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Agribusiness management in India: A review-based approach and future agenda

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Abstract

This study is a review-based approach that examines agribusiness management in India during this era of disruptive innovation and over recent years. Utilizing the advanced search option available in the Scopus database, relevant scholarly articles are fetched using keywords such as "agri-business management," "agriculture business management," "agricultural management," "agribusiness," "Agritech," and "farm management" in the context of India. The study aimed to find the key themes, trends, and gaps in the existing literature. Through an SLR, the researchers explore the advancements in agribusiness practices, technological innovations, and market dynamics in the agribusiness sector in India. Using the PRISMA framework, papers were filtered systematically, and only relevant papers were included for the study. A total of 74 papers were included in the study. Using Python libraries, topic modeling was performed, and the papers were clustered according to the themes. Five themes were discussed along with the synthesis of a few selected papers. The findings of the study would be very useful to the institutes teaching agribusiness management and for practitioners to guide the sector in the right direction. A few best practices from other countries were discussed in this article to provide a global perspective.

Keywords: Agribusiness, Agritech, Farm management, India.

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1. Introduction

1.1. Overview of Indian Agriculture Industry

Food production is particularly vital in light of the expected increase in the global population [1, 2]. Farming as a business and owning a business significantly enhance income and economic well-being in rural areas. The business and shop ownership play a key role in reducing poverty [3, 4]. Agribusiness is crucial for the sustainable economic growth of rural areas by meeting daily needs. In South Asia, the countries share similar societal structures, resources, climates, practices, and close-knit populations [5, 6]. Following Independence, the agricultural sector and food production experienced significant growth due to various pioneering schemes introduced by the Government of India [7, 8]. Factually, Indian farmers have struggled with debt, and the situation has changed little over time. The support of the Indian government doubled farmers' income by transforming agriculture from a survival activity into a profitable enterprise. This involves promoting agribusiness and entrepreneurship to create a stable and prosperous rural economy, supported by favorable policies and programs [9, 10]. In 1950-1951, India's food grain production was low at 50.8 million tons. Due to the efforts of farmers, agricultural scientists, and supportive government policies, food production increased significantly, leading to the Green Revolution. This agricultural success also spurred similar growth in other sectors, including the White Revolution (milk production), the Yellow Revolution (edible oilseed production), and the Pink Revolution (meat and poultry production) [11, 12]. The agro-industry has undergone a significant shift from agriculture to agribusiness. Current trends such as trade liberalization, have made a shift in the industry [13, 14].

1.2. Sustainable Agribusiness

The agriculture industry is struggling due to rising food demand, food security concerns, climate conditions, and regulatory challenges. The use of chemical fertilizers contributes to greenhouse gas emissions and high water consumption. So, agricultural systems need to be technology-shifted in a more resilient and sustainable way. Regenerative agriculture, which focuses on long-term organic farming, will offer a promising solution to these problems [15, 16].

Now, sustainability has become one of the central themes. The major challenges to the sustainability of agribusinesses include insufficient financial support, high post-harvest losses, gender inequality, outdated climate policies, and weak institutional controls [17, 18]. However, Inclusive agribusiness boosts the livelihoods of poor farmers by integrating them into commercial value chains, granting access to markets, inputs, and services like finance and training in a commercially sustainable way [19, 20]. As agriculture remains a key livelihood source, it's essential to reinvent farming practices by integrating technology-driven innovations to ensure sustainability and address poverty and hunger. Introducing relevant technology-enabled services will support economic sustainability and improve food security through data-driven decision-making by stakeholders such as farmers, agri-tech start-ups [21, 22].

1.3. Agritech and Agribusiness

Now technologies like blockchain provide significant benefits for agribusiness supply chains, as blockchain technology matures, it is expected to be widely adopted across various sectors, including agribusiness, enhancing reliability, information flow, and cost efficiency [23, 24]. The integration of agritech and agribusiness management is crucial, as technology and management should be combined. Despite extensive research in agri-tech, this knowledge has not yet reached many farmers, who may not be tech-savvy. Urgent government intervention is needed to address this issue [25]. Start-ups are transforming the agri supply chain by employing modern technologies such as artificial intelligence, machine learning, IoT, and blockchain. They are now sourcing directly from farm gates and supplying to retailers [26]. Urban residents are often busy with work and daily activities, making it difficult for them to travel to villages and regularly monitor their crops. Proper farm maintenance is crucial for achieving the desired results. By using cloud computing, IoT, networking, and other technologies, it is now possible to easily manage and monitor crops, weather, water, and fertilizer application remotely [27].

2. Research Methodology

This study employs a literature-based study methodology to analyze agribusiness management in India over the past 30 years, focusing on the era of disruptive innovation. Utilizing advanced search functionalities in the Scopus database, the study retrieved the research articles using keywords namely "agri-business management," "agriculture business management," "agricultural management," "agribusiness," "Agritech," and "farm management" in India alone. This systematic approach, guided by the PRISMA framework for paper selection, included 74 papers, offering valuable insights for academic institutions and practitioners in the agribusiness sector. The Preferred Reporting Items for Systematic reviews and Meta-Analyses (PRISMA)is a widely used method for reporting the reviews transparently [28].

Latent Dirichlet Allocation (LDA) was utilized to identify topics within the dataset. Topic modeling is a highly effective technique in text mining for extracting insights from data, uncovering hidden patterns, and identifying connections between data and text documents [29]. The dataset contains the abstract and paper titles to classify the papers into underlying topics The LDA model provided a set of keywords for each topic, which were then used to assign meaningful names to the topics. A total of 69 papers were classified under five themes and four papers are listed as “unclassified”.

The analysis was conducted using Python, with Scikit-learn for implementing Latent Dirichlet Allocation (LDA) to perform the classification of papers. A Python library was used in Google Colab to perform the topic modeling process. The themes were further renamed as 'Business and Agriculture,' 'Cooperative and Dairy Farming,' 'Land Efficiency and Reclamation,' 'Farmers and Rural Management,' and 'Agribusiness Policy and Sustainability.' The thematic classification was based on the prominent keywords identified by the LDA model, ensuring that the themes accurately reflected the data-driven insights. Papers were then classified into these themes, providing a structured overview of the agribusiness landscape in India.

A few of the papers from each theme were tabulated with findings. Using the bibliometrix package (R Studio), thematic maps are used to find the emerging/declining themes, niche themes, motor themes, and basic themes [30].

2.1. Process Flow for Data Analysis Using Python in Google Colab

PROCESS1. Data Upload: Load the CSV file using files upload().
PROCESS2. Data Loading: Read the CSV file into a data frame using pandas.
PROCESS3. Topic Clustering: Define topics and keywords, and classify titles.
PROCESS4. Word Cloud: Generate a word cloud to visualize keyword frequency
PROCESS5. Results Saving: Save the results to a CSV file and provide a download link.

2.2. Research Questions

1. What are the predominant themes emerging from agribusiness literature?
2. How do the identified themes reflect the current state and future directions of research in agribusiness?

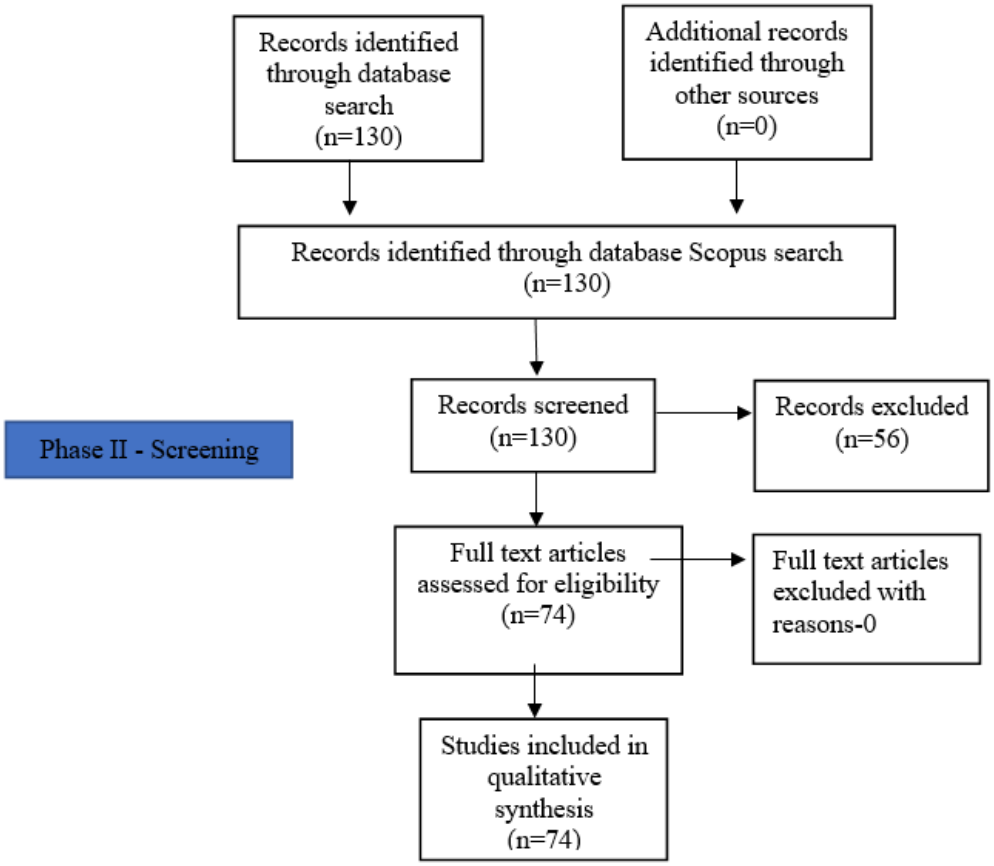

Figure 1.
The Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA)

3. Data Analysis

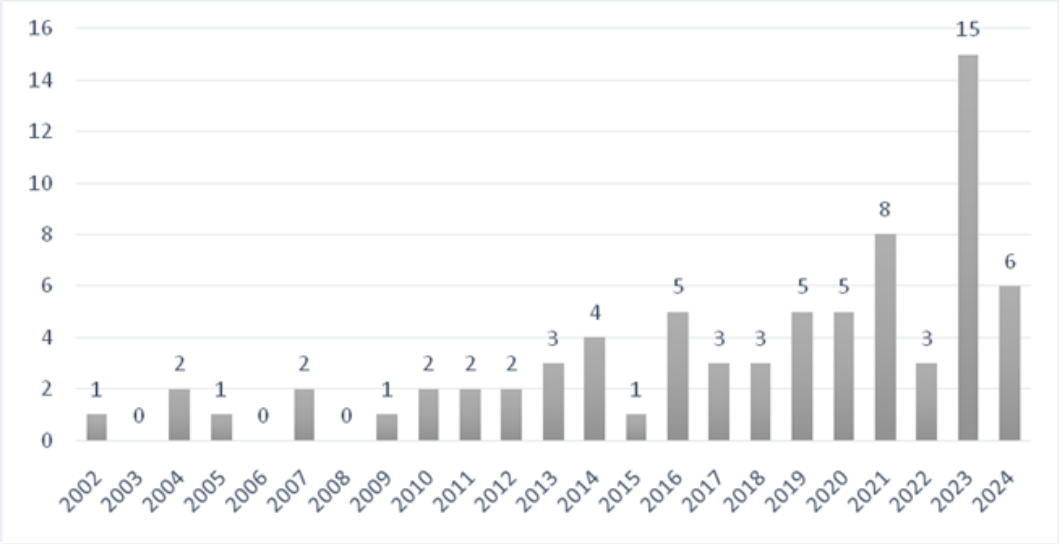

Figure 2.
Annual Production of Articles in the "Agri-Business" area.

Figure 1 shows a general increase in the number of scientific articles on agribusiness over the years, with some variations. The highest number of articles was published in 2023 which is 15, followed by 8 articles in 2021 and 5 articles in the year 2015

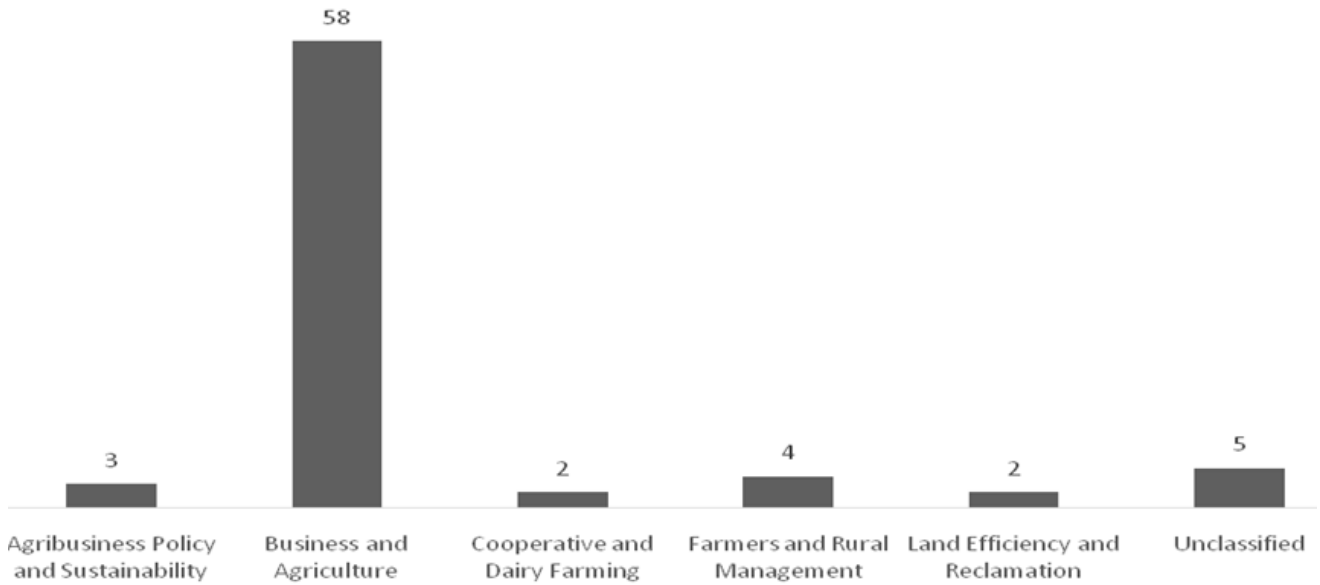

Figure 3.
Theme-wise Clustering of Papers.

Figure 2 shows a total of 74 articles related to agribusiness. Using topic modeling, five themes were clustered. The theme "Business and Agriculture" dominates with 58 articles, indicating a strong focus on this area. The theme "Farmers and Rural Management" was clustered with 4 articles, and "Agribusiness Policy and Sustainability" with 3 articles. "Cooperative and Dairy Farming" and "Land Efficiency and Reclamation" clustered with 2 articles each and 5 articles remain unclassified.

Table 1.
Synthesis of the articles related to the theme Agribusiness Policy and Sustainability.

Author	Topic	Findings
Pani, et al. [31]	Millet-based Enterprises and Sustainability: Evidence from the Farmer Producers Company in Kalahandi District, Odisha	The study in Kalahandi, Odisha, highlights the growing importance of millets in addressing climate stress and promoting sustainable agriculture among small farmers organized under Farmer Producer Companies (FPCs). Key findings reveal that value addition and innovations are crucial factors driving sustainability and enhancing farmer income in millet-based enterprises. Internal factors like age, marital status, family support, financial stability, and scale of operations, along with external factors such as policy governance and public relations, significantly influence farmers' decisions to engage in these enterprises. The Odisha Millet Mission plays a pivotal role in supporting these efforts and strengthening eco-environmental sustainability.
Riar, et al. [32]	Technical efficiencies and yield variability are comparable across organic and conventional farms	The study conducted in the Nimar Valley of central India evaluates the factors contributing to cotton productivity in both conventional and organic farming systems. The findings indicate that on organic farms, landholding and soil types are significant predictors of yield, whereas in conventional farming, the highest yields are associated with farmers who have more than five years of formal education and live in joint families. Key management factors such as nitrogen application, irrigation source, crop rotation, and maintaining an adequate plant population are crucial for improving yields in both farming systems. The study underscores the potential for enhancing cotton productivity by improving technical efficiency, strengthening extension services, and implementing targeted policy interventions.
Goswami and Challa [33]	Economic analysis of smallholder rubber plantations in West Garo Hills District of Meghalaya	Rubber plantations in India, crucial for smallholder livelihoods, have a 20-25-year lifespan. With 5.70 lakh hectares, India ranks third in rubber production and fourth in consumption. The sustainability of these plantations depends on long-term price stability, transparent marketing practices, and secure property rights for smallholders, which are essential for maintaining the economic viability of rubber cultivation.

Table 2.
Synthesis of the articles related to the theme of Business and Agriculture.

Author	Topic	Findings
Singh and Misra [34]	Developing an agricultural entrepreneur inclination model for sustainable agriculture by integrating expert mining and ISM MICMAC	The study focuses on agripreneurship in India, highlighting the challenges in the agricultural sector and the need for transformation into an agro-industrial enterprise. It aims to identify effective programs and policies that support agripreneurs in rural areas. Using the ISM-MICMAC technique, the study finds that agripreneur courses, agricultural policies, training, government support, and institutional involvement are key factors in motivating the younger generation toward agripreneurship. These insights are valuable for policymakers to design strategies that encourage agripreneurship as a viable career option.
Krishnakumar and Chan-Halbrendt [35]	Consumer preferences for imported Kona coffee in South India: A latent class analysis	The study assesses the potential for exporting 100% Kona coffee to South India by examining consumer preferences through a conjoint choice experiment with latent class analysis. It finds that while taste is a major factor for Indian consumers, price is less important, though high prices are generally unpopular. A notable 15% of consumers prioritize taste over price, suggesting a niche market for

		high-end Kona coffee. The study provides marketing strategies and policy recommendations to tap into this potential market segment.
Singh, et al. [9]	Management strategies for promotion of agri-business	The agricultural should focus on business-oriented management. Historically, policies focused on increasing food production, but current needs emphasize surplus and value addition. There is a growing demand for better marketing and value-added approaches. To address this, agricultural policies and programs must shift towards promoting agriculture as a business, incorporating initiatives that support value addition and improve farm produce management.
Sharma and Singh [36]	Agricultural Diversification in Indian Punjab: An Assessment of Government Intervention Through Contract Farming	The Punjab government's efforts to promote agricultural diversification through contract farming were evaluated in the study It finds that existing policies have been ineffective in improving crop incomes due to inadequate market institutions and pricing structures. The Punjab Contract Farming Act 2013 is criticized for its interventionist approach.
Landes [37]	The environment for agricultural and agribusiness investment in India	Investment in Indian agriculture and agribusiness has remained sluggish despite strong economic growth and increased food demand. Policies, weak infrastructure, and inadequate market services have deterred investment. Although recent reforms have made the policy environment more investor-friendly, significant barriers remain, and the pace of future reforms is uncertain.
Kumari, et al. [38]	Is agripreneurship a mitigating measure for agricultural issues in India?	The study finds that integrating entrepreneurship with agriculture known as agripreneurship, can shift agriculture from a subsistence to a competitive enterprise. This approach can enhance job creation, increase productivity, and improve farmers' incomes.
Gill and Mathur [39]	Religious beliefs and the promotion of socially responsible entrepreneurship in the Indian agribusiness industry	The research highlights that while religious beliefs and financing strategies are linked to investment behaviors, the study's correlational nature means causal relationships are not established. The results offer valuable insights for financial managers, agribusiness owners, and investors, along with policy recommendations to improve socially responsible investment in agriculture.
Jarial and Roy [40]	Relationship between Sex and Entrepreneurship Traits of Agri-Undergraduate Students in Northern India	The study explores how sex influences agricultural entrepreneurship characteristics among Indian university students. Key entrepreneurial traits such as creativity, initiative, decision-making, risk-taking, competitiveness, and pressure coping were identified. The analysis showed significant correlations between these traits and entrepreneurship, with gender not affecting supervisory roles. A significant association was found between gender and perceived trustworthiness. The research highlights the need for targeted educational strategies to enhance entrepreneurial skills, particularly focusing on gender-related aspects within agricultural studies.
Swamy [41]	Analyzing the agricultural value chain financing: approaches and tools in India	The study evaluates agricultural value chain (AVC) financing approaches in India, identifying the need to enhance models by reviewing lead actors, business models, and sustainability strategies. It highlights the importance of understanding financing flows and comparing financing options across different chain levels. The paper recommends improving value chain efficiency through government-private sector partnerships, creating supportive policies, and expanding financing to include long-term investments in infrastructure and technology.
Khan, et al. [42]	Understanding the ease of doing agribusiness in emerging Asian economies: evidence from World Enterprises survey	The study compares agribusiness firms in India, China, and Pakistan, revealing that Chinese firms excel in quality certification, online presence, and credit access. Pakistani firms struggle with land access and moderate tax and political stability issues, while Indian and Chinese firms find land acquisition easier and face fewer obstacles related to taxes and politics. Labor regulations are not a major issue in India and Pakistan. This comparison offers insights for agribusiness managers and policymakers in understanding regional differences and challenges.

Pray and Nagarajan [43]	The transformation of the Indian agricultural input industry: Has it increased agricultural R&D?	The transformation of India's agricultural input industries over the past 40 years has led to a significant increase in private agribusiness R&D spending, rising from $23 million in 1985 to $250 million in 2009. Key findings indicate that R&D expenditure growth is positively associated with industry factors such as firm size, multinational ownership, and decreased industry concentration. Furthermore, the enhancement of patent policies and the expansion of research-intensive sectors like the seed industry have also contributed to this growth.
Hussain and Guha [44]	Role of farm infrastructure in agribusiness during a crisis: insights from rural Assam, India	The study examines the impact of village farms and marketing infrastructure on agribusiness crises during a pandemic-induced lockdown in rural Assam. Findings reveal that inadequate storage and agro-processing facilities led to significant crop damage, sales losses, and reduced farm income. The analysis suggests that improving rural marketing infrastructure and access to Agricultural Produce Market Committee (APMC) yards could help mitigate these issues and better support farmers during emergencies.

Table 3.
Synthesis of the articles related to the theme of Cooperative and Dairy Farming.

Author	Topic	Findings
Kaushik, et al. [45]	Modeling the challenges of technology adoption in dairy farming	This study explores challenges in technology adoption on dairy farms in India, focusing on milk-producing states in Haryana, Punjab, and Uttar Pradesh. It identifies 12 key challenges using a hierarchical model developed through expert discussions and interviews with dairy farm managers. The findings highlight a lack of government support and insufficient educational opportunities as major drivers of adoption issues, while high costs and low decision-maker acceptance are seen as dependent challenges. The study aims to guide policymakers and stakeholders in enhancing technology adoption and improving the dairy sector's performance.
Kaushik and Rajwanshi [46]	Examining the Linkages of Technology Adoption Enablers in Context of Dairy Farming Using ISM-MICMAC Approach	This research investigates enablers of technology adoption in India's dairy sector using ISM methodology. Key driving factors include experience in the dairy business, competitive pressure, and digital literacy. In contrast, agreeableness and managerial interest are identified as dependent factors. The findings offer valuable insights for decision-makers, policymakers, and farmers in India and other agriculture-dependent countries, highlighting the hierarchical relationships among enablers to enhance technology adoption in dairy farming.

Table 4.
Synthesis of the articles related to the theme Farmers and Rural Management.

Author	Topic	Findings
Santos, et al. [47]	Scientific production on tourism-related rural entrepreneurship	The study emphasizes that historical entrepreneurship was rooted only in agriculture, and recent research shows a renewed focus shifted to rural entrepreneurship. This includes leveraging agribusiness to drive innovation and address local socioeconomic issues. Insights from India and Spain highlight regional differences, with India emphasizing gender and Spain integrating tourism, which can inform strategies to enhance agribusiness development and sustainability.
Chakravarty [48]	Benefitting Smallholder Farmers in Africa: Role of ICRISAT	ICRISAT's initiatives in Africa and Asia have significantly impacted smallholder agriculture by addressing key challenges such as low productivity and limited market access. The exchange of germplasm and

		the development of new crop varieties tailored to local conditions have enhanced resilience and productivity. These efforts have transformed subsistence farming into more sustainable and profitable agricultural practices.

Table 5.
Synthesis of the articles related to the theme Land Efficiency and Reclamation.

Author	Topic	Findings
Kumar and Khanna [49]	From the local to the global: the journey of Suguna Foods	Suguna Foods' contract farming model effectively supported both the company and farmers by providing essential resources, which led to significant growth and market leadership. Through efficient value chain management, strategic segmentation, and strong branding, Suguna reduced inventory costs, enhanced revenue, and maintained a competitive advantage. Despite rising costs and market challenges, this approach helped Suguna sustain its success and support over 40,000 farmers across India.
Sowers [50]	Remapping the Nation, Critiquing the State: Environmental Narratives and Desert Land Reclamation in Egypt	The New Valley Project, launched by Egypt's Mubarak regime in 1998 to transform desert land into arable fields, aimed to alleviate population pressure on the Nile Valley by creating new agricultural zones. Despite the ambitious goals and significant infrastructure investments, the project faced major setbacks: by 2008, limited irrigation demand led to underutilization of the facilities, and only a fraction of the targeted land was cultivated. The project became a symbol of governmental inefficiency and corruption, contributing to the regime's downfall. Criticisms from water experts and agribusiness managers, alongside persistent challenges in land reclamation, reflect a broader critique of Egypt's environmental and developmental policies, highlighting the disconnect between official narratives and on-the-ground realities.

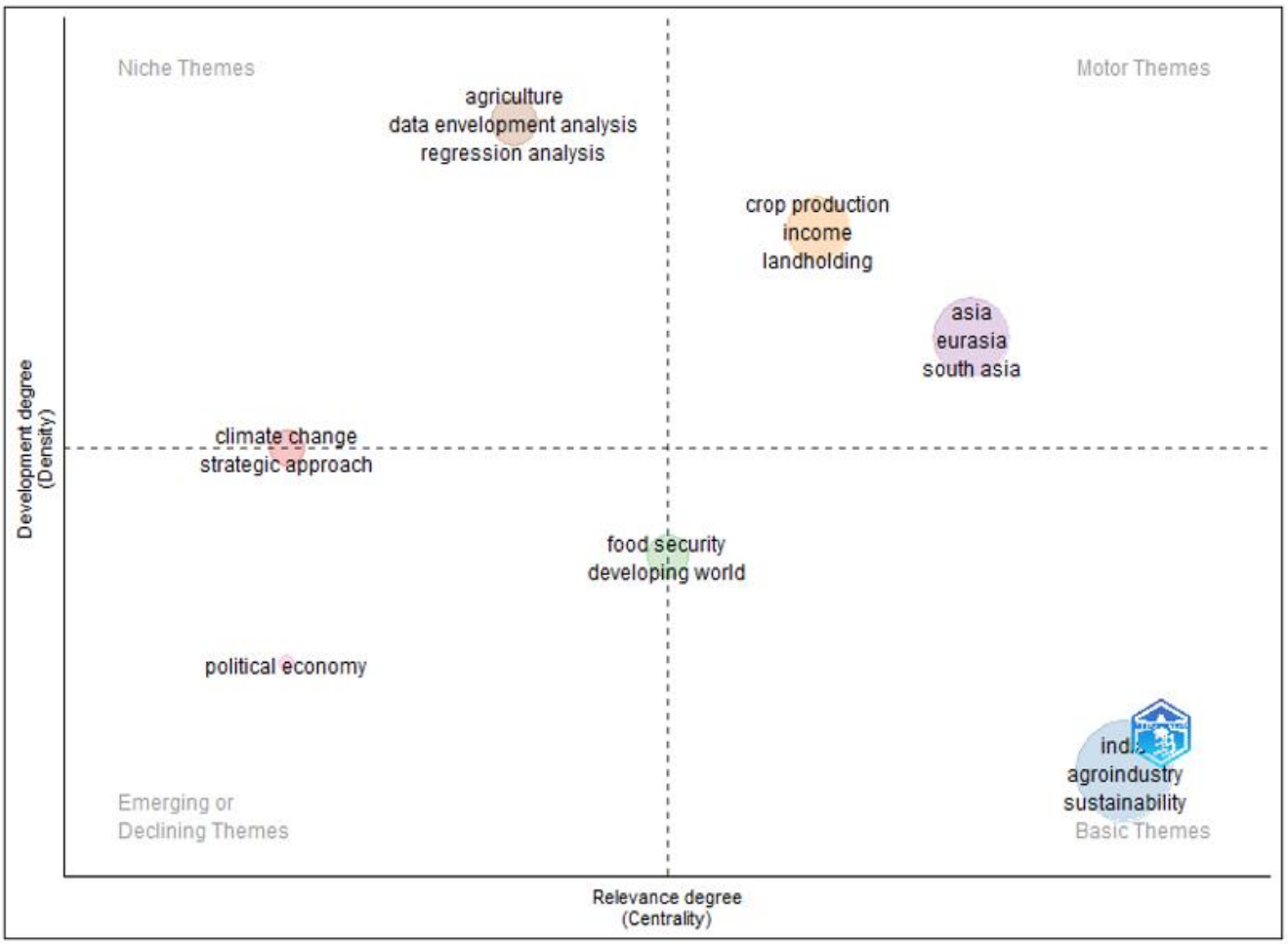

Figure 4.
Thematic Map.

The thematic map provides a quadrant-wise view of four themes. Motor Themes (Top Right) are both highly relevant and well-developed, focusing on agricultural production and economic factors in Asia, indicating a robust foundation in these areas. Basic Themes (Bottom Right) are important but underdeveloped, with key areas like agro-industry and sustainability in India needing further exploration to enhance their impact. Niche Themes (Top Left) are advanced but have limited wider influence, such as advanced analyses like data envelopment and regression. The Emerging or Declining Themes (Bottom Left) are areas with low relevance and development, including climate change and food security; it looks like these areas are either budding or declining.

5. Discussions

The study is initiated to find the emerging themes and to identify the research gaps in the existing system of agribusiness in India. We can give a big applause to our system and administrators. In the past 78 years of post-independence, we have grown a lot. However, there are several miles to go. The startup ecosystem in India, especially in "agribusiness," is encouraging. But at the educational and curriculum level, entrepreneurship is still an unattained component. Based on the topic modeling (LDA), five themes were identified, and the papers related to the themes were tabulated along with the word cloud.

The theme “Agribusiness Policy and Sustainability" shows how various factors influence agricultural enterprises' sustainability and economic feasibility. The areas related to sustainability in agribusiness are still yet to be developed, which is also replicated in the thematic analysis conducted by the biblioshiny package. The “Business and Agriculture” theme provides important insights into how entrepreneurship, market dynamics, and policy frameworks impact the agricultural sector. Agripreneurship is a new term in India that has yet to transform traditional agriculture into a competitive and sustainable industry by integrating effective programs and policies, specifically in rural clusters to strengthen and widen rural marketing. Consumer preferences, such as the demand for high-quality products like Kona coffee, highlight the importance of focusing on the attributes of a product rather than just a component of “price.” This shows that “Niche marketing” opportunities for farmers are plentiful and need to be materialized. There is a shift needed towards value addition and business-oriented management in agriculture, moving beyond traditional food production. The effectiveness of government interventions, like contract farming and infrastructure development, is still in the nascent stage, indicating a need for more robust and flexible policies. Again, institutional intervention in curriculum design is very important to inculcate entrepreneurial traits during college days, as we always know that entrepreneurship is an attitude. The first generation of

agripreneurs learns from shared experiences [51]. The peer networking and entrepreneurship ecosystem should be strengthened.

The theme related to cooperative and dairy farming indicates that advancing technology adoption in dairy farming in India faces significant challenges related to government support, educational opportunities, and high costs. Policymakers should focus on enhancing support structures, improving educational initiatives, and reducing costs. Strengthening these areas can facilitate better technology integration and surely boost dairy farming efficiency and productivity. The D2C marketing is emerging now, where farmers need to be trained to sell their products directly to customers.

The theme "Land Efficiency and Reclamation" efforts require integrated resource management and planning. The effective value chain and support for farmers lead to sustained growth and market leadership, emphasizing the value of collaboration between stakeholders. The successful domestic models that are already involved in contract farming shall be taken as examples, and large agri projects shall be planned involving the unused lands to be converted into potential agri projects. Government intervention and local body tie-ups are needed for land reclamation efforts to benefit both the farmers and the local communities.

The thematic map (done using the biblioshiny package in R) suggests that agricultural production and economic factors in Asia are well established and should be enhanced further for better coordination and to meet our future food needs. This shows that Asian countries are proficient in agricultural production and satisfying their wants and needs. However, there is a critical need to progress in "sustainability," especially in India, which remains nascent. These "Basic Themes" require targeted research and investment to enhance their impact. The niche theme indicates that cutting-edge technologies and advanced research tools like Data Envelopment Analysis are yet to be widely adopted for further advancement. Attention to "Emerging or Declining Themes" like climate change and food security is crucial to determine whether they should be refreshed or phased out, positioning them with future significance in agro-industry.

6. Conclusion

The study is a literature-based study linked with topic modeling using the Python library and bibliometric analysis. The systematic review of articles shows the progress of India's agribusiness sector, with a good startup ecosystem and evolving themes such as agribusiness policy, sustainability, and niche marketing. However, gaps remain in integrating entrepreneurship into higher education, leveraging technology, D2C marketing for farmers, and enhancing central/state government interventions. Strong importance should be given to agri-sustainability, value chains, and improved policy frameworks to further enhance the industry. India is marching towards “Vikshit Bharat 2047” to make India a completely developed nation. Surely, the efforts of the government in agribusiness and agritech will bring laurels to the nation in the years to come.

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