

# Farmer Producer Organizations: A Bibliometric Analysis

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Received: 13 Jan 2024; Revised accepted: 20 Mar 2024; Published online: 02 Apr 2024

## Abstract

Farmer Producer Organizations (FPOs) are the institutional progeny of cooperative institutions. Emerging small and marginal landholdings encountered unique and complex problems and experienced intricacies in the existing support system, which the cooperatives could not address effectively. Thus, the FPOs emerged as a needed new institutional model to understand and remedy the issues of the farmers and agriculture system as a whole. India, China, Africa, and Europe have taken a lead role in promoting the FPOs for the welfare of farmers and the betterment of agriculture. Comprehensively, the studies on FPOs focus on various areas that are not properly researched and documented. Bibliometric analysis essentially caters to the needs of the researchers in identifying the themes of the studies conducted on the FPOs. The present study has selected 70 research papers on the FPOs and adopted bibliometric tools i.e. co-word, network, cluster, and thematic analysis. The study has identified the themes - smallholder, collective action, agricultural development, agricultural worker, commodity market, and supply chain management. The clusters that the studies are grouped are – smallholder, income, agricultural land, food supply, and livelihood. The themes and clusters identified from the studies indicate the evidence for future research and intervention.

**Key words:** FPOs, Smallholder, Collective action, Supply chain management, Bibliometric analysis

Global glimpses of the transition from cooperative institutions to farmer-producer organizations indicate a historical phenomenon. Collectivization of farmers took a public campaign mode through mobilizing the farmers to protect their interests and cooperatively own the means of production. The cooperative movement, which originated in the early 19th century, aimed to provide its members with affordable food and other necessities, inspiring the creation of cooperatives worldwide. In the United States, the cooperative movement gained momentum in the late 19th century, with farmers and rural residents forming cooperatives to purchase supplies and market their products, thereby gaining more control over their economic destiny. Throughout the 20th century, cooperatives expanded in various sectors and were crucial in promoting economic development and reducing poverty, especially in developing countries.

Smallholder farmers are vital contributors to global food production and rural economies, yet they face significant challenges that impede their productivity, profitability, and overall well-being. The emergence of Farmer Producer Organizations (FPOs) presents a promising solution to address these challenges and empower smallholder farmers [1-2]. FPOs serve as platforms for farmers to collectively address common obstacles and provide access to inputs, services, market linkages, bargaining power, risk mitigation, and capacity building.

Several measures can be implemented to enhance the effectiveness of FPOs. Firstly, governmental and developmental support is essential, including financial

assistance, infrastructure development, and policy reforms [3]. FPOs should also share knowledge and collaborate with research institutions and agricultural stakeholders to stay updated with innovations and sustainable practices [4-5]. Successful FPO models should be scaled up and replicated in different regions to reach larger smallholder farmers [6-7]. By implementing these measures, FPOs can effectively support and empower smallholder farmers, contributing to improved livelihoods and agricultural productivity.

At this background, the bibliometric analysis explores the scholarly landscape surrounding FPOs, examining publications, authors, journals, and thematic clusters. By synthesizing existing research, we identify key trends, gaps, and opportunities in FPO research to inform policies, practices, and interventions for smallholder farmers and sustainable agricultural development. The concept of FPOs in India can be traced back to the early 2000s when governmental and non-governmental organizations began to explore ways to address small and marginal farmers' challenges. Small and marginal farmers form FPOs nationwide to improve their bargaining power, increase access to inputs and services, and enhance their income and livelihoods [8-9]. Small and marginal landholdings, a unique feature of Indian agriculture, demand a leading and hand-holding support system in a collective mode. Advancements in agricultural techniques and technologies are brought under the government support system to promote agriculture and support the farmers. Earlier, the complex institutions for credit and market support to the farmers tended to be governed by the intricacies of macro policies and

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procedures [10-12]. Thus, a hybrid mode of the cooperatives and the companies felt imperative in the form of FPOs.

Therefore, the primary aim of the study is to retrieve the literature on the FPOs from the databases and analyze the studies to present the quality of the articles and impact of the journals in generating a solid knowledge base that guides further research, provides evidence for interventions and enable to undertake corresponding initiatives to show change or outcome.

At this behest, the present study intends to contribute in the following ways:

- *Identify emerging research trends:* Analyze the bibliometric data to identify emerging themes and clusters within the literature on FPOs, thereby understanding the current research landscape and predicting future research directions.
- *Evaluate author contribution and impact:* Assess the contribution and impact of key authors in the field of FPO research by examining citation counts, authorship trends, and collaboration networks, aiming to recognize influential voices and collaborations driving knowledge generation in this domain.
- *Assess journal impact and publication trends:* Evaluate the impact of journals publishing FPO-related research by analyzing bibliometric indicators such as citation counts, H-index, and publication trends over time, aiming to identify high-impact outlets and dissemination patterns in the field.
- *Explore cluster analysis and thematic mapping:* Explore cluster analysis and thematic mapping techniques to understand the interrelationships between research topics and themes within FPO literature. This aims to uncover underlying patterns and connections that can inform future research agendas and interdisciplinary collaborations.

## MATERIALS AND METHODS

### *Data collection*

Bibliometric review is gaining impetus in social science research to understand the quality of papers published and the quality of journals that published high-quality research papers. Further, the focus is on the knowledge framework and domains that inherently show interconnectedness and identify the focus of themes and clusters of knowledge domains observed in the studies. The present bibliometric review reflects on the impact of the knowledge that can be linked for further research and practice to change or modify the condition.

In the present study, 70 research papers with an empirical nature have been selected for bibliometric analysis. The knowledge that the research studies contributed is aptly analyzed through the bibliometric techniques for citation analysis, co-citation analysis, and bibliographic coupling. The bibliometric analysis, therefore, has the upper hand over the descriptive and narrative type of studies that are not as robust as the bibliometric studies. The review also found that no bibliometric study was conducted on the FPOs.

### *Inclusion criteria of the studies*

1. *Focus on FPOs:* Research studies must primarily focus on farmer-producer organizations, examining their establishment, organization, operation, and outcomes within the agricultural sector.

2. *Relevance to structure, functions, and performance:* Studies should address aspects related to the structure, functions, and performance of FPOs. This includes but is not limited to, the organizational structure of FPOs, their roles, and

functions in agricultural development, and their performance in achieving their objectives.

3. *Scope of analysis:* Research studies may encompass various dimensions of FPOs, such as their impact on smallholder farmers, market linkages, financial sustainability, governance structures, and policy frameworks.

4. *Methodological rigor:* Studies selected for inclusion should demonstrate methodological rigor, employing sound research methodologies and analytical approaches to generate valid and reliable findings.

5. *Publication source:* Research studies must be published in reputable academic journals, conference proceedings, or scholarly books, ensuring the credibility and quality of the research output.

### *Exclusion criteria of the studies*

1. *Focus on cooperative societies and companies:* Studies primarily focusing on cooperative societies or companies, without specific emphasis on FPOs, are excluded from consideration. While cooperative societies and companies may share similarities with FPOs in some aspects, research studies must specifically address FPOs to be included.

2. *Irrelevant topics:* Research studies that do not directly relate to the structure, functions, or performance of FPOs are excluded. This includes studies on unrelated agricultural practices, non-agricultural cooperatives, or topics outside the scope of FPOs.

3. *Methodological limitations:* Studies with significant methodological limitations or flaws that undermine the validity and reliability of the findings are excluded. This includes studies with insufficient sample sizes, biased data collection methods, or inadequate analytical approaches.

4. *Publication source:* Research studies published in non-peer-reviewed sources, predatory journals, or sources lacking academic credibility are excluded. Only studies published in reputable academic journals, conference proceedings, or scholarly books are considered for inclusion.

5. *Geographical limitations:* Studies focusing exclusively on FPOs in geographical regions or contexts outside the scope of interest (e.g., regions with vastly different agricultural systems or policy frameworks) may be excluded to ensure the relevance and applicability of the findings.

Research studies that focused on cooperative societies and companies were left out of the purview of the present study.

### *Data collection and processing*

The dataset, comprising 70 documents, was collected from the prestigious Scopus database, which aggregates research from a wide range of scholarly sources, including journals, books, and other publications. From 2012 to 2023, the dataset provides a comprehensive overview of academic research in various fields. The considered period for the study is indicative of the research works conducted during the period. The annual growth rate of 13.43% indicates that the dataset reflects the continuous influx of new research into Scopus, ensuring its relevance and up-to-date coverage. The average age of the documents, at 3.27 years, further confirms the timeliness of the datasets, making it a valuable resource for researchers seeking current scholarly information. Moreover, the impressive average citation counts of 7.986 per document underscores the impact and recognition of the research

contained within the dataset. This suggests that the documents in the dataset have made notable contributions to their respective fields, attracting scholarly attention and citations from other researchers.

In terms of content, the dataset includes 155 unique Keywords Plus (ID) and 241 Author's Keywords (DE), providing a rich and diverse set of keywords that represent the breadth of topics covered by the included documents. The dataset features contributions from 181 authors, indicating a collaborative effort in producing the research. Among the documents, ten were authored by a single individual, highlighting the presence of single-authored works. Additionally, there are 13 single-authored documents indicating the independent contributions of specific authors. Collaboration is a prominent aspect of the dataset, with an average of 2.93 co-authors per document. Furthermore, the dataset showcases international collaboration, as approximately 15.71% of the collaborations involve authors from different countries, highlighting a global perspective and the exchange of knowledge across borders. The document types within the dataset are varied, with articles comprising the majority (61), followed by reviews (6) and book chapters (3), reflecting the focus on original research and critical analysis within the Scopus database.

## RESULTS AND DISCUSSION

### Journal co-citation analysis

The (Table 1) lists several academic journals in the field of economics and rural development along with their h-index, g-index, m-index, total citations (TC), number of publications (NP), and the year of the first publication (PY start).

The (Table 1) implies that the Economic and Political Weekly has the highest h-index among the listed journals (3), while several journals have a lower h-index of 2 or 1. This suggests that the Economic and Political Weekly has published more highly cited articles than the other journals. Looking at the table, we can see that the top journal in terms of h-index is "Economic and Political Weekly" with an h-index of 3, while the top journal in terms of g-index is "Environment and Planning a" with a g-index of 2. The journal with the highest m-index is "Journal of Agribusiness in Developing and Emerging Economies," with an m-index of 1 [13-14].

Other journals in the table also have relatively high impact measures, such as "World Development," "Journal of Rural Studies," and "Food Policy." These journals have published many articles and been cited many times, indicating their influence in their respective fields [15].

Table 1 Most impactful journals (Number:70)

Element	H_index	G_index	M_index	TC	NP
Economic and political weekly	3	5	0.375	33	7
Environment and planning a	2	2	0.16666667	84	2
International Journal of Rural Management	2	3	0.5	12	5
Journal of agribusiness in developing and emerging economies	2	2	1	7	3
Journal of Rural Studies	2	2	0.28571429	45	2
World development	2	2	0.66666667	11	2
Cooperatives, economic democratization, and rural development	1	1	0.125	2	1
Development policy review	1	1	0.16666667	16	1
Economia agro-alimentare	1	1	0.09090909	7	1
Environment, development, and sustainability	1	1	0.33333333	25	1

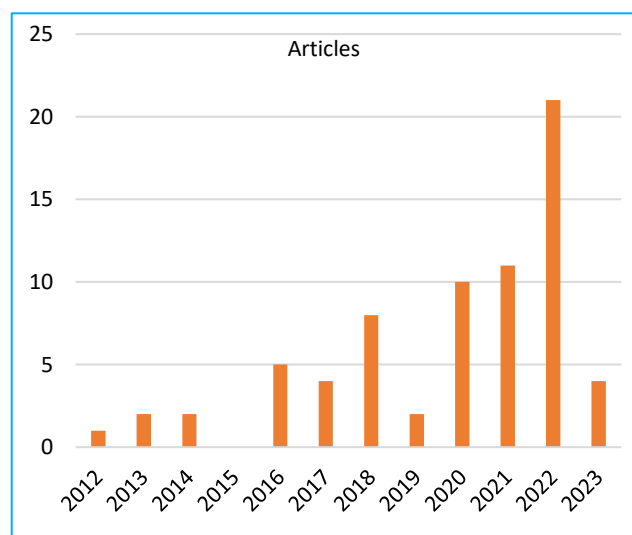


Fig 1 Year-wise publications of the papers

The papers were selected from 2012 to 2023 for the present study. A good number of publications came from 2020 onwards. Several publications on FPOs were published in 2022.

The (Table 2) shows the number of articles published by different authors and the corresponding fractionalized articles.

For instance, Corsi S has published four articles; the corresponding fractionalized articles are 1.416666667. Singh R has published four articles; the corresponding fractionalized articles are 1.083333333. Singh S has published four articles, and the corresponding fractionalized articles are 4. Similarly, Kumar S has published three articles; the corresponding fractionalized articles are 1.083333333. Orsi L has published three articles; the corresponding fractionalized articles are 0.916666667. Trebbin A. has published three articles, and the corresponding fractionalized articles are 1.833333333.

Table 2 Fractional analysis of authors

Authors	Articles	Articles fractionalized
Corsi S	4	1.416666667
Singh R	4	1.083333333
Singh S	4	4
Kumar S	3	1.083333333
Orsi L	3	0.916666667
Trebbin A	3	1.833333333
Bhamoriya V	2	0.666666667
Bharti N	2	0.583333333
De Nonii	2	0.583333333
Dey K	2	1.5

Table 3 Citation analysis of papers

Paper	DOI	Total citations	TC per year	Normalized TC
Trebbin A, (2014). Food policy	10.1016/j.foodpol.2013.12.007	88	8.8	1.833333
Trebbin, (2012). Environ plan a	10.1068/a44143	51	4.25	1
Liverpool-tasie Iso, (2020). Nature sustains	10.1038/s41893-020-00621-2	37	9.25	5
Krishnan R, 2021, Resource conserve recycle	10.1016/j.resconrec.2020.105253	33	11	4.125
Tregear, (2016). Environ plan a	10.1177/0308518X15607467	33	4.125	2.29167
Pauls T, (2013). Singap J Trop Georg	10.1111/sjtg.12026	28	2.54545455	1.6
Jose A. (2020). J adv manage res	10.1108/JAMR-02-2019-0010	27	6.75	3.648648
Chaudhuri S, (2021). Environ dev sustainability	10.1007/s10668-020-00762-6	25	8.33333333	3.125
Mishra PK, (2018). J Rural Stud	10.1016/j.jrurstud.2018.09.020	23	3.83333333	2.830769
Orsi L, 2017, J Rural Stud	10.1016/j.jrurstud.2017.02.011	22	3.14285714	1.872340

The (Table 3) provides information about the citation metrics of 10 research papers, including their DOI (Digital et al.), the total number of citations they have received, the average number of citations per year, and the normalized total citation (TC) score. The normalized TC score is calculated by dividing the average number of citations per year by the geometric mean of the number of years since publication and dividing that result by the average normalized TC score of all

papers in the dataset. This metric allows for comparing the impact of papers published in different years by considering the years since publication [16-17]. The (Table 3) indicates that the paper with the highest total citations is “Trebbin a, 2014, Food Policy,” with 88 citations. However, when considering the normalized TC score, “Liverpool-tasie Iso, 2020, Nature sustain” has the highest score of 5, indicating that it has a relatively high impact compared to other papers in the dataset.

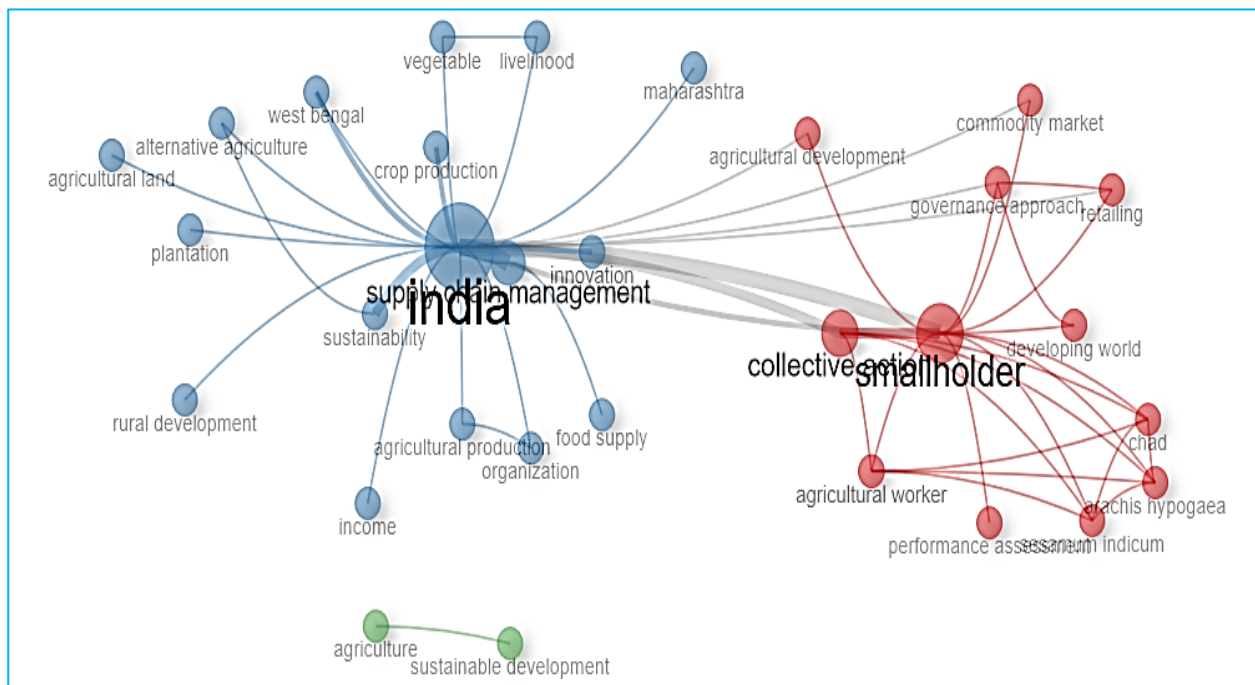


Fig 2 Co-word networking analysis

Table 4 Co-word networking

Node	Cluster	Betweenness	Closeness	Pagerank
Smallholder	1	113.184343	0.02325581	0.11134078
Collective action	1	26.3434343	0.01960784	0.05305095
Agricultural development	1	0	0.01818182	0.01757193
Agricultural worker	1	0	0.01515152	0.0334497
Commodity market	1	0	0.01818182	0.01757193
Developing world	1	0	0.01449275	0.01753809
Governance approach	1	4.72222222	0.01886792	0.03192658
Arachis hypogaea	1	0	0.01515152	0.0334497
Chad	1	0	0.01515152	0.0334497
Performance assessment	1	0	0.01428571	0.01075369
Retailing	1	0	0.01851852	0.02435633
Sesamum indicum	1	0	0.01515152	0.0334497
India	2	291.229076	0.02857143	0.22059028
Supply chain management	2	28.5209235	0.01923077	0.04810123
Innovation	2	0	0.01612903	0.01506608



The (Table 4) appears to show network metrics for different nodes in a graph. Each row represents a node in the graph, and the columns show various metrics such as the cluster to which the node belongs, betweenness centrality, closeness centrality, and PageRank. The nodes in the table seem to be related to agriculture, with some examples being smallholder, collective action, agricultural development, agricultural workers, commodity markets, and supply chain management. The table also includes location-based nodes such as India, West Bengal, and Maharashtra and some related to specific crops like *Arachis hypogaea* and *sesamum indicum*.

The (Table 5) provides information about the co-citation network of authors in a particular field. Each row represents an

By looking at these measures, we can observe the network. For example, nodes with high betweenness centrality, such as Pustovoitova N. 2011 and Penrose-Buckley C. 2007, play an essential role in connecting different clusters in the network. Nodes with high closeness centrality, such as Hellin J. 2009-2, are more central in the network, as they have more direct connections to other nodes. Nodes with high PageRank, such as Markelova H. 2009-1 and Bernard T. 2009, are more critical in the network as they are connected to other critical nodes. The PageRank column indicates the importance of an author in the network based on the number and quality of their connections to other authors. An author with a high PageRank score is highly cited by other essential authors in the network and is therefore considered influential.

Node	Cluster	Betweenness	Closeness	PageRank
Pustovoitova N. 2011	1	31	0.005291005	0.026814931
Trebbin A. 2012-3	1	0	0.002906977	0.023279624
Penrose-Buckley C. 2007	2	31	0.005586592	0.025628192
Trebbin A. 2012-1	2	0	0.002994012	0.022439017
Trebbin A. 2014-1	3	106.234781	0.00625	0.025802697
Cherukuri R. R. 2014	3	82.29956951	0.005952381	0.02277433
Markelova H. 2009-1	4	118.7510217	0.007042254	0.080336124
Bernard T. 2009	4	137.7426228	0.007462687	0.075359192
Barham J. 2009-1	4	6.670601068	0.004504505	0.057328397
Kaganzi E. 2009	4	5.969596716	0.004545455	0.062409822
Hellin J. 2009-1	4	44.63333333	0.005291005	0.03898649
Roy D. 2008	4	89.17084907	0.006369427	0.022908332
Shiferaw B. 2011	4	54.91810358	0.006944444	0.032554264
Fischer E. 2012-1	4	0.831746032	0.004132231	0.037684821
Narrow C. 2009	4	0.024464832	0.004132231	0.031774568

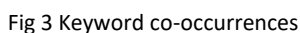


Table 6 Cluster list

Cluster	Callon centrality	Callon density	Rank centrality	Rank density	Cluster frequency
Smallholder	2.25462963	102.719907	6	6	48
Income	0.25	75	3.5	4.5	6
Agricultural land	0	62.5	1.5	3	4
Food supply	0.5	110	5	7	10
Livelihood	0	75	1.5	4.5	4

### Cluster analysis

The (Table 6) includes six columns, each representing a different measure of the clusters. The (Table 6) provides a snapshot of the relative importance, connectivity, and density of different clusters or topics related to FPOs. The Callon measures used in the analysis can help identify areas of research that are currently underrepresented and track changes. The clusters identified are smallholder, income, China, India, agricultural land, food supply, and livelihood.

#### Cluster 1: Smallholder

Despite their crucial role in global food production and rural economies, smallholder farmers face significant challenges that hinder their productivity, profitability, and overall well-being. However, the emergence of Farmer Producer Organizations (FPOs) provides a promising model to address these challenges and empower smallholder farmers. These FPOs serve as platforms for farmers to collectively address common obstacles and provide access to inputs, services, market linkages, bargaining power, risk mitigation, and capacity building. By enhancing the effectiveness of FPOs, smallholder farmers can gain further support and benefits [18].

#### Cluster 2: Income

Income is a pivotal factor in farmers' livelihoods, particularly in countries like India, where a significant proportion of the population depends on agriculture. Farmer Producer Organizations (FPOs) play a vital role in tackling the obstacles faced by farmers, such as limited access to inputs, extension services, and market value chains. By organizing farmers into groups, FPOs offer numerous advantages to income generation. These include reducing transaction costs, providing technical assistance, and fostering social capital, which enhances farmers' ability to access resources and seize market opportunities. By facilitating collective action and fostering collaboration, Farmer Producer Organizations (FPOs) empower farmers to improve their income potential and achieve economic sustainability [19-20].

#### Cluster 3: Agricultural Land

Organizing farmers into groups like Farmer Producer Organizations (FPOs) has the potential to address various challenges faced by farmers, with a particular focus on agricultural land. Farmer Producer Organizations (FPOs) can improve access to inputs, extension services, and different market value chains for farmers, including women farmers. By working together as a collective, farmers in FPOs can benefit from economies of scale, leading to lower transaction costs and improved technical assistance in agricultural production. FPOs enable smallholder farmers, including women farmers, to overcome various challenges they face in agricultural production and marketing by fostering collective action, enhancing bargaining power, and promoting inclusive development. Moreover, FPOs can create social capital by fostering networks and collaborations among farmers [21-22].

#### Cluster 4: Food Supply

Farmer Producer Organizations (FPOs) have the potential to impact the food supply system significantly. These organizations can address various challenges of farmers including women farmers, face in accessing inputs, extension services, and different market value chains [23].

#### Cluster 5: Livelihood

Farmer Producer Organizations (FPOs) can significantly impact livelihoods by addressing various challenges farmers face. These organizations offer benefits such as lower transaction costs, technical assistance, and the creation of social capital through economies of scale [24]. Sociocultural norms, gender perceptions, and access to resources and information should be considered barriers to women's participation [25]. Governments should develop strategies and policies to incentivize women's enrolment in FPOs by reducing membership fees and providing financial benefits.

### Research trends and topics

In conducting cluster analysis, researchers label the clusters based on the most frequent and representative words or themes within them. For instance, the most prominent clusters in the text are "smallholder" and "income." "Smallholder" is related to small-scale agriculture, as evident from the words in the cluster, such as "collective action," "commodity market," and "crop production." Meanwhile, "income" is related to economic well-being, with words such as "rural area," "poverty alleviation," and "performance assessment" appearing in the cluster. Other labelled clusters include "China," "India," "agricultural land," "food supply," and "livelihood," with corresponding themes based on the words within each cluster.

Cluster frequency is also a vital aspect of the analysis, indicating how often the words within the cluster appear in the text. The most prominent clusters, such as "smallholder" and "food supply," have high frequency and are highly connected and dense. Conversely, "income" has low connectivity and interconnectivity values, indicating it is less connected to other clusters and has less interconnectivity within itself. Furthermore, the frequency of occurrence column shows that "smallholder" is the most frequent, appearing 48 times in the corpus, followed by "food supply," appearing ten times, while the other clusters have six or fewer occurrences.

The lower-right quadrant states the basic themes that are foundational concepts or subtopics like supply chain management and innovation that support the core research areas pertaining to the Farmer Producer Organizations (FPOs). The lower-left quadrant includes "emerging or disappearing themes," representing novel or declining areas of research interest. The themes identified are agricultural land and plantation. These themes have a moderate keyword density and centrality. The upper-left quadrant contains "very specialized/niche themes," focusing on highly specific subdomains within the field like livelihood, income, rural area and rural development. These themes have a high keyword density but low centrality. They represent particular subtopics or niche areas within the field. While these themes may not be widely studied or cited, they are distinctive and cater to a

specialized audience. The upper-right quadrant denotes the themes like food supply, agriculture production, agriculture, smallholder, collective action and agricultural development. These very specialized themes often focus on unique aspects, specific populations, or specialized methodologies. By examining the distribution of themes within these quadrants, researchers can gain insights into the structure and dynamics of the research field. Themes like food supply, agricultural

production, and agricultural development are likely to represent core areas of research within the field. These topics are fundamental to understanding the dynamics of agriculture and its impact on food security, economic development, and environmental sustainability [26]. This analysis helps identify core areas, foundational concepts, emerging trends, and highly specialized subdomains, enabling a comprehensive understanding of the literature [27].

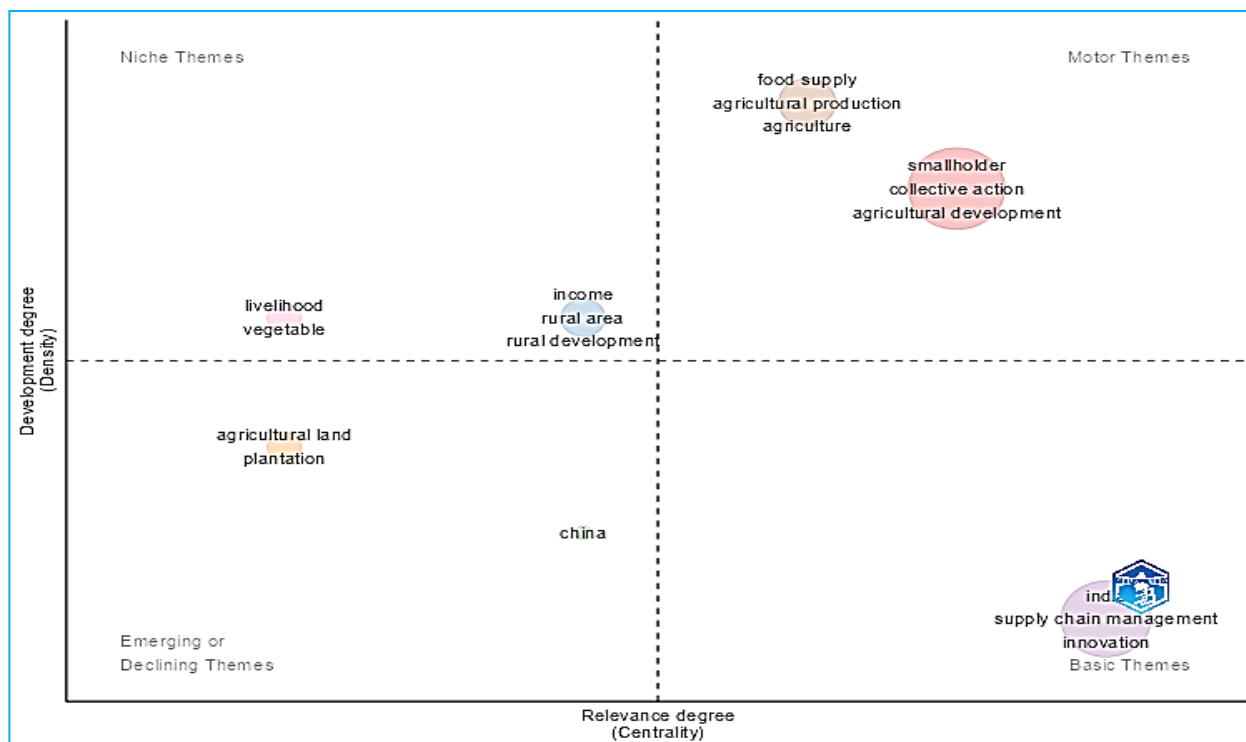


Fig 4 Thematic map

## CONCLUSION

The bibliometric analysis of Farmer Producer Organizations (FPOs) sheds light on various critical aspects of research and scholarship in this field. Significant insights have been gained into the evolving landscape of Farmer Producer Organizations (FPO) research by examining publications, authors, journals, and thematic clusters. The analysis identified key themes such as smallholder empowerment, income generation, agricultural land management, food supply chain dynamics, and livelihood enhancement, highlighting the multifaceted nature of Farmer Producer Organizations (FPO) interventions. Moreover, identifying influential authors, top journals, and impactful publications underscores the scholarly

contributions driving advancements in FPO research. By understanding the network of connections between different thematic clusters, researchers can pinpoint areas of collaboration and gaps in knowledge, thereby informing future research directions and interventions. Additionally, the analysis provides valuable guidance for policymakers, practitioners, and stakeholders seeking evidence-based strategies to support FPOs and promote sustainable agricultural development. Overall, the bibliometric analysis serves as a valuable tool for synthesizing existing knowledge, identifying research trends, and guiding future initiatives aimed at enhancing the effectiveness and impact of farmer producer organizations in addressing the challenges faced by smallholder farmers and promoting inclusive agricultural development.

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