2022, followed by approximately 250 publications in 2023 and 340 publications in 2024. The number of publications reached its maximum in 2025, at approximately 500 papers. This rapid expansion suggests a substantial increase in scientific interest in AI-enabled poultry systems and may reflect the convergence of several rapidly advancing technologies, including deep learning, computer vision, Internet of Things (IoT), intelligent sensors, automated disease diagnosis, robotics, and predictive analytics. The sharp increase during 2023–2025 is particularly noteworthy because it indicates that research in this domain is moving beyond isolated technological applications toward more integrated and intelligent production systems.

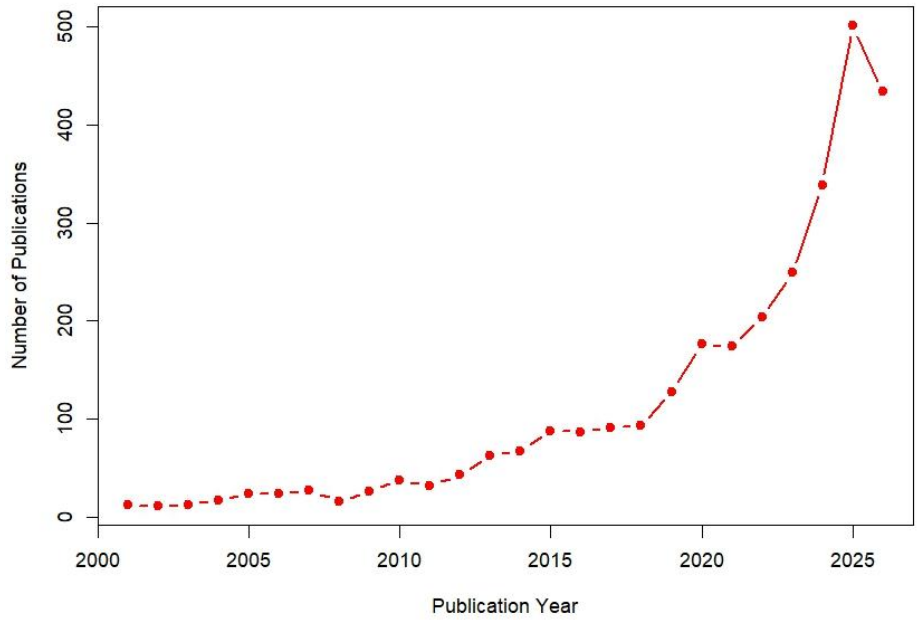

Fig.1: Publications on AI in poultry farming from 2001 to 2026

Increasing computational capacity, improved sensing technologies, availability of large datasets, and advances in AI algorithms have created new opportunities for automated assessment of bird behaviour, health, welfare, productivity, and environmental conditions. The apparent reduction in publications during 2026 should not be interpreted as evidence of declining research interest. Since the bibliographic dataset was retrieved during the year, the 2026 record count is likely affected by incomplete indexing and partial-year coverage. Consequently, 2025 provides a more appropriate endpoint for evaluating the recent publication trajectory.

The annual growth rate demonstrates a highly dynamic but overall expanding research landscape in artificial intelligence and precision poultry farming. Publication growth fluctuated considerably during the early years, ranging from negative values to peaks of more than 60%, reflecting the relatively small and developing nature of the field. After 2019, research activity gained greater momentum, with strong growth observed in 2019–2020 and a sustained positive trend from 2022 onward. The growth rate increased from approximately 18% in 2022 to 49% in 2025, indicating accelerating scientific interest and technological development in AI, computer vision, IoT, intelligent sensing, automated disease detection, and related precision-farming applications. The decline observed in 2026 should be interpreted cautiously because the year likely represents incomplete publication coverage. Overall, the pattern indicates that AI-enabled precision poultry research has progressed from an emerging and volatile research area toward a rapidly expanding and increasingly established interdisciplinary field.

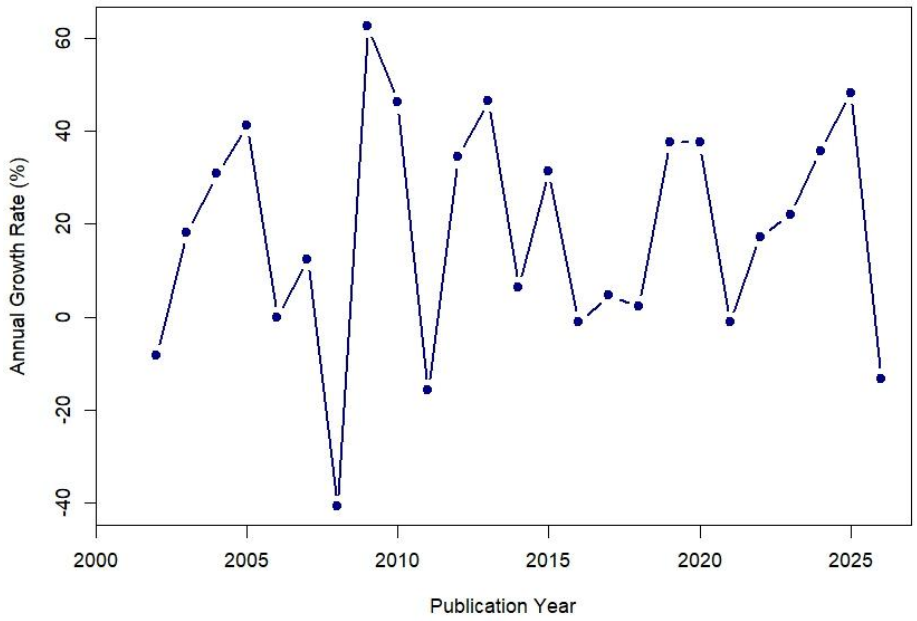

Fig.2: Annual growth rate of publication during 2001 to 2026

Status of Global Research on AI in Poultry Farming

The figure shows the geographical distribution of publications in the field of artificial intelligence and precision poultry farming. England is the leading contributor, with approximately 1,170 publications, followed by Switzerland with around 700 and the United States with approximately 620 publications. The Netherlands and Germany occupy the next positions, contributing roughly 220 and 110 publications, respectively. China, Canada, Austria, South Korea, Australia, Brazil, Japan, France, and New Zealand form a second tier of contributors, although their publication outputs are substantially lower than those of the leading countries. The remaining countries, including Bangladesh, Italy, Libya, Ireland, Poland, and Russia, contribute comparatively fewer publications. Overall, the distribution indicates a strong geographical concentration of research activity in Europe and North America, particularly in England, Switzerland, and the United States. The dominance of these countries suggests the presence of well-established research infrastructure, interdisciplinary expertise, and stronger integration of artificial intelligence, sensing, automation, and precision-livestock technologies into poultry research. At the same time, the comparatively limited contribution from several Asian, African, and other emerging research regions indicates opportunities for broader international participation and collaborative research.

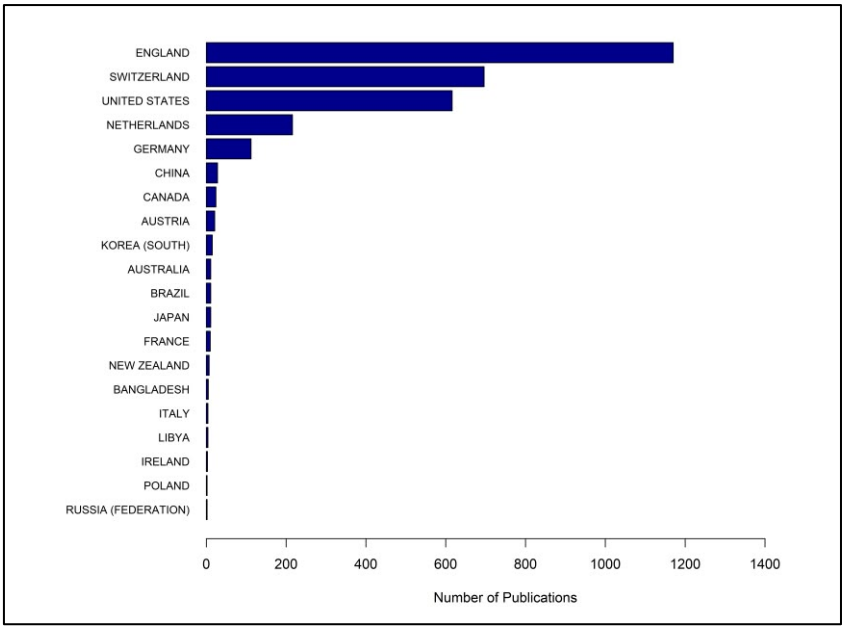

Fig.3: Top 20 countries publishing work on AI in poultry farming

Top leading journals publishing work on AI in Poultry Farming

The figure presents the leading journals contributing to research on artificial intelligence and precision poultry farming, based on the number of publications indexed in the analyzed dataset. Poultry Science is the most prominent source, with more than 400 publications, indicating its central role in disseminating research related to poultry production, management, health, technology, and emerging precision-farming approaches. Sensors (Basel, Switzerland) and Animals: An Open Access Journal from MDPI follow, with approximately 190 and 180 publications, respectively, reflecting the increasing importance of sensor technologies, digital monitoring, artificial intelligence, and animal-focused research. Scientific Reports, PLOS ONE, and Food Chemistry constitute another important group, although their publication contributions are considerably lower than the leading journals. British Poultry Science, BMC Genomics, Journal of Animal Science, Frontiers in Veterinary Science, and Frontiers in Animal Bioscience also make notable contributions, demonstrating the multidisciplinary character of the research field.

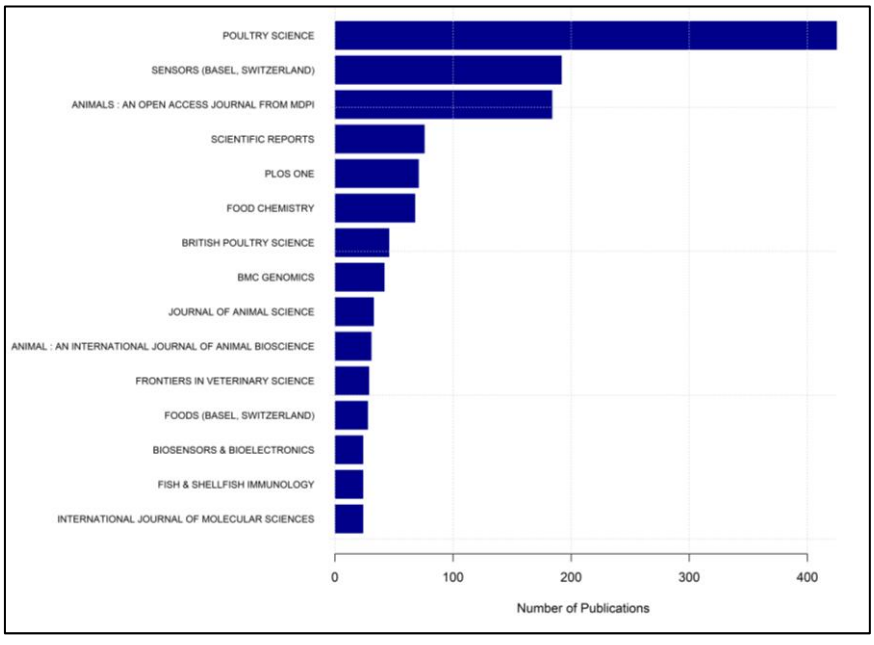

Fig.4: Top 15 journals publishing work on AI in poultry farming

The presence of journals specializing in biosensors, bioelectronics, immunology, molecular sciences, genomics, and food research further indicates that AI-enabled poultry research extends beyond conventional poultry science into technological, biological, veterinary, and data-intensive domains. Overall, the distribution suggests that Poultry Science serves as the principal disciplinary hub, while the substantial representation of technology-oriented and multidisciplinary journals reflects the growing convergence of poultry science with artificial intelligence, sensing, genomics, computer-based monitoring, and precision production technologies.

Top authors publishing work on AI in Poultry Farming

The figure presents the most productive authors contributing to research on artificial intelligence and precision poultry farming. Wang Y. ranks first, with approximately 148 publications, followed by Zhang Z. and Liu Y., each contributing around 120 publications.

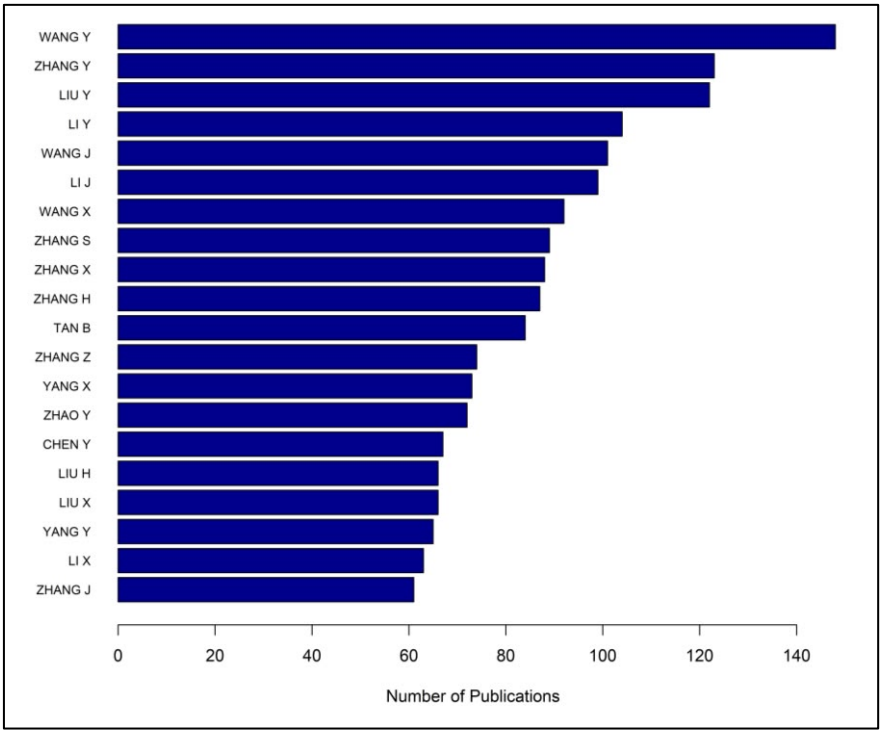

Fig.5: Top 20 productive authors published work on AI in poultry

Overall, the distribution indicates the presence of a relatively concentrated group of highly productive researchers who appear to play important roles in advancing this research domain. The prominence of multiple authors with common surnames such as Wang, Zhang, Liu, Li, and Yang also suggests strong participation from East Asian research communities; however, author nationality or institutional affiliation should be confirmed from the bibliographic metadata rather than inferred from names alone. The relatively high productivity of the leading authors further indicates that AI-enabled poultry research has developed established research groups capable of sustained contributions across areas such as machine learning, computer vision, sensing, disease detection, animal health, and precision production.

IV. CONCLUSIONS

The scientometric analysis demonstrates a clear and accelerating expansion of research on artificial intelligence and precision poultry farming. Publication output increased markedly, particularly after 2020, with sustained growth during 2022–2025, indicating growing scientific and technological interest in AI-enabled poultry production. Research contributions are geographically concentrated in leading countries such as England, Switzerland, and the United States, while Poultry Science, Sensors, and Animals represent major publication outlets. A relatively concentrated group of highly productive authors, including Wang, Zhang, Liu, and Li, further indicates the emergence of established research communities. Collectively, these patterns highlight the increasing convergence of poultry science with AI, computer vision, sensing, IoT, automation, and precision-management technologies, positioning AI-enabled

precision poultry farming as a rapidly developing interdisciplinary research frontier.

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