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Research Article

Insights of agricultural insurance in India: A Bibliometric and Network analysis

Nemala Naga Venkata Sai[1*], Dr. P.V Rajeev[2]

[1*]Research Scholar Institute of Management Studies, BHU, Varanasi Email - venkatasainn@fmsbhu.ac.in
[2] Professor Institute of Management Studies, BHU, Varanasi Email - pvrajeev@fmsbhu.ac.in

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ABSTRACT

India is the only country having one of the largest crop insurance schemes in terms of area covered as well as highest number of uninsured farmers. It has been 50 years since the first ever crop insurance scheme was introduced in India, still its impact and adoption rate is very low in India. One of the main reasons for such low adoption rates is lack of awareness and complex processes. farmers are often exposed to the different types of risks. Crop insurance is one of the institutional mechanisms to mitigate the agriculture risks. Despite its enormous potential, crop insurance progress is very low in India. Crop insurance has the scope for development and can become a risk mitigation tool in India. The current study reviewed 3944 articles for the time period 2001 to 2022 march from the Scopus data base related to the crop and agriculture insurance. Finally bibliometric analysis and network analysis was performed on 1257 articles further a detailed study has been conducted in the Indian context of agriculture insurance for identifying the future research scope in India.

Keywords: Crop insurance, Agriculture insurance, Bibliometric analysis, Content analysis, PRISMA framework, Systematic Literature Review, Network analysis.

Introduction:

It has been 50 years since the first ever crop insurance scheme was introduced in India, still its impact and adoption rate is very low in India. One of the main reasons for such low adoption rates is lack of awareness and complex processes (Panda, 2013). According to
Situational assessment survey of farmers, carried out by National Sample Survey Office (NSSO) in the year 2012–2013 (GoI, 2014) Only 5% of the Indian households are willing to insure their crops, out of them 87% are not receiving claims (Cariappa et al., 2021). 40% of the farmers stated that they would leave farming if they find the better alternatives this is because of the high risks, low status in the society, low profits. Risk is the key reason for disliking farming as occupation (Birthal et al., 2015). Farmers are often exposed to three types of risks, they are: 1. Input risk 2. Production risk 3. Price risk. Input risk arises when there is a scarcity of inputs as well as when their prices go up (Rajeev et al., 2016). Production risks mainly arises of floods, drought, cyclones, early and late coming of monsoon, weather fluctuations etc. Price risks arises of fluctuations in the market price of the output. Crop insurance is one of the institutional mechanisms to mitigate the agriculture risks. India is the only country having one of the largest crop insurance schemes in terms of area covered as well as highest number of uninsured farmers (Korekallu Srinivasa et al., 2021). Despite its enormous potential, crop insurance progress is very low in India. Crop insurance has the scope for development and can become a risk mitigation tool.
This research paper uses bibliometric analysis and network analysis to give an overall idea about the agriculture insurance research area i.e., top journals, top authors, prominent keywords, top countries and various important metrics information like their index rankings. This will help the future researchers in identifying relevant articles for their study. Further a detailed study has been conducted in the Indian context of agriculture insurance for identifying the future research scope in India.
This review uncovers gaps in prevailing academic literature and discusses the gap in the field of agriculture insurance by conducting a systematic review and bibliometric analysis and network analysis, as well as, offering

new future research insights. Network analysis has been conducted to identify the most prominent keywords in the field.
The article provides the direction for future research scholars, academicians and policy makers in better understanding of agriculture insurance as well as identifies the future research scope in agriculture insurance.

2.Research methodology:

This current study presents a thorough scientometric review of the last 22 years. A scientometric study can help discover existing and growing relevant research fields. Scientometric analysis is increasing its significance in the early stages of scientific research. This analysis can assist in compiling existing literature. Scientometric review helps to broaden the possibilities of recognizing a lack of alternative approaches in the subject area. Network analysis and bibliometric analysis are the two major components of scientometric analysis.
The bibliometric analysis is used in this study to visualise the literature from 2001 to 2022 march. The bibliometric study includes the analyses of the evolution of publications trend during the study period, top journals, research areas, the citation volumes, influential authors, affiliations, and contributing countries analysis. The analysis has been conducted by using the Bibliometrix R package (4.1.3). The network analysis is used for identifying the most prominent keywords and this analysis is conducted by using the open-ended software VOS viewer.
The Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) procedure was followed for Bibliometric analysis and network analysis. A systematic review helps to identify, screen, and summarize the relevant outcomes to research questions. It entails conducting a broad, transparent, and reproducible search of the literature by conducting a thorough and scientific search of both published and unpublished literature while limiting biases in the review process. Furthermore, it enhances the scrutiny process of the literature by offering objective evidence relating to a topic or issue.
We focus on the peer-reviewed literature and thus excluded grey literature sources. Thus, only peer- reviewed papers in journals that were indexed in Scopus at the time of publication are included for reviewing.

2.1 Literature retrieval and selection.

Step 1. Article identification:

This step concentrated on identifying referred journals that were pertinent to the research questions. Studies prior to 2001 are not taken into consideration, and only articles published between 2001 and 2022 March were chosen. In order to retrieve the related articles and to eliminate the unrelated retrieval, Key words such as agriculture insurance, crop insurance in table 1 was chosen. Using these keywords search has been performed in Title, Keywords and abstract fields in the Scopus database A total of 3944 articles were retrieved on 22/04/2022.
Next to reduce the unrelated articles retrieved by the database the following filters were applied Area, Language, Journal articles, Published, Articles, sources. By this a total of 2687 were removed from the study and the number was limited to 1257.
Search keywords applied to the databases.

Table 1 Search keywords applied to the database

SEARCH TERMS	DATABASE
TITLE-ABS-KEY (AGRI* OR CROP) AND INSURANCE	Scopus

Step 2. Article screening:

Primarily 3944 articles were retrieved for the period of 2001- 2022 march. These articles were screened by the following subject areas

1. Economics, Econometrics and finance
2. Social sciences
3. Business, management and accounting
4. Decision sciences
5. Multidisciplinary
6. Arts & humanities

A total of 1962 articles were identified and then researcher gone through each source profile to identify the most relevant articles and this led to the removal of 705 articles resulting 1257 are left out. Further researcher has gone through the titles of each article which resulted in removal of 399 articles. A total of 858 documents were subjected for further screening, then researcher went through each abstract and summaries of the articles to find out that 258 articles were relevant with research objectives, out of 258 articles 30 articles were Indian context. The researcher has chosen these 30 articles for final literature review.

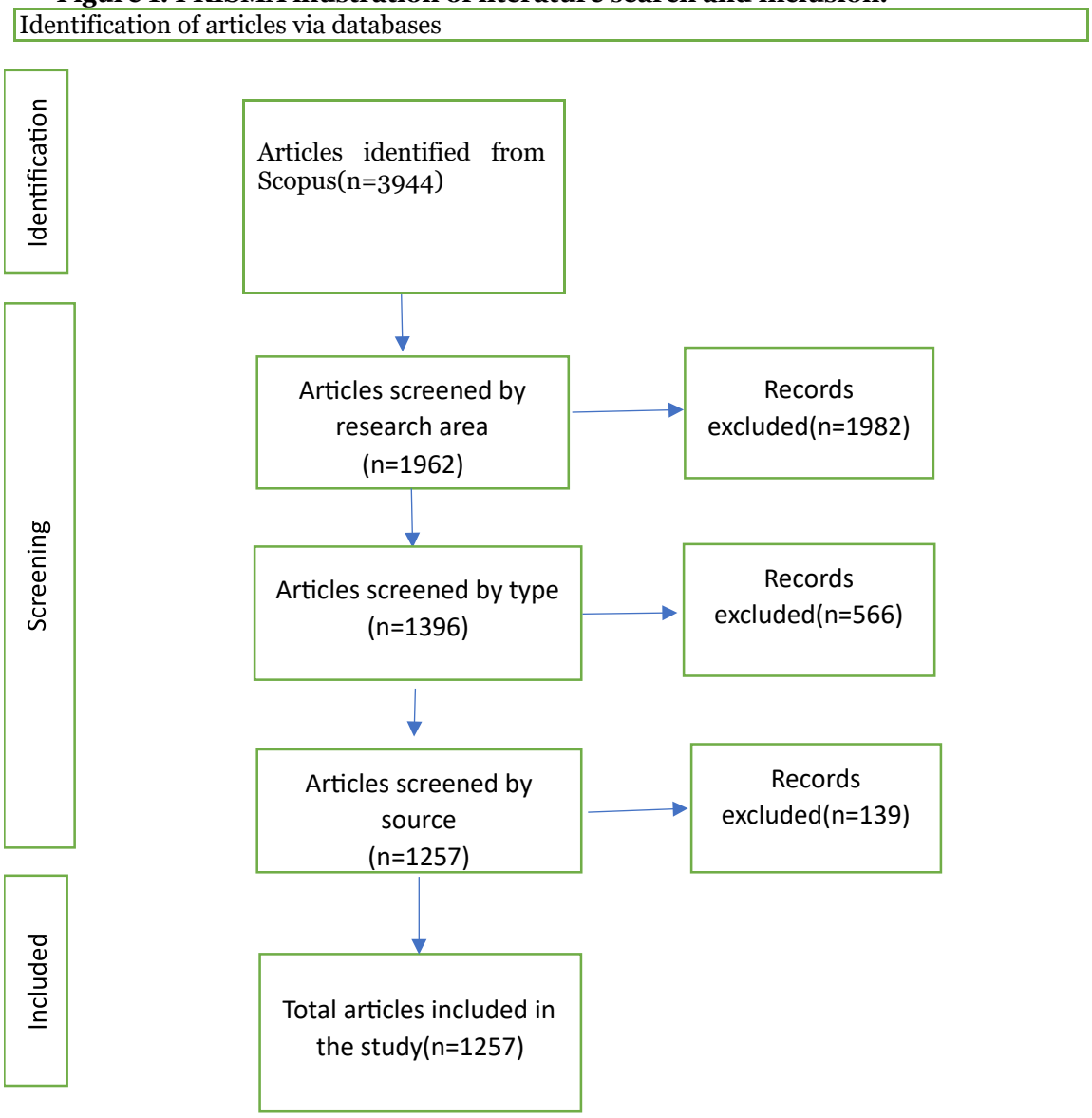
Step 3. Inclusion and data synthesis:

This step concentrated on data extraction from all 1257 articles in order to perform the bibliometric analysis and network analysis. The data was analysed using a mix of quantitative and qualitative methodologies. Chronological trend, Journals publication trend, Countries scientific production are shown by the graphical representation, Top authors, Countries, Organizations, Journals were analysed using frequencies, Tables, Rankings, Percentages.

Table 2 Inclusion and exclusion criteria.

Inclusion	Exclusion
Published time period 2001-2022 March	Published earlier 2000 and after 2022 march
English	Other than English
Indexed in Scopus	Other than Scopus indexed journals
Document type: Peer reviewed articles	Others, e.g. (reviews, book chapters, reports editorials, letters, conference proceedings, unpublished, non-peer-reviewed documents, articles in the press, etc.)
Articles focused on crop and agriculture insurance.	Articles focused on cattle insurance, Aquaculture insurance etc.
Articles related to the arts & social sciences. Example Economics, Econometrics and finance, Business management accounting etc.	Articles related to environmental sciences, Earth and planetary sciences etc.

Figure 1. PRISMA illustration of literature search and inclusion.



2.2 Data analysis:

On the selected papers, bibliometric analysis and network analysis are conducted. bibliometric analysis employs a series of evaluative and relational methodologies to discover and highlight influential authors, journals, and research papers in a specific field.as well as the social structure of that field. For bibliometric analysis, several opensource software packages such as CiteSpace, Histcite, Sitkis, Bibexcel, Bibliometrix, and ScientoPy are available. For bibliometric analysis, the current study makes use of the Bibliometrix R package (4.1.3). The network analysis is used for identifying the most prominent keywords and this analysis is conducted by using the open-ended software VOS viewer.

3. Bibliometric analysis

3.1Chronological publication trend

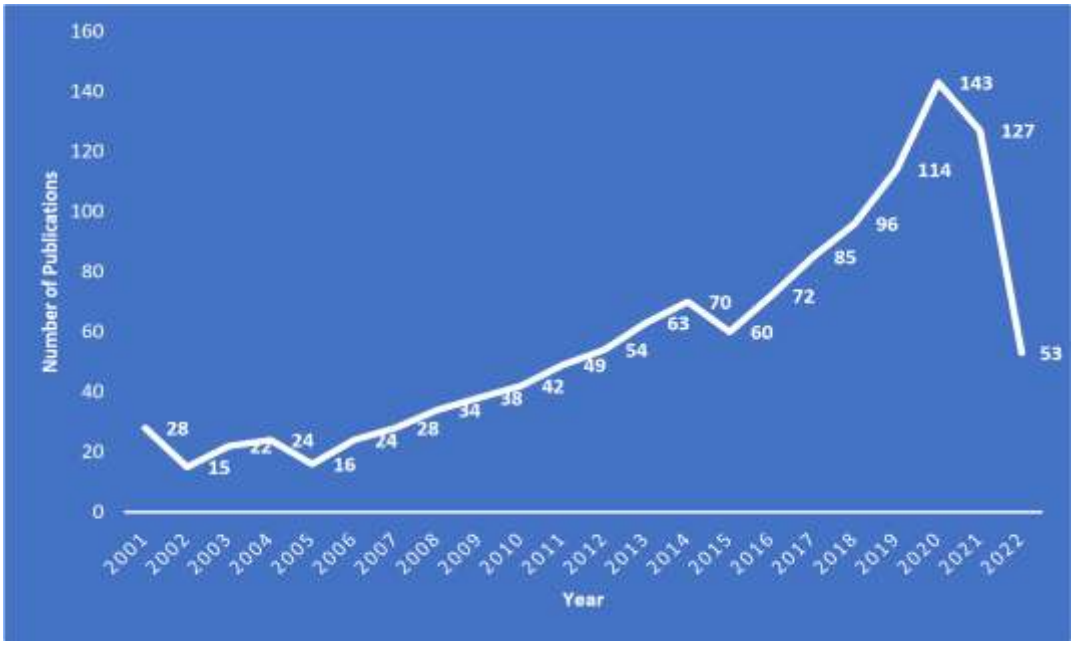


Figure 2. Publishing trend of agriculture insurance

Figure 2 illustrates the publication trend of agriculture insurance. It is evident that in the initial years there is an increase and decrease trend till 2006. However, there has been a significant growth in the number of articles published since 2007. Agriculture insurance has grown exponentially in the previous 15 years, accounting for almost 70% of all articles published in these 15 years. This growth indicates the importance of the agriculture insurance studies among the academicians. 2020 is the year has the highest publications in a year.

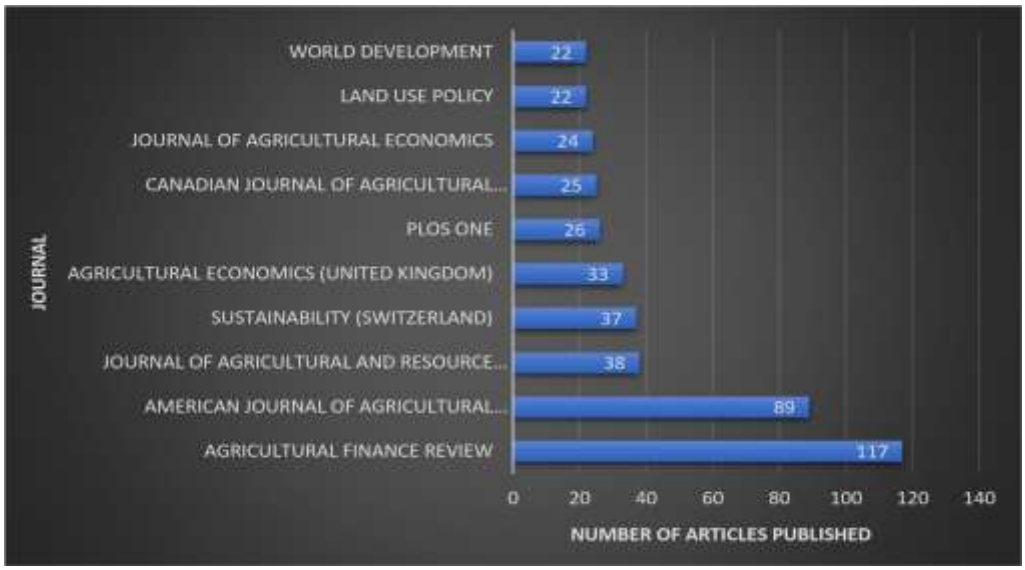


Figure 3. top 10 journals and their publications

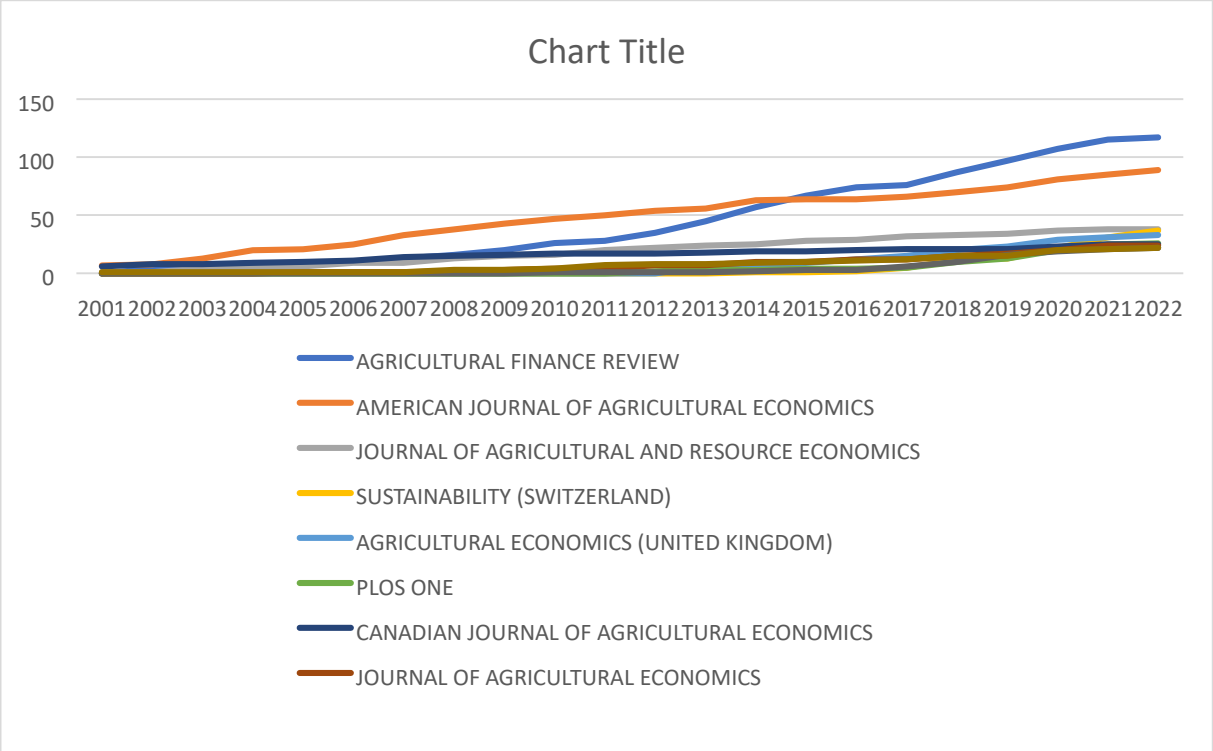


Figure 4. Top Journals and their publication trend

3.2 Journal quality analysis:

According to the primary findings, 406 journals are contributing to the total of 1257 research publications. A total of 433 research papers were published by these top 10 journals which is accounted to almost 34 percentage. table 3 represents the total no of articles published by the journals and their metrics such as H index, G index, M index which are an important metrics for the journal quality. The data clearly shows that Agricultural finance review has the highest number of publications but one can observe that American Journal Of agricultural economics is most influential in terms of total citations. Sustainability Switzerland and Agricultural Economics (United Kingdom).

Table 3 Top 10 journals contributing to agriculture insurance

Journal	Total articles	H index	G index	M index	TC	TC/A	Time span
AGRICULTURAL FINANCE REVIEW	117	17	26	0.80952381	1170	10	2002-2022
AMERICAN JOURNAL OF AGRICULTURAL ECONOMICS	89	28	47	1.27272727	2500	28.0898876	2001-2022
JOURNAL OF AGRICULTURAL AND RESOURCE ECONOMICS	38	14	24	0.63636364	657	17.2894737	2001-2021
SUSTAINABILITY (SWITZERLAND)	37	9	12	1	189	5.10810811	2014-2022
AGRICULTURAL ECONOMICS (UNITED KINGDOM)	33	14	25	1.4	658	19.9393939	2013-2022
PLOS ONE	26	9	13	0.81818182	209	8.03846154	2012-2022
CANADIAN JOURNAL OF AGRICULTURAL ECONOMICS	25	13	19	0.59090909	377	15.08	2001-2021
JOURNAL OF AGRICULTURAL ECONOMICS	24	11	23	0.61111111	598	24.9166667	2005-2021
LAND USE POLICY	22	14	20	1.07692308	578	26.2727273	2010-2022
WORLD DEVELOPMENT	22	15	22	0.68181818	564	25.6363636	2001-2022

3.3 Leading countries, regions and organisations driving research on momentum investing:

The figure 5 represents top 10 countries contributing to the literature of agriculture insurance, and it also discloses that United States of America and China are the major countries contributing to the literature of agriculture insurance.

Fig 5 Countries contribution to the agriculture insurance

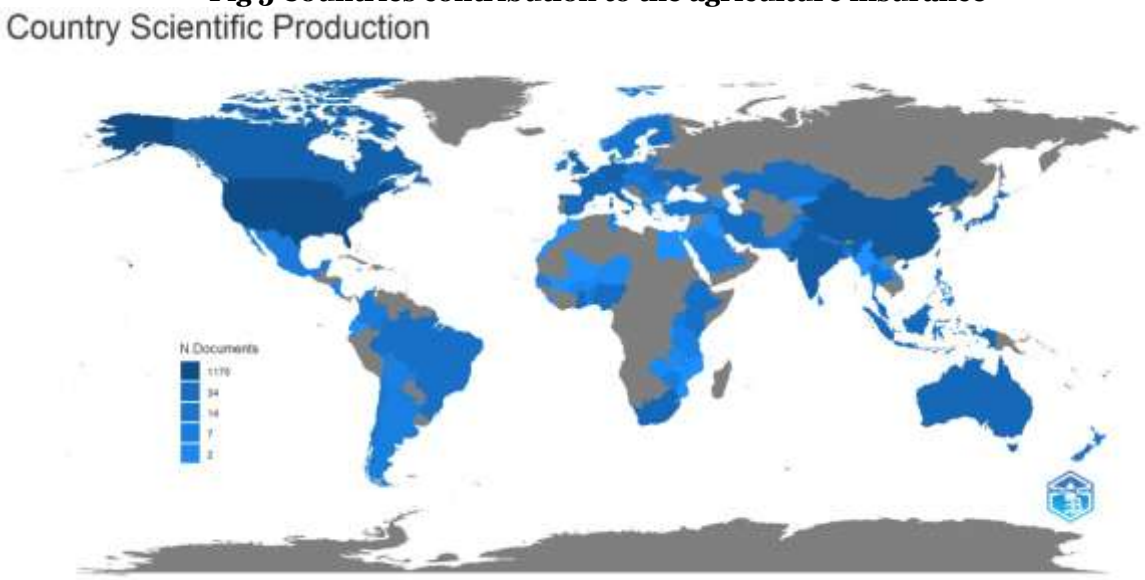


Table 4 Top 10 Countries with total and average citations

Country	Total Citations	Average Article Citations
USA	6862	21.78
CHINA	1052	11.19
FRANCE	977	28.74
UNITED KINGDOM	943	21.93
GERMANY	645	16.12
NETHERLANDS	559	18.63
SWITZERLAND	356	18.74
CANADA	324	8.10
ITALY	317	15.10
SOUTH AFRICA	295	14.05

3.4 Author influence:

Table 5 shows the most prominent authors in the field of agriculture insurance. Goodwin BK and Barnett BJ are the are the leading authors in terms their publications. If we closely observe one can find that GINÉ X is the most influential author in terms of no of total citations of 493 with only 3 articles. GOODWIN BK, BARNETT BJ are most influential in terms of their H index and G index.

Table 5 Top 10 Authors and their metrics

Authors	H index	G index	M index	TC	NP	Time span
GOODWIN BK	13	25	0.591	673	27	2001-2022
BARNETT BJ	8	13	0.364	622	13	2001-2022
GINÉ X	3	3	0.188	493	3	2007-2022
SHERRICK BJ	8	12	0.4	386	12	2003-2022
KARLAN D	2	2	0.167	375	2	2011-2022
UDRY C	2	2	0.167	375	2	2011-2022
SCHNITKEY GD	8	11	0.4	371	11	2003-2022
TURVEY CG	10	18	0.476	358	20	2002-2022
DERCON S	2	2	0.167	340	2	2011-2022
GLAUBER JW	5	8	0.238	334	8	2002-2022

Table 6 represents total no of articles published by the various organizations, North Carolina state university and WAGENINGEN UNIVERSITY are the top organizations contributing to the literature. It is clearly evident that 70 percentage of the top 10 organizations are located in United States of America which clearly indicate the dominance of USA in this field.

Table 6 Top 10 contributing organizations

Organization	Location	Articles
NORTH CAROLINA STATE UNIVERSITY	United States of America	63
WAGENINGEN UNIVERSITY	Netherlands	48
BEIJING NORMAL UNIVERSITY	China	46
IOWA STATE UNIVERSITY	United States of America	46
CORNELL UNIVERSITY	United States of America	42
MISSISSIPPI STATE UNIVERSITY	United States of America	39
UNIVERSITY OF MANITOBA	Canada	35
KANSAS STATE UNIVERSITY	United States of America	33
UNIVERSITY OF CALIFORNIA	United States of America	33
UNIVERSITY OF ILLINOIS	United States of America	31

Network analysis: VOS viewer software was employed to conduct network analysis. The analysis has been conducted to identify the most prominent keywords in the field. The table 7 demonstrates the primary keywords used in 1257 examined research articles. These keyword analysis helps to identify the most relevant keywords and their relation with the other keywords. The most prominent keywords are “Crop insurance” with the frequency of 237, “Insurance” (frequency of 118), Agriculture (frequency of 116), “Risk management (frequency of 76), “Climate change (frequency of 68). All of these words were used to emphasise the relevance and interconnectedness of among the examined articles.

Only those keywords which met the minimum frequency of 10 are taken into the network analysis. It resulted in Identifying 47 most prominent keywords and these 47 keywords are made into 8 relevant clusters each cluster is represented by the different colour. Figure 6 depicts the relevance and weight of these clusters with the important keywords.

The visualisation of the interconnectedness of the keywords used in the 1257 articles is another aspect of the analysis. The VOS viewer software was employed to crate the keyword network map. Figure 6 shows the co-occurrence of keywords. “Crop Insurance”, “Risk”, “Agriculture insurance” are the most prominent keywords situated at the center of the network. Weight of the point determines the size of the point and label size. Larger the label and circle of the point means it has the higher weight of the point. The keywords crop insurance and agriculture insurance have interconnection with almost every other keyword in the network.

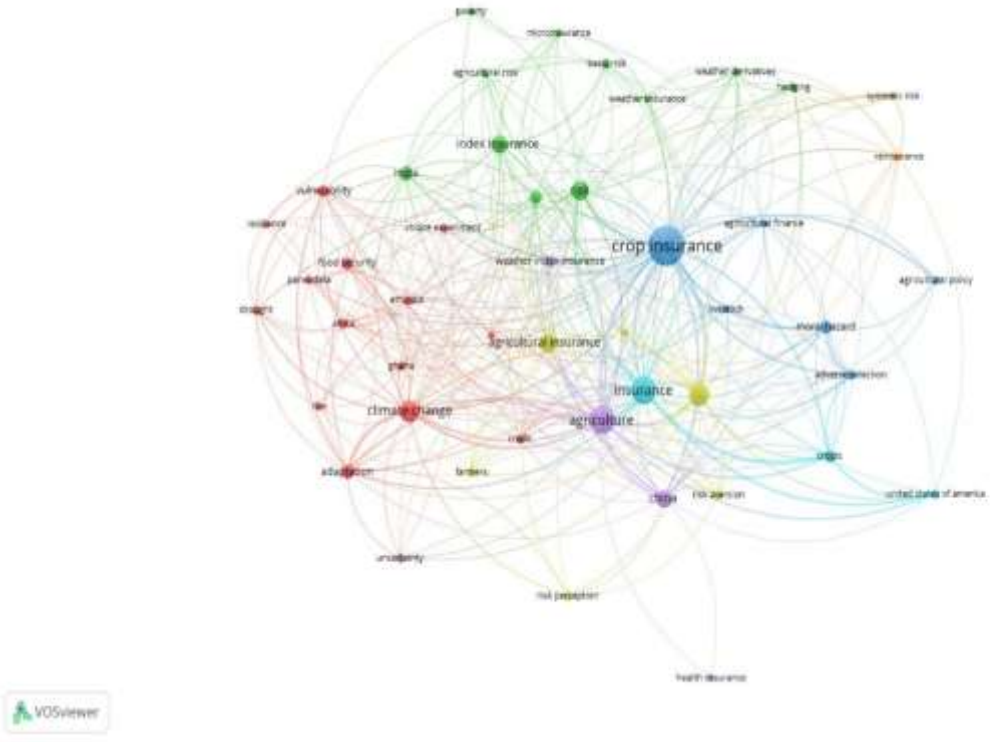


Figure 6. Keywords interconnectedness network

Table 7. Most prominent keywords.

Keywords	Frequency
Crop insurance	237
Insurance	118
Agriculture	116
Risk management	76
Climate change	68
Agriculture insurance	59
Risk	58
Index insurance	51
China	48
India	32

Content analysis: The present study aims to give overview of objectives, recommendations summaries of the existing literature of agriculture insurance published between 2001-2022 march in Indian context and to identify the future research scope areas.

Ghosh et al., (2021) the study mainly focused on the insights of the farmers willingness for crop insurance. Besides the study focused to determine the how farmers perceive about different crop insurance features and attributes of the insurance products.

The study findings concluded that Policy designing & its implementation are the key reasons that limiting the farmers uptake, study results suggest that farmers are generally willing to pay higher than the subsidised premiums they are currently paying under PMFBY. While Crop cutting experiments and timely indemnities are also key attributes according to the farmers, Coverage period and cost of insurance.

The study recommended an alternative mechanism through remote sensing over Crop cutting experiments for estimating the crop losses, which could result decrease in cost & burden on the government.

The study was conducted in the states Gujarat, Himachal Pradesh, Karnataka and Uttara Pradesh.

Panda, A. (2013) Examined the effects of Crop insurance as adoption tool for climate change. And pointed out that Low awareness and lengthy registration process for insuring crops are cited as major roadblocks. Raising the awareness and educating the farmers about various types of insurance schemes will be critical in increasing the participation.

The study findings suggested that crop insurance should be integrated with the climate change adoption.

The study was conducted in Odisha.

Cariappa, A. A., et al., (2020) The purpose of the research is to study the impact of the crop insurance on farmers debt & income. What are the factors influencing farmers decision to opt crop insurance?

The study finds that still majority of the farmers are borrowing from money lenders paying 3 times higher interest charge than formal institutions. Majority of the farmers are not aware of the crop insurance benefits and the claim settlement is very low. The study find that Crop insurance resulted in lower farm debt and increased the income of the farmers.

The study has Recommended that more farmers should be provided formal financial assistance. Recommended Revenue based insurance over area yield insurance.

The study is based on the secondary data of NSSO house hold survey.

Ghosh et al., (2022) The study has focused on the influential factors of crop insurance. The study analyzed the farmer specific characteristics that are mostly influencing the crop insurance uptake

The study concluded that age, education, social stratification, non-farm occupation and co-risk management options such as irrigation are the influential factors in farmers uptake of insurance, while farm size has no influence in uptake. Further the study concluded female farmers are participating voluntarily in the scheme.

The research study suggested to consider meso-insured loans in case of indemnity-based insurance becomes unpopular when it will be made voluntary. In meso-insured loan lender is insured in the place of farmer. In case of yield loss lender will be directly paid.

Singh & Agrawal, (2020) The study has focused on the Evolution & current status of agriculture insurance schemes in India. The paper studied the policy interventions of the government regarding the agricultural insurance schemes over the time.

The study concluded that Agriculture insurance is key tool for managing risks but still it is not accessible for the majority of the farmers in the country. Every decade a new insurance scheme is brought up by the government but its implementation is ineffective.

The study has stressed the need of Digitalization farm records, Mobile based technology and digital knowledge, differentiated pricing strategy.

Senapati, A. K. (2020) assessed the farmers willingness to participate in rainfall insurance and to identify the socio-economic factors that influencing the insurance uptake.
The research results concluded that age and participation in a farmer association have little influence on a household's decision to engage in a rainfall insurance scheme. Education, farm experience and land ownership, awareness, off farm income, household size, have a significant influence in uptake. Education and awareness are the most influential in uptake.

The study has recommended that more formal education should be inculcated for the farmers so that they can understand and accept the insurance. The research was conducted in the state of Odisha.

Bjerge & Trifkovic, (2018) The study focused the area of influential factors and investigated the relation between the experience of extreme weather events and decision to take index insurance
The study concluded experience of extreme weather events has a positive impact on the uptake of index insurance. Previous insurance payouts, the study also found that dry weather spells have no significant impact on uptake. The research was conducted in the state of Gujarat.
Tiwari et al., (2020) The objective of the study is to present an over view of the recently Introduced crop insurance scheme, PMFBY
The study has concluded that the scheme has adopted supply side push by ignoring the demand side pull of crop insurance. Transparency issues, long delays in claim settlements operational efficiencies are keeping farmers away from demanding insurance. The study highlighted the need of delinking crop insurance from political allegiance by eventually transforming it from a political mercy-dependent approach to a market-driven environment supported by National Insurance Bank. A variety of insurance products should be offered for different needs of the farmers.

The study recommended that extension services should be aligned with crop insurance for better results. The paper recommends that institutions in agriculture sector should be given the responsibility of extension services in association with other industrial agencies as a part of corporate social responsibility. The issues of subsidy sharing between center and states should be resolved by incorporating a National Insurance Bank exclusively for to handle the crop insurance issues under the regime of NABARD.

Rao, K. N., (2002) The main objective of the study is to present the past, Present & future status of the crop insurance schemes in India. The study finds the importance of crop insurance programs as a risk mitigation tool in agriculture.
Jain & Dharmaraja, (2019) The objective the study is to do literature review over different mathematical techniques for crop insurance all over the world
The study concluded that designing a practical crop insurance program in India is challenging due to the absence of earlier yield data, the small size of farmers' land, the low value of the crops, and the hefty crop insurance price. Farmers perception is also one of the issues in crop insurance adoption.

Rajeev et al., (2016) Studied the effectiveness of crop insurance and analyzed the current status of crop insurance in India.
The study results concluded that only 4% of households have taken the crop insurance, Lack of Information is the major obstacle in uptake, it is also found that majority of the households are uninterested due to its poor and unattractive design. The regression analysis of the study also reveals that both economically and socially advanced classes exhibit higher adoption rates. From the sample of the study, it is also found that 40% of the farmers are not interested in taking insurance. The reason behind this is area-based approach. Farmers feels that they are paying premium unnecessarily
In this context, it is critical to gain the trust of farmers while developing insurance schemes The premium impacts of an individual-based insurance policy should also be examined; otherwise, the entire effort will be futile. Developing Non-farm activities also need of the hour for reducing risk in agriculture.

Kaur, S, et.al (2021) This research paper has comprehended the various characteristics of crop insurance policies in India, as well as to assess the Pradhan Mantri Fasal Bima Yojana's (PMFBY) effects on Indian farmers.
The regression results of the study concluded that premium has a significant effect on the farmers insurance, and the subsidy had little impact on farmers' participation in the insurance scheme.
Jha, N., et.al (2021) The paper tried presented an efficient, Affordable, low-cost crop insurance solution by using blockchain technology. The study designed and created a decentralized crop insurance mechanism based on the developing blockchain technology. The suggested and built system will reduce the need for middlemen while also ensuring openness in the agriculture finance sector.

Kumar, K. N. R., & Babu, S. C. (2021).This research has examined the influence of a WeatherBased Crop Insurance Scheme (WBCIS) on the Technical Efficiency (TE) of smallholder groundnut farmers in India in the context of climate change.

The study concluded that Engagement of smallholder farmers in the WBCIS has improved the technical efficiency of groundnut output. Despite the fact that the WBCIS protects farmers against weather-related hazards, it has yet to gain momentum. This is due to the complex procedure required to participate, the technical limitations involved in developing indices for various weather parameters, and the fact that the scheme only tends to cover weather-related risks and payments are made only for adverse weather deviations, rather than yield shortfalls.

The study has recommended the following:
Greater awareness and understanding about the WBCIS should be improved among farmers. WBCIS should cover more weather parameters or more perils. Refining the design of the WBCIS (shorter claim settlement periods, greater transparency, and ease of enrollment) premium should be refunded if no claims are made in past. The study has been conducted in the state of Andhra Pradesh.

Cariappa, A. G., et.al (2019) The main objective of the study is to find out the farmers preferences and perception on the recent scheme. PMFBY
The study found that the scheme has some gross root level issues such as low education among the farmers, Claim settlement issues, and transparency issues.

The study has recommended the need of establishing local level offices this will help in clarifying the quires related to the schemes.

Aditya, K. S., & Kishore, A. (2018) The objective of the paper is to identify the most influential factors in purchasing the crop insurance and to find its impact on farm revenue and production expenses.
The study results find that adoption of crop insurance is low in Rabi season in comparison with the Kharif season. Formal training in Insurance products and experience in the crop losses have higher probability in adoption of crop insurance. Lack of awareness is the most influential factor for low uptake. Subsidies have a positive impact on adoption, Access to the extension services and education are playing key role in insuring. Farmers from lower castes and tenants are less likely to buy crop insurance
The study recommended that agriculture extension mechanism needs to be improved, it has the potential to increase the awareness. Crop insurance programme redesign should take into account issues of inclusion with regard to tenant, small and marginal farmers. The study is based on NSSO- house hold survey
Duhan, A., & Singh, S. (2017) The study aims to explore the informational sources awareness regarding crop insurance scheme, The study also attempts to determine the influence of education on information sources.
The study find that Lack of literacy is the major barrier in obtaining information from different sources. And awareness about the sources is also found be low among the respondents. Most of the farmers are aware by fellow farmers and relatives, banks and financial institutions are also playing a key role in awareness.
The study recommended that Infrastructure facilities needs to be improved so that farmers awareness level can be increased.
The study has been conducted in the state of Haryana.
Haque & Khan, (2017) This study analyses farmer's sensitivity to crop yield loss in India
The study find that crop loss is major due to drought/inadequate rainfall and small landholdings poor irrigation facilities.

Combining micro finance and social protection schemes with crop insurance would attract the private players to invest in the sector. The study highlighted the need of implanting agency for monitoring crop insurance schemes.

Varadan, R. J., & Kumar, P. (2012) The objective of the study is to find crop insurance impact on rice farming In Tamil Nādu.
The study found that AICL has succeeded in implementing the most complex program. Crop insurance is able to mitigate the production risk efficiently. Farmers started growing a few profitable crops instead of adopting new resources and techniques for many crops.

Rathore, V. S., et.al (2011) To study the performance of crop insurance schemes in Udaipur district of Rajasthan.
The study results shows that farm revenue is higher in insured families farms compared to the uninsured farms. The study found the positive growth of crop insurance. The beneficiary farmers used more inputs because of guaranteed compensation in the event of losses. the study found that farmers are satisfied with the scheme. They have expressed dissatisfaction with the delayed payment of claims, the current framework for determining compensation, and the inadequate payout of compensation.

Observations and suggestions: From reviewing the above literatures, it has been found that despite its potential for managing farmers risk, crop insurance reached very less population. Policy designing & its implementation are the key reasons for the low reach of crop insurance. Studies can be undertaken in designing policies of crop insurance and its implementation. There is a huge miss match between the crop cutting experiments and the actual yields one can undertake the research on alternative mechanism such as remote sensing over crop cutting experiment procedures. indemnities are not reaching the farmers in time it is also one of the major reasons for low uptake (Ghosh et al., 2021).

Low awareness and lengthy registration process for insuring crops are cited as major roadblocks crop insurance can be integrated with the climate change adoption (Panda, 2013). Research can be done to make the crop insurance procedure simple and understandable. Most of the researches has been conducted to find out the reasons for low awareness and they found that education is the major reason for low awareness. Meso-insured loans are one of the alternatives if indemnity-based insurance becomes unpopular when they are made voluntary (Ghosh et al., 2022). There is a scope for studying the meso-insured loans effectiveness on the farmers.
There is an urgent need of more formal education among the farmers so that they can understand and accept the crop insurance. These can be possible only with the help of agriculture extension services one can study the extension services and their role in crop insurance promotion in the country (Aditya and Kishore, 2018).

Experience of extreme weather events has a positive impact on the uptake of index insurance (Bjerge and Trifkovic, 2018). There is a need of educating farmers regarding this adverse event and their impact on their lives so that can actively participate in insurance schemes. One can undertake the impact of these adverse events and insurance role in reducing this. lack of motivation and information from officials is also one of the problems in crop insurance (Duhan and Singh, 2017).
The recent scheme PMFBY has concentrated more on supply side by ignoring the demand side of crop insurance. There is a strong need of delinking crop insurance from political allegiance by eventually transforming from a political mercy-dependent approach to a market-driven environment supported by National insurance bank (Tiwari et al., 2020).

Farmers perceive insurance as an additional cost rather than seeing it as a risk management tool, this view needs be changed among the farmers, it is not possible without the formal education and awareness. Some of the studies highlighted the need of revenue-based insurance over area yield insurance (Cariappa et al., 2020). Majority of the researches identified that most of the farmers are not aware of the insurance. Earlier researches stressed the need of the extension services alignment with the crop insurance benefits for better results (Tiwari et al., 2020). absence of earlier yield data, the small size of farmers' land, the low value of the crops, and the hefty crop insurance price are the key reasons for the low uptake of insurance (Jain and Dharmaraja, 2019).

The studies identified that crop insurance policies have poor and unattractive design. Crop insurance programs should be redesigned by taking into consideration of tenant, small and marginal farmers (Rajeev et al., 2016)

Infrastructure facilities needs to be improved so that farmers awareness level can be increased (Duhan and Singh, 2017). The agencies implementing crop insurance expressed that lack of staff, lack of coordination among them and hinderance to their routine functions were the major constraints. A Separate entity should be created for implementation and monitoring. Dedicated offices are needed at district level for effective implementation.
To determine the actual losses, a precise framework should be developed (Rathore et al., 2011). This will assist in minimizing the government's financial burden (Ghosh et al., 2021). Asymmetric information, Moral hazard, Adverse selection are the major roadblocks for the development of crop insurance (Panda, 2013). These should be reduced to nominal cost nonfarm activities also need of the hour for reducing risk in agriculture.

Scope for further researches:
The researcher finds out the following research gap from the reviewed literature on agriculture insurance in India. These gaps will help the future research scholars and academicians for further investigation
One of the major reasons for low insurance up take is lack of awareness, a few researches has been conducted in this area. Future researchers can focus in this area.
Lack of information access is the major roadblock for the uptake. Further research is need of hour to improve the information access to the farmers.
A few studies have been made on the adverse selection and moral hazard in Indian context. There is a vast scope for future research in this area.
Policy design and its implementation has gained very low attention. Further research in this area will help the government and policy designers in designing flaw free polices.
Delayed indemnities and getting no indemnities even for the losses making the farmers to lose faith in the crop insurance and hindering its growth. The solution for these issues can be solved by the future research.

Meso-insured loans are the one of the alternatives in case of crop insurance fails to reduce the risk of the farmers. These needs to be proved theoretically.
Majority of the researches have concentrated on demand side of crop insurance. No studies have concentrated on the supply side of the crop insurance. This gap is needs to be filled.
Revenue based insurance is the new era of crop insurance in developed countries. No studies have concentrated on the revenue insurance in the Indian context and its potential in India.
India is the unique country in the world has all type of weather conditions and different geographical diversity. A single type of insurance scheme will not serve the desired purpose of crop insurance and differentiated insurance schemes are needed for different regions. Future researchers have to concentrate on developing differentiated and individual specific crop insurance policies.
A combination of area based, Yield and revenue insurance is the need of the hour. Studies have to be conducted to find out the potentiality of these combination insurances in risk reduction.

Majority of the farmers treat crop insurance as an expenditure rather than seeing it as an investment. Premium refund for successive no claims will be a solution for this problem in depth investigation is required to implement these types of policies.

Subsidies, their impact in uptake and their role in expansion of the program in the Indian context needs further research.
More studies needs be made in infrastructure, legal & regulatory environment of agricultural insurance.
A detailed comparison between Indian & developed countries insurance programs is missing the literature this will help in solving the issues and challenges of crop insurance.
Government intervention role in development of private sector insurance can be studied in depth
A detailed study of experiences of yield, area, revenue and individual based insurances performances can be compared to find the effective insurance scheme.

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