

## A BIBLIOMETRIC REVIEW OF GLOBAL CATTLE INSURANCE RESEARCH, 2016–2025: TRENDS AND INDONESIA’S CONTRIBUTION

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### Article history:

Received  
13 July 2026

Revised  
20 July 2026

Accepted  
19 August 2026

Available online  
30 September 2026

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### Abstract:

**Background:** Cattle insurance has become a central instrument in agricultural risk management amid increasing climate variability, animal disease outbreaks, and market volatility. However, the intellectual structure and evolution of cattle insurance research remain fragmented

**Purpose:** This study maps the global scientific landscape of cattle insurance research from 2016–2025, identifies its thematic evolution and interdisciplinary knowledge structure, and evaluates Indonesia's research position relative to global developments. Indonesia is analysed separately because it represents an emerging economy with a national cattle insurance program (AUTS/K), yet its scientific contribution and integration into the international research network remain limited

**Design/methodology/approach:** Employing bibliometric review, using 306 Scopus-indexed journal articles. Using VOSviewer 1.6.20 and Biblioshiny 5.0 we performed performance analysis and science mapping to examine publication trends, country contributions, collaboration networks, and thematic clusters. A supplementary analysis of 13 Indonesian publications was undertaken to characterize the country's thematic and methodological profile.

**Findings/Result:** The annual publication output almost doubled from 26 articles in 2020 to 50 in 2025, demonstrating accelerating scientific interest in cattle insurance. Research was dominated by the United States (105 articles), China (31), and the United Kingdom (29), while Indonesia ranked 14th with 8 Scopus-indexed journal articles (2.6%) and exhibited no significant international co-authorship links. Three distinct knowledge domains structure the cattle insurance research literature: (1) climate risk and index-based livestock insurance, (2) behavioral determinants of cattle insurance adoption and willingness to pay, and (3) epidemiological and actuarial modelling of livestock mortality risk. Thematic evolution indicates that epidemiology, vaccination, and farmer decision-making have become major research frontiers after 2023. Compared with global developments, Indonesian research remains concentrated on adoption behavior, willingness to pay, and institutional program evaluation, relying predominantly on descriptive and conventional regression approaches, with limited integration of epidemiological modelling, actuarial methods, digital technologies, or international collaboration.

**Conclusion:** The bibliometric findings highlight opportunities to strengthen the integration of behavioural, epidemiological, and actuarial perspectives, advance technology-oriented and data-driven research, and expand international research collaboration.

**Originality/value (State of the art):** This study is among the first to systematically compare the thematic evolution, collaboration structure, and methodological orientation of global cattle insurance research with Indonesia's research portfolio during 2016–2025

**Keywords:** adoption behavior, bibliometric analysis, cattle insurance, livestock insurance, risk management

### How to Cite:

Andrianto, M. S., Sumarwan, U., Sarma, M., & Indrawan, D. (2026). A bibliometric review of global cattle insurance research, 2016–2025: Trends and Indonesia's contribution. *Jurnal Aplikasi Bisnis dan Manajemen*, 12(3), 831. <https://doi.org/10.17358/jabm.12.3.831>

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## INTRODUCTION

Livestock production is increasingly exposed to multiple sources of uncertainty, including climate change, emerging infectious animal diseases, fluctuating commodity prices, and market instability. Extreme weather events, prolonged droughts, floods, and transboundary animal diseases such as Foot-and-Mouth Disease (FMD) and African Swine Fever (ASF) have intensified production uncertainty and economic losses, particularly among smallholder livestock producers. These challenges have elevated livestock insurance from a traditional compensation mechanism to an essential policy instrument for strengthening agricultural resilience, climate adaptation, food security, and sustainable rural development (Maina et al. 2024; Melketo et al. 2025; Timpanaro et al. 2023).

Responding to these global challenges, governments and international organizations have expanded livestock insurance programs through indemnity-based insurance, index-based livestock insurance (IBLI), and public–private partnership schemes. Countries including the United States, Canada, Kenya, Ethiopia, China, and India have increasingly integrated climate information, disease surveillance, and actuarial modelling into livestock insurance systems to improve farmers' resilience against production shocks and enhance the sustainability of agricultural value chains (Maina et al. 2024; Melketo et al. 2025; Oduniyi et al. 2020; Pai & Ravishanker, 2020).

Unlike crop insurance, livestock insurance involves more complex biological, epidemiological, and actuarial considerations because mortality risk depends on animal health, disease transmission, and management practices (Boyd et al. 2013). The objects of livestock insurance can be animals such as cattle and goats, swine, rabbits, poultry, dogs and cats, decorative exotic animals, freshwater fish (Čolović et al. 2016) but based on observation cattle insurance is more dominant. Consequently, cattle insurance research has expanded rapidly during the past decade, attracting contributions from agricultural economics, behavioral science, veterinary epidemiology, actuarial science, sustainability, and digital agriculture.

Indonesia is a key case for studying livestock insurance due to its important cattle sector and one of the few government-backed livestock insurance programs in Southeast Asia (AUTS/K). AUTS/K is supported by the

Law of the Republic of Indonesia No. 19 of 2013 on the Protection and Empowerment of Farmers and has been in place since 2016 with a premium subsidy (Sulaiman et al. 2018). Additionally, the Indonesian Government plans to increase the cattle population by importing livestock, which raises both risks and opportunities for livestock insurance. The country mainly consists of smallholder production systems that are very vulnerable to climate changes, new animal diseases, and market instability, making livestock insurance crucial for agricultural resilience and food security. According to the 2023 Agricultural Census (BPS, 2024), over 12 million agricultural households are involved in livestock activities, showing the importance of livestock production for rural livelihoods and national food security. Despite this, Indonesia contributes little to global scientific literature, with limited international collaboration and research mainly focused on insurance adoption and program evaluation. Therefore, comparing Indonesia with global developments offers valuable insights into how emerging economies can enhance interdisciplinary livestock insurance research, innovate methods, and design evidence-based policies.

The scientific literature on livestock insurance has expanded considerably following increasing concerns regarding climate-induced agricultural risks. Recent studies have focused on several research streams, including behavioural determinants of insurance adoption (Shantosi et al. 2025; Timpanaro et al. 2023), willingness to pay (Suharyanto et al. 2021), institutional performance (Islami et al. 2024), Quality of milk (Fadillah et al. 2023; Mukson et al. 2017) and epidemiological modelling for livestock mortality (Pai & Ravishanker, 2020). Meanwhile, Bibliometric techniques have been used to analyse broader insurance purchasing research, identifying publication trends and emerging themes. However, these studies do not focus specifically on livestock insurance but rather on the insurance sector as a whole (Akhil, 2022; Zheng et al. 2026). Other bibliometric reviews have investigated agricultural insurance broadly (Vyas et al. 2021) but none has systematically examined cattle insurance as an independent scientific field.

Bibliometric methods are commonly applied in veterinary sciences, animal welfare, and sustainable livestock systems, certification industry, but these analyses do not address livestock insurance directly (Cui et al. 2023; Freire & Nicol, 2019; Gautret et al. 2017; Irwandi et al. 2025; Marino et al. 2023; Yardibi

et al. 2021). Moreover, previous reviews have mainly described publication productivity without exploring the evolution of research themes, international collaboration patterns, or the intellectual structure connecting behavioural, epidemiological, and climate-risk perspectives. In Indonesia, published studies are still dominated by descriptive adoption analyses and program evaluations, while integration with epidemiological modelling, actuarial approaches, and interdisciplinary collaboration remains limited.

Consequently, there is a lack of comprehensive evidence regarding how cattle insurance research has evolved globally, which themes dominate the literature, where emerging research frontiers exist, and how Indonesia is positioned within the international scientific landscape. The study is expected to produce a comprehensive mapping of the global cattle insurance literature by identifying publication trends, collaboration networks, thematic structures, and emerging research frontiers. It also aims to position Indonesia within the global research landscape by evaluating its scientific productivity, thematic focus, and collaboration patterns. The resulting evidence is expected to highlight knowledge gaps and inform future research directions in cattle insurance.

This study offers several novel contributions. First, it provides the first comprehensive bibliometric mapping specifically dedicated to cattle insurance research, rather than agricultural insurance in general. Second, it integrates performance analysis and science mapping to reveal publication trends, collaboration networks, thematic evolution, and intellectual structures simultaneously. Third, this study compares the global research landscape with Indonesia's research portfolio, thereby identifying strategic research gaps and future opportunities for integrating behavioural economics, epidemiology, and actuarial science into livestock insurance studies.

To address the identified research gaps, this study employs a bibliometric approach using Scopus-indexed publications published between 2016 and 2025. The choice of bibliometric analysis was guided by the objective of this study, which is to map the intellectual development of cattle insurance research rather than to synthesize empirical findings from individual studies. While PRISMA-based systematic reviews are designed to evaluate evidence addressing

narrowly defined research questions, bibliometric analysis enables large-scale quantitative assessment of publication performance, collaboration patterns, citation structures, keyword networks, and thematic evolution. These characteristics make bibliometric analysis particularly suitable for identifying research trends, knowledge gaps, and future research directions across an interdisciplinary field such as cattle insurance (Aria & Cuccurullo, 2017; Donthu et al. 2021).

Bibliometric techniques enable systematic evaluation of publication performance while simultaneously visualizing knowledge structures through keyword co-occurrence networks, thematic evolution analysis, and international collaboration mapping. The combination of VOSviewer and Biblioshiny provides comprehensive evidence regarding the maturity, development, and future direction of cattle insurance research.

This study aims to:

RQ1 : analyse the publication growth of global cattle insurance research during 2016–2025;

RQ2: identify the most productive countries, journals, and international collaboration networks;

RQ3: examine the thematic structure of cattle insurance research using keyword co-occurrence analysis;

RQ4: investigate thematic evolution and emerging research frontiers; and

RQ5: evaluate Indonesia's scientific position and identify strategic opportunities for future research development.

## METHODS

This study employed a bibliometric research design, combining performance analysis and science mapping to investigate the development of cattle insurance research. Performance analysis evaluates scientific productivity, while science mapping identifies relationships among publications, authors, countries, and research topics through bibliometric networks.

The study used secondary bibliographic data obtained from the Scopus database. Scopus was selected because it provides comprehensive multidisciplinary coverage, standardized bibliographic information, and reliable citation metadata suitable for bibliometric analysis. The unit of analysis consisted of peer-reviewed journal articles published between 2016 and 2025.

Data were collected through a systematic literature search conducted in the Scopus database on 26 February 2026. To capture the broader literature relevant to cattle insurance, the search strategy incorporated related terms, including “livestock,” “animal,” “dairy,” and “cattle.” This approach was intended to reduce the risk of excluding relevant studies that discuss cattle insurance within the broader livestock or animal insurance context. Accordingly, “insurance” was used as the primary keyword and was combined with these related terms. The initial search used the following query:

*TITLE-ABS-KEY (insurance) AND TITLE-ABS-KEY (livestock OR animal OR dairy OR cattle)*

The search initially identified 3,227 records. Subsequently, the following inclusion criteria were applied: publication year: 2016–2025; document type: journal article; source type: journal; publication stage: final publication; language: English; subject

areas: Social Sciences, Economics, Business, Multidisciplinary, Psychology. The complete search string was:

*( TITLE-ABS-KEY ( insurance ) AND TITLE-ABS-KEY ( livestock OR animal OR dairy OR cattle ) ) AND PUBYEAR > 2015 AND PUBYEAR < 2026 AND ( LIMIT-TO ( SUBJAREA , "SOCT" ) OR LIMIT-TO ( SUBJAREA , "ECON" ) OR LIMIT-TO ( SUBJAREA , "MULT" ) OR LIMIT-TO ( SUBJAREA , "BUSI" ) OR LIMIT-TO ( SUBJAREA , "PSYC" ) ) AND ( LIMIT-TO ( DOCTYPE , "ar" ) ) AND ( LIMIT-TO ( SRCTYPE , "j" ) ) AND ( LIMIT-TO ( LANGUAGE , "English" ) ) AND ( LIMIT-TO ( PUBSTAGE , "final" ) )*

After screening titles and abstracts and applying all eligibility criteria, 306 journal articles were retained for bibliometric analysis. Figure 1 shows the specific procedures for both the bibliometric analysis and the search technique used in this study.

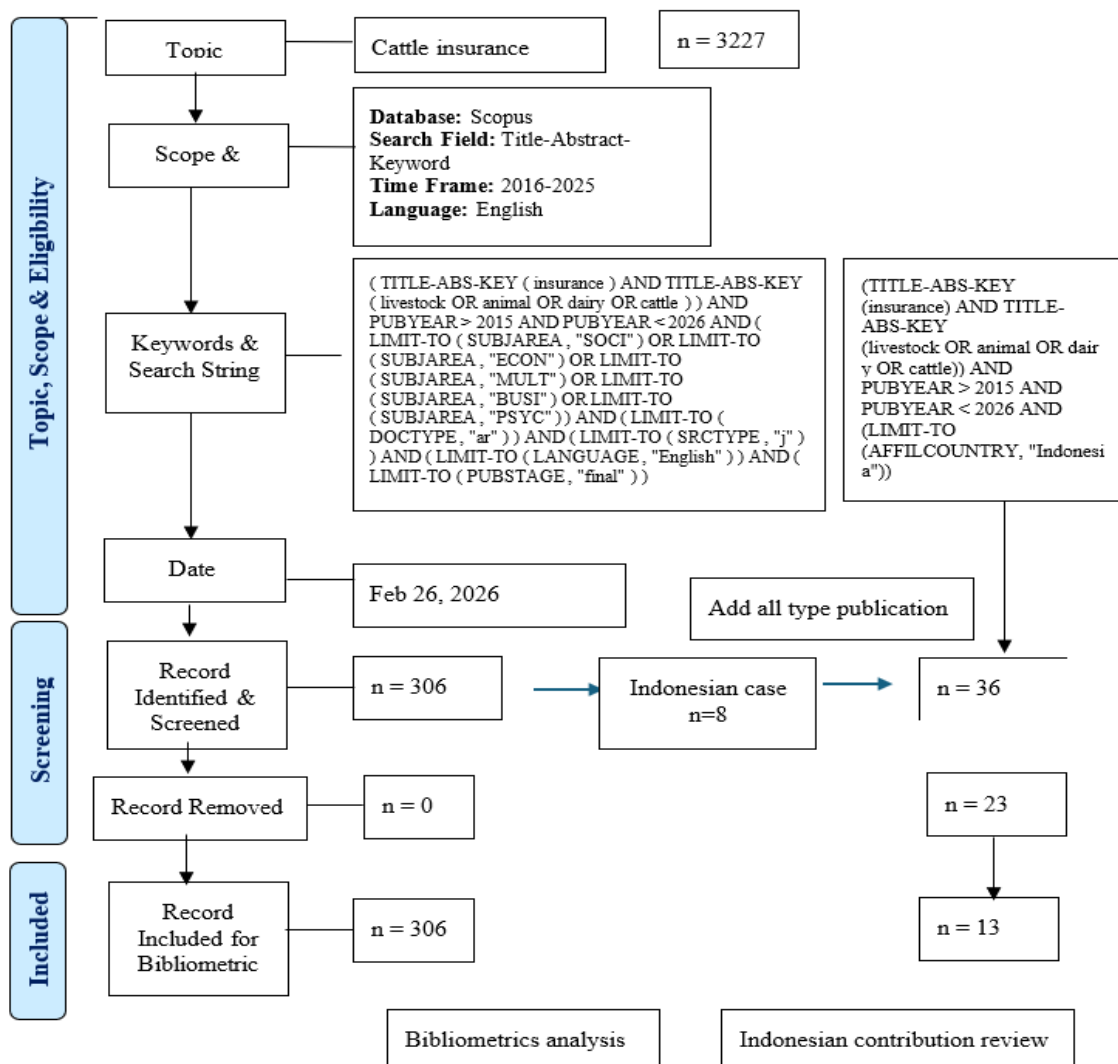


Figure 1. Framework to select data bibliometrics analysis with main topics cattle insurance and Indonesian contribution review between 2016-2025 in Scopus database

Two bibliometric software packages were employed. VOSviewer version 1.6.20 was used for: keyword co-occurrence analysis; network visualization; cluster identification; collaboration mapping. Biblioshiny (Bibliometrix R-package version 5.0) was used for: publication trend analysis; country productivity; journal productivity; citation analysis; thematic evolution analysis.

Keyword co-occurrence analysis employed a minimum occurrence threshold of 15, resulting in 36 representative keywords. A thesaurus file was developed to merge synonymous keywords before network construction (e.g., “animal” and “animals”).

Because the main dataset yielded only 8 articles with Indonesian affiliation, a supplementary search was conducted to capture the broader Indonesian research landscape, including conference proceedings. This

decision was based on the understanding that in emerging economies, significant research may be disseminated through proceedings before appearing in journals. A separate search was conducted in Scopus on February 26, 2026, using the following string:  
(TITLE-ABS-KEY (insurance) AND TITLE-ABS-KEY (livestock OR animal OR dairy OR cattle)) AND PUBYEAR > 2015 AND PUBYEAR < 2026 AND (LIMIT-TO (AFFILCOUNTRY, “Indonesia”))

This search yielded 36 documents (journal articles, conference proceedings, book, book chapter, and review). Titles and abstracts were screened for relevance, resulting in 13 documents included in the thematic analysis presented in Table 1. This supplementary analysis is presented separately from the main global findings and is used specifically to address RQ5.

Table 1. Summary of the Indonesian cattle insurance article based on Scopus database 2016-2025

| Author, Year          | Research Theme                                  | Method (sample n)               | Main Findings                                                                                                                         | Managerial Implications                                                                                                                         | Limitation Research                                                                                                              |
|-----------------------|-------------------------------------------------|---------------------------------|---------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------|
| Astati et al. (2019)  | Sustainability and business scale               | Descriptive Qualitative (n=NA)  | Farmer groups, technical skills, feed availability, and insurance support business expansion.                                         | Insurance should be integrated with farmer capacity building and cooperative development rather than offered as a standalone financial product. | Does not quantify the causal contribution of insurance to farm growth and ignores behavioural factors influencing participation. |
| Pratiwi et al. (2020) | Institutional Performance and Program Obstacles | Descriptive (n=69)              | Long administrative procedures and claim complexity discourage participation.                                                         | Insurance providers should simplify claim procedures and digitalize administrative processes to improve customer experience.                    | No empirical analysis explaining how institutional quality affects adoption decisions.                                           |
| Riana et al. (2020)   | Adoption Factors and Willingness to Pay (WTP)   | Logistic Regression (n=98)      | Attitude, subjective norms, family size, guarantee certainty, and dependence on livestock significantly influence insurance adoption. | Marketing strategies should strengthen trust, family engagement, and communication of insurance guarantees.                                     | Limited behavioural variables; trust, perceived value, and financial literacy were not examined.                                 |
| Annisa et al. (2020)  | Institutional Performance and Program Obstacles | IPA–CSI (n=50)                  | Farmer satisfaction reached 68.49%; improvements are needed in claim processing and information transparency.                         | Customer satisfaction should become a key performance indicator (KPI) for insurance providers.                                                  | Satisfaction is measured without linking it to customer loyalty or renewal behaviour.                                            |
| Fadhil et al. (2021)  | Institutional Performance and Program Obstacles | Soft Systems Methodology (n=NA) | Institutional strengthening, staff capacity, communication, sanctions, and Islamic insurance innovation are needed.                   | Insurance companies should strengthen governance systems and diversify insurance products, including Sharia-based insurance.                    | Recommendations remain conceptual and lack empirical validation.                                                                 |

Table 1. Summary of the Indonesian cattle insurance article based on Scopus database 2016-2025 (continue)

| Author, Year             | Research Theme                                  | Method (sample n)                   | Main Findings                                                                                                                                      | Managerial Implications                                                                                             | Limitation Research                                                                                       |
|--------------------------|-------------------------------------------------|-------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------|
| Amrawaty et al. (2021)   | Institutional Performance and Program Obstacles | Descriptive (n=60)                  | Institutional performance was generally rated as good.                                                                                             | Maintaining service quality is important, but continuous monitoring is necessary to sustain farmer trust.           | Service quality was evaluated descriptively without measuring its impact on participation.                |
| Suharyanto et al. (2021) | Willingness to Pay                              | WTP Analysis (n=150)                | Farmers' willingness to pay is lower than the current insurance premium.                                                                           | Flexible premium subsidies and differentiated pricing strategies are required.                                      | Economic affordability was studied without considering behavioural determinants of willingness to insure. |
| Roessali et al. (2022)   | Adoption Factors and Willingness to Pay (WTP)   | Probit Model (n=150)                | Farmers perceive climate, biological, financial, and market risks as high.                                                                         | Insurance products should cover multiple risk dimensions instead of mortality risk alone.                           | The relationship between perceived risks and insurance purchasing behaviour remains unexplored.           |
| Sulfiar et al. (2022)    | Sustainability and business scale               | Valuation of Sustainability (n=105) | Smallholder beef farming remains economically, socially, and environmentally unsustainable.                                                        | Insurance should be incorporated into broader sustainability and farm development programs.                         | Does not evaluate whether insurance improves sustainability outcomes.                                     |
| Pratomo et al. (2024)    | Sustainability and business scale               | Margin Analysis (n=30)              | Partnership farming is financially feasible, and insurance contributes to profitability.                                                           | Insurance can be positioned as an investment-support instrument rather than solely a risk-transfer mechanism.       | Behavioural and institutional determinants of insurance participation were not investigated.              |
| Islami et al. (2024)     | Institutional Performance and Program Obstacles | Delphi & Factor Analysis (n=68)     | Limited socialization, long claim procedures, and poor understanding hinder insurance adoption.                                                    | Insurance companies should strengthen extension programs and simplify communication with farmers.                   | Barrier identification lacks behavioural modelling explaining adoption decisions.                         |
| Ismail et al. (2025)     | Institutional Performance and Program Obstacles | Descriptive (n=52)                  | Farmers require greater education regarding FMD prevention and livestock insurance.                                                                | Insurance providers should integrate insurance promotion with veterinary extension and disease prevention programs. | Does not analyse whether disease awareness directly increases insurance participation.                    |
| Shantosi et al. (2025)   | Adoption Factors and Willingness to Pay (WTP)   | Binary Logistic Regression (n=200)  | Education, extension services, and insurance knowledge positively influence adoption, while age and farming experience negatively affect adoption. | Educational campaigns and extension services are effective instruments for increasing insurance uptake.             | Behavioural constructs such as trust, perceived value, and risk perception remain underexplored.          |

The framework illustrates the sequential process adopted in this study (Figure 1). Bibliographic data retrieved from the Scopus database were systematically screened before being analysed using performance analysis and science mapping techniques. Performance analysis identifies scientific productivity, whereas science mapping uncovers thematic structures and collaboration patterns. A complementary analysis of Indonesian publications is conducted to compare national research with global trends. The integration of these analyses provides a comprehensive understanding of the intellectual structure, emerging themes, and future research directions in cattle insurance research.

## RESULTS

### RQ1: Analyse The Publication Growth of Global Cattle Insurance Research During 2016–2025

Figure 2 presents the annual publication trends in cattle insurance research from 2016 to 2025. The dataset comprises 306 articles, with publication output increasing substantially over the study period. Early years (2016–2019) exhibited moderate growth, averaging 22 articles annually. A sharp acceleration occurred after 2020, with publications rising from 26 in

2020 to 50 in 2025—an increase of 92%. The Annually average growth from 2016-2025 is 17.3%. compare to other study bibliometric in the animal welfare has annually growth 13.3% in the range 1968-2017(Freire & Nicol, 2019) and sustainability in dairy farming 6.07% in the range 1992-2025 (Serin et al. 2025).

This post-2020 acceleration coincides with several global developments that likely heightened research attention to livestock insurance. Increasing climate variability and extreme weather events, growing policy focus on systemic food security risks and expansion of index-based livestock insurance products in developing regions(Amare et al. 2019; Melketo et al. 2025; Oduniyi et al. 2020).

While bibliometric data cannot establish causation, the temporal coincidence suggests that cattle insurance research has gained momentum as part of broader scholarly attention to agricultural resilience. The upward trajectory indicates that livestock insurance is transitioning from a niche technical topic to a recognized component of sustainable development discourse.

## RQ2: Leading Countries, Journals, and Collaboration Networks

### Country Productivity

According to the Scopus database, research interest in studying the livestock insurance research spans 45 countries, with the top 15 contributors shown in Figure 3. This indicates a widespread international interest in exploring this topic. The United States is the most

productive country, with 105 articles—more than triple the output of second-ranked China (31 articles). The United Kingdom follows closely with 29 articles, while Australia (18), Germany (12), and Canada (11) round out the top six. Indonesia ranks 14th with 8 articles, representing 2.6% of the global total. While the United States leads in absolute output, influence is also shaped by citation impact and collaboration patterns. This indicates that the USA is the most influential country when it comes to livestock insurance innovation such as livestock subsidy (Boyer & Griffith, 2023; Maina et al. 2024). This finding similar with the other bibliometric analysis in the composite cattle worldwide with USA has the highest number of publications and citations ((McManus et al. 2024)

Figure 3 provides details about the top 15 countries that have made significant contributions to research on livestock insurance. The United States is the most productive country in terms of research output, with 105 articles. China holds the second position with 31 papers. The United Kingdom follows closely in third place with 29 articles.

### Most Relevant Journals

Figure 4 displays the journals publishing the most cattle insurance research. *PLOS ONE* is the most productive journal (35 articles), followed by *Scientific Reports* (21 articles) and *Agricultural Finance Review* (14 articles). The prominence of multidisciplinary mega-journals (*PLOS ONE*, *Scientific Reports*) suggests that cattle insurance research reaches a broad scientific audience beyond specialized agricultural outlets.

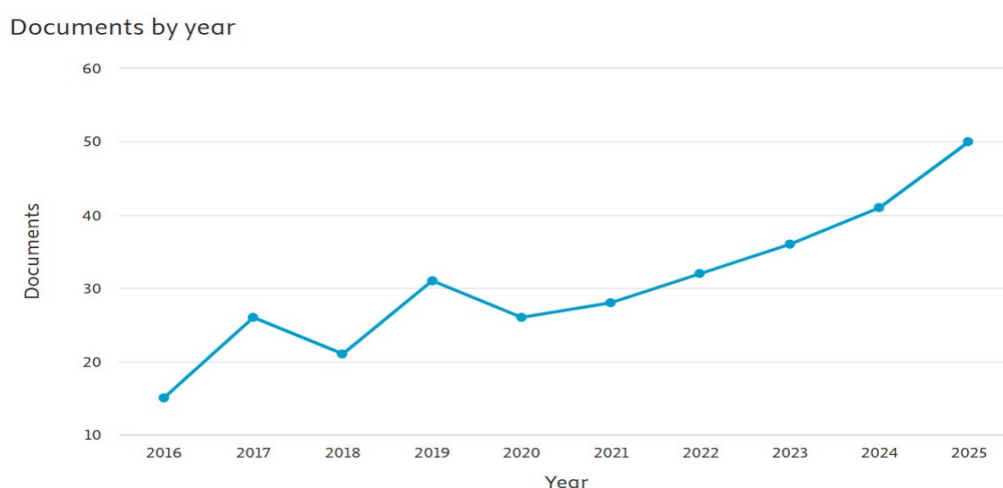


Figure 2. Growth of number of document publishing trend around cattle insurance 2016-2025 used Biblioshiny

## Documents by country or territory

Compare the document counts for up to 15 countries/territories.

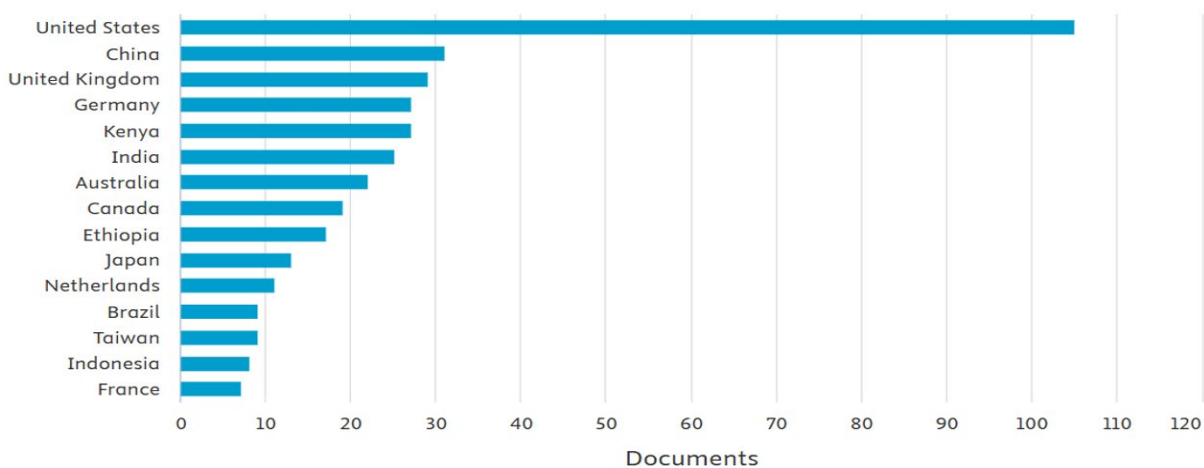


Figure 3 Number of publications by country in cattle insurance research, 2016-2025

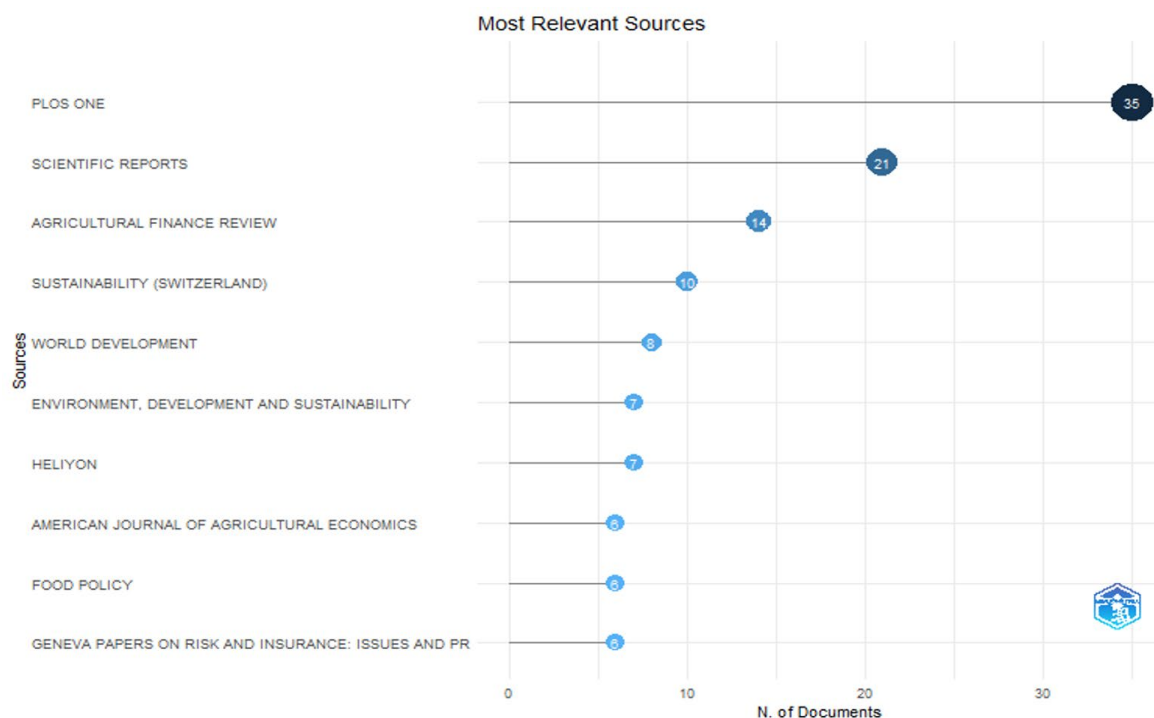


Figure 4. The most relevant journals related cattle insurance based on number of documents 2016-2025 in Scopus database used biblioshiny

## International Collaboration Patterns

Figure 5 illustrates international co-authorship networks. The United States exhibits the strongest collaboration network, with extensive linkages to researchers in Europe, Africa, China, and Australia. Countries with intermediate levels of international collaboration are Germany, United Kingdom, Australia, Japan and China with other countries. This dense collaboration network likely contributes to the visibility and influence of US-

affiliated research. (Jensen et al. 2016; Takahashi et al. 2019).

In contrast, several countries—including India, South Africa, Japan, Brazil, Iran, Ghana and Indonesia—show limited international co-authorship linkages in the dataset. This isolation suggests that research in these countries is conducted primarily within national boundaries, potentially limiting exposure to methodological innovations and theoretical

advances from the global research front. For emerging economies like Indonesia, strengthening international collaboration could accelerate research capacity building and enhance the policy relevance of domestic studies.

### RQ3: Thematic Clusters Structuring Cattle Insurance Research

Keyword co-occurrence analysis revealed three principal thematic clusters (Figure 6), which together form the intellectual structure of cattle insurance research.

#### Cluster 1 (Red): Climate Risk and Agricultural Systems in Vulnerable Regions

This cluster comprises 16 keywords, including: *Africa, agriculture, climate change, drought, Ethiopia, food security, index insurance, livestock, pastoralism, risk assessment, risk management, rural area*. The cluster emphasizes macro-level resilience strategies and is geographically concentrated in sub-Saharan African contexts, where climate variability poses acute threats to pastoralist livelihoods. Research in this cluster focuses on designing and evaluating index-based insurance products as alternatives to traditional indemnity-based schemes.

#### Cluster 2 (Green): Socio-Demographic and Behavioural Determinants of Insurance Participation

This cluster (11 keywords) includes: *adult, aged, controlled study, female, health insurance, humans, major clinical study, male, middle aged, risk factor*. Despite the clinical terminology (a reflection of term inheritance from medical literature), this cluster represents micro-level analyses of insurance adoption. Keywords such as “risk factor” and “controlled study” indicate a focus on identifying demographic and psychological predictors of participation, aligning with behavioural economic frameworks including the Theory of Planned Behaviour and prospect theory.

#### Cluster 3 (Blue): Epidemiological and Actuarial Modelling for Mortality Risk

This cluster (8 keywords) contains: *animal experiment, animals, economics, epidemiology, mortality, nonhuman, procedures, United States*. This theme focuses on quantifying biological risk (mortality, disease) and translating it into actuarial models. The presence of “United States” suggests this research is concentrated in countries with advanced veterinary epidemiology infrastructure. This cluster represents the technical core of insurance product design, linking disease dynamics to premium-economic calculation.

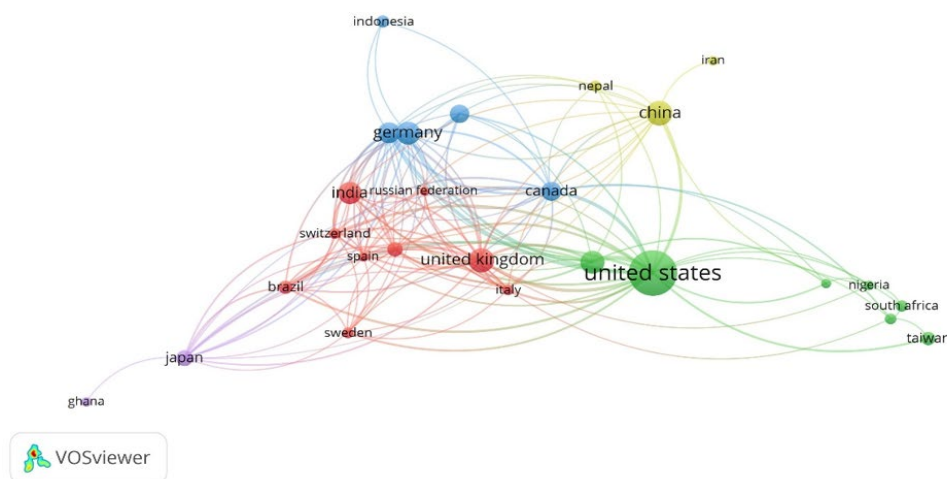


Figure 5. The collaboration authors based on number of documents of cattle insurance 2016-2025 in Scopus database used VOSviewer

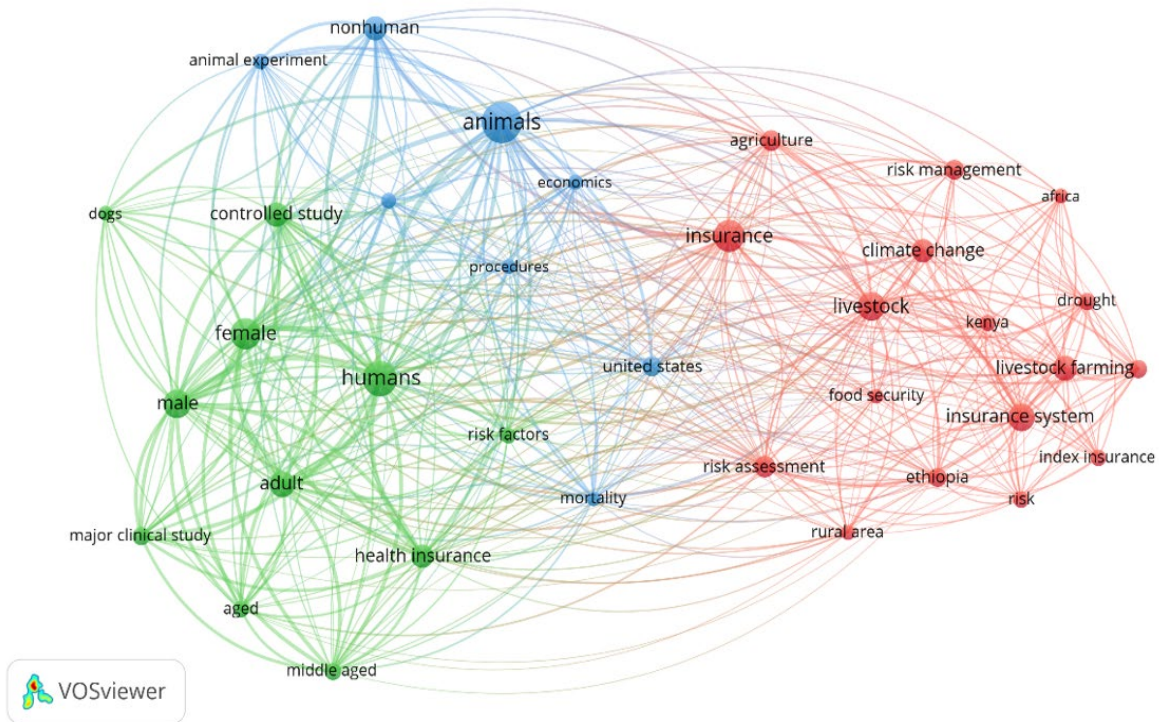


Figure 6. A visual representation of the Co-Occurrence Network and clusters of keywords related cattle insurance 2016-2025 in the Scopus database use VOSviewer

Overall, the thematic structure suggests that cattle insurance research has evolved into an increasingly interdisciplinary field encompassing behavior science, agricultural economics, climate adaptation, veterinary epidemiology, and actuarial modelling. Nevertheless, the bibliometric evidence indicates opportunities to strengthen integration across these domains and to expand research into areas such as digital and precision technologies (de Oliveira et al. 2024), technology-enabled traceability systems (Papa et al. 2024), comparative policy analysis, and interdisciplinary risk management approaches.

## Interrelationships Among Clusters

The three clusters form a triangular intellectual structure. Cluster 1 (climate risk) identifies the *hazards* that necessitate insurance. Cluster 3 (epidemiological modelling) quantifies the *biological consequences* of those hazards in actuarial terms. Cluster 2 (behavioural determinants) explains the *human response* to the resulting insurance products. The field's fragmentation arises from limited integration across these clusters: studies focusing on climate risk rarely incorporate behavioural micro-foundations, while epidemiological models often assume rational

uptake that behavioural research contradicts. This suggests that advancing the field requires deliberate interdisciplinary integration.

The triangular structure identified in RQ3 reveals both the field's richness and its fragmentation. The climate risk cluster (red) reflects the policy-driven expansion of index-based insurance, particularly in African pastoral systems (Jensen et al. 2017). The behavioural cluster (green) aligns with established agricultural economics traditions applying the Theory of Planned Behaviour and prospect theory to technology adoption (Timpanaro et al. 2023). The epidemiological cluster (blue) represents the technical core of insurance product design, linking disease surveillance to actuarial science (Pai & Ravishanker, 2020).

However, the limited integration across these clusters constitutes a fundamental barrier to advancing the field. Behavioural studies rarely incorporate epidemiological parameters that determine actual risk exposure, while actuarial models often assume rational uptake contradicted by behavioural evidence. This disconnects echoes broader calls in agricultural risk research for interdisciplinary frameworks that bridge biophysical and social science perspectives (Vyas et al. 2021).

## RQ4: Thematic Evolution and Emerging Research Frontiers

Figure 7 presents the thematic evolution of cattle insurance research from 2016 to 2025, visualizing the periods during which specific keywords were most prominent. Several patterns emerge.

### Established Themes (2016–2022)

Keywords such as “insurance system,” “rural area,” and “psychology” appear consistently throughout the study period, indicating sustained attention to institutional arrangements, geographic targeting, and behavioural factors. These themes form the foundational concerns of the field.

### Emerging Frontiers (2023–2025)

The distinction between established themes and emerging frontiers illustrates the maturity and evolution of cattle insurance research. Established themes demonstrate the stable knowledge base upon

which the field has developed, whereas emerging frontiers reveal how scientific priorities are adapting to contemporary challenges such as climate change, transboundary animal diseases, and digital risk management. Consequently, thematic evolution suggests that cattle insurance research is progressing from a predominantly behavior and institutional focus toward a more integrated interdisciplinary framework combining epidemiology, actuarial science, and agricultural resilience.

Three keywords have gained prominence in the most recent period, signalling new research directions:

1. Epidemiology: Reflects growing integration of disease dynamics into insurance research, likely driven by heightened awareness of pandemic risks.
2. Vaccination: Indicates attention to preventive health measures as complements or alternatives to insurance payouts.
3. Farmers: Suggests increased focus on farmer-level agency and decision-making, moving beyond aggregate analyses.

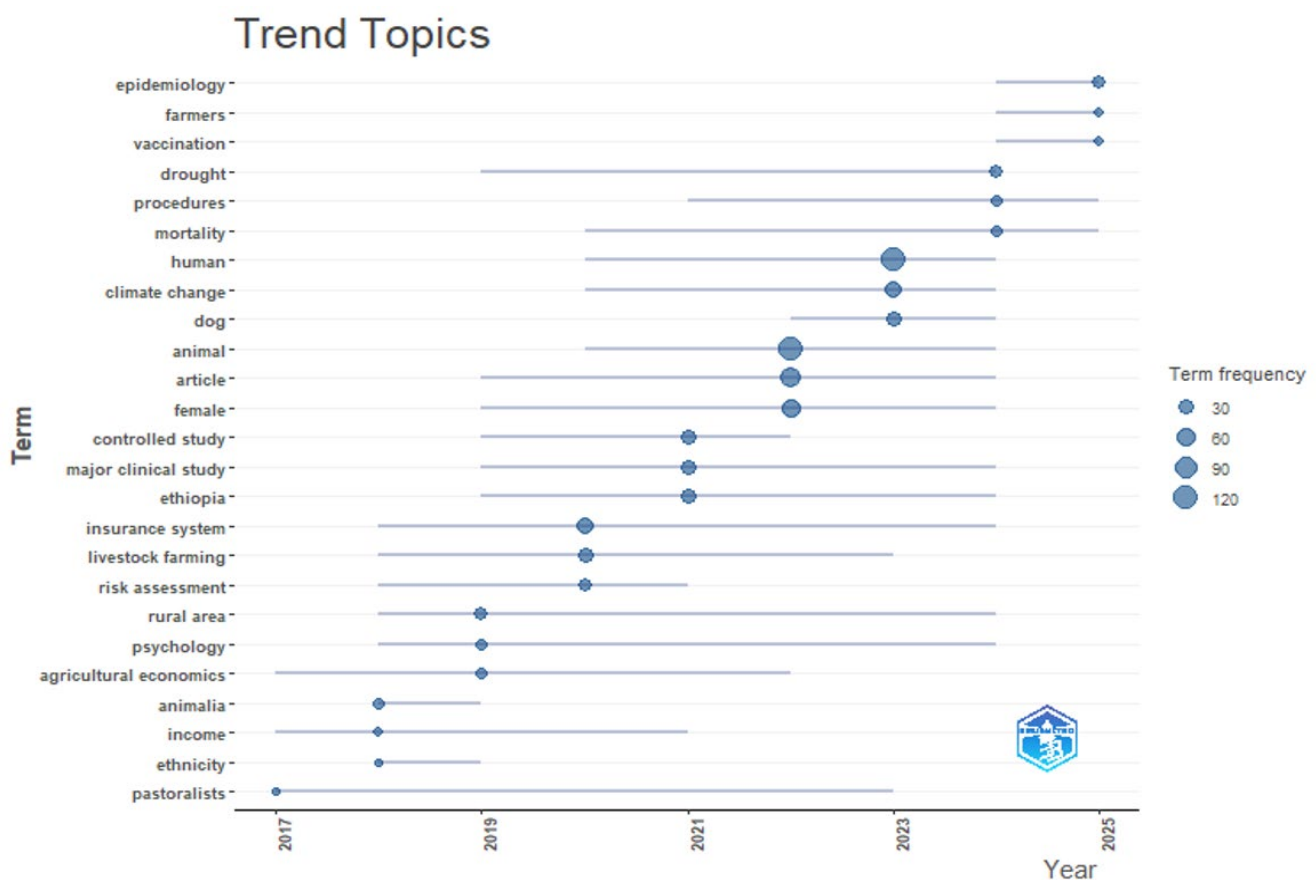


Figure 7. Trend topics related cattle insurance 2016-2025 in Scopus database used biblioshiny

The emergence of epidemiology and vaccination as research topics aligns with the post-2020 acceleration noted in RQ1. This shift suggests that the COVID-19 pandemic and subsequent outbreaks (e.g., African swine fever, foot-and-mouth disease) have catalysed research integrating animal health with financial risk protection. The persistence of behavioural keywords (“psychology,” “farmers”) alongside emerging epidemiological themes points toward a potential convergence of behavioural and epidemiological modelling a frontier identified in RQ3 as critical for advancing the field.

## RQ5: Indonesia’s Positioning Within the Global Research Landscape

### Overview of Indonesian Contributions

Indonesia is scientifically valuable because it is an emerging economy with high policy relevance but relatively low international scientific visibility, making it an ideal case for benchmarking the development of livestock insurance research against global trends.

Of the 306 articles in the global dataset, 8 include authors affiliated with Indonesian institutions, placing Indonesia 14th in overall productivity (Figure 3). Table 1 summarizes which were analysed to characterize Indonesia’s thematic focus, methodological approaches, and gaps relative to the global research

front. Indonesia’s research profile (RQ5) reflects the challenges facing emerging economies seeking to build evidence-based livestock insurance systems. The concentration on adoption studies and institutional performance mirrors early-stage research trajectories observed in other developing regions (Vyas et al. 2021). However, the absence of epidemiological integration and methodological experimentation suggests that Indonesian research has not yet reached the “take-off” point observed in the global literature after 2020.

### Thematic Concentration

Indonesian research clusters around three interconnected themes: Adoption factors and willingness to pay (31%), Sustainability and business scale (23%), and Institutional performance and program obstacle (46%). (Figure 8). The summary presented in Table 1.

#### 1. Adoption Factors and Willingness to Pay (WTP)

Studies in Bangka Belitung (Suharyanto et al. 2021), Gowa (Riana et al. 2020), and Yogyakarta (Shantosi et al. 2025), Grobogan (Roessali et al. 2022) examine determinants of insurance uptake. Common findings include premium affordability constraints, the influence of education and extension contacts, and the role of subjective norms. These studies align with Cluster 2 (behavioural determinants) in the international context.

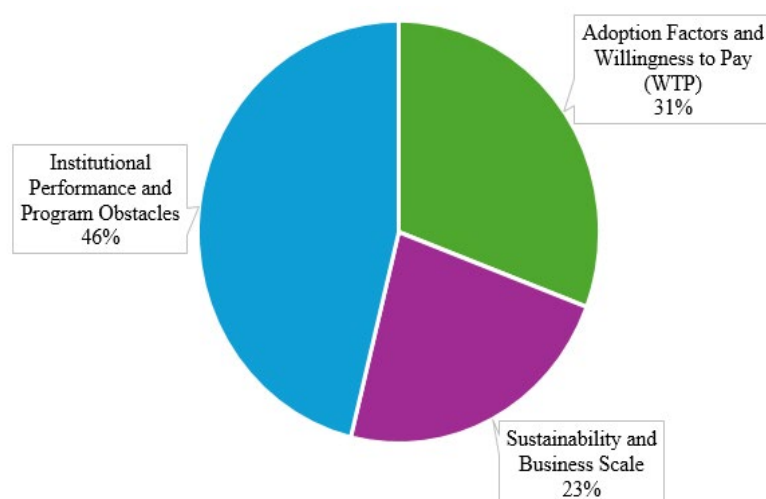


Figure 8. Thematic concentration related cattle insurance in Indonesia based on Scopus data base 2016-2025

## 2. Sustainability and Business Scale

Research in Bantaeng (Astati et al. 2019), Konawe (Sulfiar et al. 2022), and Karanganyar (Pratomo et al. 2024) links insurance participation to farm sustainability and business expansion. Insurance should be integrated with farmer capacity building and cooperative development rather than offered as a standalone financial product.

## 3. Institutional Performance and Program Obstacles

Multiple studies (Amrawaty et al. 2021; Annisa et al. 2020; Fadhil et al. 2021; Islami et al. 2024; Ismail et al. 2025; Pratiwi et al. 2020) assess farmer satisfaction and identify implementation barriers: complex claims procedures, inadequate socialization, limited awareness of disease risks (e.g., FMD), and administrative bottlenecks. These studies correspond to the “insurance system” keywords identified in the global thematic evolution (RQ4).

### Managerial Implications

The findings of this bibliometric study provide several practical implications for managers, insurance providers, agribusiness firms, financial institutions, and policymakers involved in livestock risk management.

First, the increasing volume of global research since 2020 indicates that livestock insurance is evolving from a conventional indemnity product into a broader risk management instrument integrated with climate adaptation and food security strategies. Insurance companies should therefore redesign livestock insurance products by incorporating climate-related risk indicators, disease surveillance information, and digital monitoring technologies rather than relying solely on traditional mortality-based compensation schemes.

Second, the identification of three major research clusters climate risk management, behavioural determinants of insurance participation, and epidemiological modelling suggests that successful insurance programs require interdisciplinary product development. Managers in insurance companies should collaborate with veterinarians, agricultural economists, meteorological agencies, and digital technology providers to develop integrated insurance products that combine disease prevention, early warning systems, veterinary advisory services, and financial protection.

Third, the collaboration network analysis reveals that countries with strong international research partnerships, such as the United States, China, and the United Kingdom, dominate scientific productivity and innovation. For agribusiness firms and insurance providers in emerging economies, establishing partnerships with international universities, research institutes, and development organizations can accelerate technology transfer, product innovation, and access to advanced actuarial methodologies. Collaborative innovation may also improve the competitiveness of domestic livestock insurance markets.

For Indonesia, the findings suggest that the government should continue premium subsidies, while insurance providers should strengthen collaboration with farmer cooperatives and simplify claims procedures.

## CONCLUSIONS AND RECOMMENDATIONS

### Conclusions

This study mapped the global scientific landscape of cattle insurance research published between 2016 and 2025 using bibliometric techniques. The analysis demonstrates a sustained increase in publication output and identifies three broad and interconnected research domains: (i) behavioural determinants of insurance adoption, (ii) climate risk and index-based livestock insurance, and (iii) epidemiological and actuarial approaches to livestock risk management. The thematic evolution further indicates growing scholarly attention to animal health, epidemiology, and farmer-centred research in recent years, suggesting an expansion of the field towards more interdisciplinary perspectives.

The country analysis shows that scientific production is concentrated in a small number of countries, while Indonesia contributes a relatively modest share of publications and exhibits limited international research collaboration. Rather than indicating research underperformance, these findings highlight opportunities to strengthen international engagement and broaden the thematic scope of Indonesian cattle insurance research. To the best of our knowledge, this study is among the first bibliometric analyses dedicated specifically to cattle insurance research, providing a quantitative overview of publication trends, collaboration patterns, and thematic development that may serve as a reference for future studies.

## Recommendations

The thematic gaps identified in this study suggest several promising directions for future research. First, greater integration between behavioural, epidemiological, and actuarial perspectives could improve understanding of livestock insurance systems. Second, comparative studies across countries with different institutional and insurance arrangements would enhance knowledge of context-specific implementation. Third, as digital agriculture continues to evolve, future research may explore the application of emerging technologies including remote sensing, geospatial information, artificial intelligence, and large-scale data analytics to livestock insurance design and risk assessment.

This study has several limitations that should be considered when interpreting the findings. First, bibliometric analysis provides a quantitative overview of publication patterns, citation relationships, and thematic structures but does not evaluate the theoretical depth, methodological rigour, or empirical quality of individual studies. Consequently, the identified thematic clusters should be interpreted as patterns of scientific attention rather than evidence of conceptual or methodological superiority.

Second, keyword co-occurrence and thematic mapping depend on author-provided keywords and database indexing. Variations in terminology, synonym usage, and indexing practices may fragment conceptually similar studies into separate clusters, potentially influencing the interpretation of thematic relationships and research evolution.

Finally, although Indonesia was analysed to examine its position within the global research landscape, the number of eligible Indonesian Scopus-indexed journal publications meeting the predefined inclusion criteria remained relatively limited. Consequently, the Indonesian findings should be interpreted as an indication of current publication patterns rather than a comprehensive representation of all livestock insurance research conducted nationally. Future studies could complement bibliometric analysis with systematic literature reviews or qualitative content analyses to provide deeper theoretical and methodological insights into this evolving research field

**CONFLICT OF INTEREST:** The author declares no conflict of interest.

**FUNDING STATEMENT:** This research did not receive funding.

**DECLARATION OF GENERATIVE AI STATEMENT:** During the preparation of this work the authors used ChatGPT in order to check grammar and polish text. After using this tool/service, the authors reviewed and edited the content as needed and took full responsibility for the content of the publication.

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