

# Original Research Article

## Evaluating the Impact of Agri-Startups on Technology Transfer: Insights from Farmers in Madurai and Dindigul Districts, Tamil Nadu

### ABSTRACT

Agri-startups are emerging as transformative agents in the agricultural sector, particularly in developing regions. This study explores the critical role of Agri-Startups in facilitating technology transfer to farmers in the Madurai and Dindigul districts of Tamil Nadu, India. Through a survey of 150 farmers associated with five prominent Agri-Startups, the research delves into the financial, technological, and marketing contributions of these startups, as well as farmers' perspectives on their impact. The findings reveal that Agri-Startups significantly attract investment for agricultural innovation (72.7% agreement), promote the adoption of new technologies (81.3% agreement), and identify market opportunities (72% agreement). Despite these advancements, farmers' overall agreement on the role of Agri-Startups in technology transfer is varied, with 44% expressing low agreement, 43.33% medium agreement, and only 12.7% showing high agreement. This disparity underscores the need for Agri-Startups to strengthen their engagement with farmers, particularly in areas of education, after-sales support, and demonstrating the practical benefits of their innovations. The study offers valuable insights into the Agri-Startup ecosystem in rural India, highlighting both its potential and the challenges that must be addressed to enhance the effectiveness of technology transfer in agriculture.

*Keywords: Agri-Startups, Technology Transfer, Farmers' Perspectives, Agricultural Innovation, Tamil Nadu, Marketing Role, Financial Role, Technological Role*

### 1. INTRODUCTION

Agri-startups have become important players in this changing field, bridging the gap between innovative ideas and real-world applications. These businesses are not only creating new technologies, but they are also essential in getting these advancements to farmers. The need for efficient, sustainable farming methods and the rapid advancement of technology are driving a massive transformation in the agricultural sector. There is a widespread belief, that startups must be located in industrialised nations with access to all resources. In reality, however, startups must be located in nations with higher requirements and better prospects [1]. Especially in developing nations, the convergence of agriculture and technology through startups is becoming a critical factor in increasing agricultural sustainability and production [2]. With a \$10.6 billion worldwide investment in 2022, despite a decline in funding, Agri-tech

startups continue to draw a significant 13% less than in 2011 [3]. This industry has grown by an astounding 20 times in venture capital investments during the last ten years, indicating the increased significance of tackling food security in the face of a growing global population and climate-related challenges [4]. According to the economic survey 2021-22, the majority of India's 83 unicorns, have a combined worth of over \$277.70 billion people and generate more than 50% of the country's Gross Domestic Product (GDP), are in the service industry, according to the economic report 2021-2022 [5]. To solve many of the major problems facing the agriculture industry, Agri-Startups have arisen as a "wind of change". Startups create a ripple effect on the socio-economic fabric of the demography in which they operate [6]. With the use of cutting-edge concepts and contemporary technology, these startups aim to transform the agricultural environment in India. Startup companies, also known as Startups or Agri-startups, are entrepreneurial endeavours that are usually recently established, expanding quickly, and seeking to fill a market gap by creating or providing an exceptional and novel product, service, or method. Things have begun to change in India with the rise of Start-ups. There is no denying that Startups have revolutionized the agricultural sector and pushed for growth [7]. It's also important to note that the advent of free market economies around the world has led to the formation of a new entrepreneurial spirit known as "Agripreneurship" and an increase in the necessity for individuals to take responsibility for managing their enterprises [8]. The Agripreneurship programme is essential for producing managers and entrepreneurs to serve the global agriculture industry [9]. Infrastructure development, funding allocations, regulatory reforms, ease of doing business, and specialized strategies and activities have all contributed to the sector's increased profitability for aspirational business owners. An increasing number of individuals are showing interest in the sector and its various difficulties [10]. A total of Rs. 3671.75 lakhs in investment is being given to 346 startups in the agricultural and associated sectors, providing opportunities that will both directly and indirectly assist farmers in growing their businesses and employing young people their income [11].

When an entity satisfies the requirements listed below, it will be considered as a "STARTUP":

- ✓ The startup has to file for registration as a limited liability partnership or private company.
- ✓ The startup cannot be the result of reorganisation.
- ✓ The Startup must not be older than 10 years
- ✓ Annual turnover of the start-up must not be more Rs. 100 crores [12].

This study aims to investigate how important a role agri-startups play in helping farmers in Tamil Nadu's southern districts, Madurai and Dindigul in particular transfer and embrace innovative agricultural technology. By looking at their effects on adoption rates, technological

transfer, and the difficulties farmers have accepting these advances, this study seeks to understand how these companies are changing the agricultural location and improving their production. This study aims to shed light on the current state of technology adoption in the research area and the efficacy of Agri-startups in bridging the innovation-to-practical application gap, given that technology adoption rates vary across regions and are crucial for advance agricultural practices. The study validates the necessity to look at how Agri-startups are influencing the direction of agriculture in these regions and due to this technology transfer and adoption farmers were able to improve their skills in improving their production level . By examining the Agri-Startups of their role in marketing, finance, technological and farmers perspectives, this study aims a thorough grasp of how these startups are influencing the agricultural environment. Therefore, present study was initiated with the following specific objective.

### 1.2 Objective of the study

- ✓ To examine the role of Agri-Startups in facilitating the transfer of technology to farmers

## 2. MATERIAL AND METHODS

This study, conducted in the Tamil Nadu districts of Madurai and Dindigul, focused on Agri-Startups that have become important players in the growth of the agricultural industry. The sampling method used was proportionate to the number of farmers associated with each Agri-Startup. A total of 150 farmers were selected as respondents using a purposive random sampling technique. The selected blocks were chosen based on their significant contribution to farmers' adoption of technology transfer from these startups. Five blocks were randomly selected for the study, and farmers who had adopted the technologies provided by the startups were randomly chosen. Five Agri-Startups, each established more than 10 years ago, were identified and selected in the Madurai and Dindigul districts. These districts were specifically chosen due to the higher number of developed Agri-Startups. The five Agri-Startups operate in collaboration with farmers from various blocks, including Nilakottai and Vedasandur in Dindigul district, and Vadipatti, Usilampatti, and Alanganallur in Madurai district. The primary data was collected using an interview schedule designed according to the study's objectives, and the data was analyzed and tabulated using frequency and percentage.

**Table 1. The distribution of Agri-Startups according to their technologies**

S.No	Name of the Agri-Startups	Technologies provided
1.	Adish-technologies private limited	Web-services, Mobile Applications development

2.	Gusto-crop technologies private limited	Nano-based fertilizer and growth products
3.	RNR-Agri developers private limited	Agri-Consultant
4.	Infarmsys technologies private limited	Agritech solution and Soil NPK sensors
5.	Brainfarms Agrotech private limited	Artificial neural networks (ANN) and Remote sensing

Different categories of role in facilitating the transfer of technologies in questionnaire schedule were developed and used in this study. There were twenty statements on the questionnaire, divided into four categories: Financial Role, Technological Role, Marketing Role and other aspects. In order to ascertain the perceived significance of the various functions performed by agri-startups, farmers' answers were recorded on a binary scale (Yes/No). Using SPSS software, descriptive statistics data was analyzed and tabulated.

**Table 2. The distribution of Agri-Startups and selection of respondents.**

S.No	Name of the Agri-Startups	No. of respondents selected
1.	Adish-technologies private limited	30
2.	Gusto-crop technologies private limited	30
3.	RNR-Agri developers private limited	30
4.	Infarmsys technologies private limited	30
5.	Brainfarms Agrotech private limited	30
	<b>Total</b>	<b>150</b>

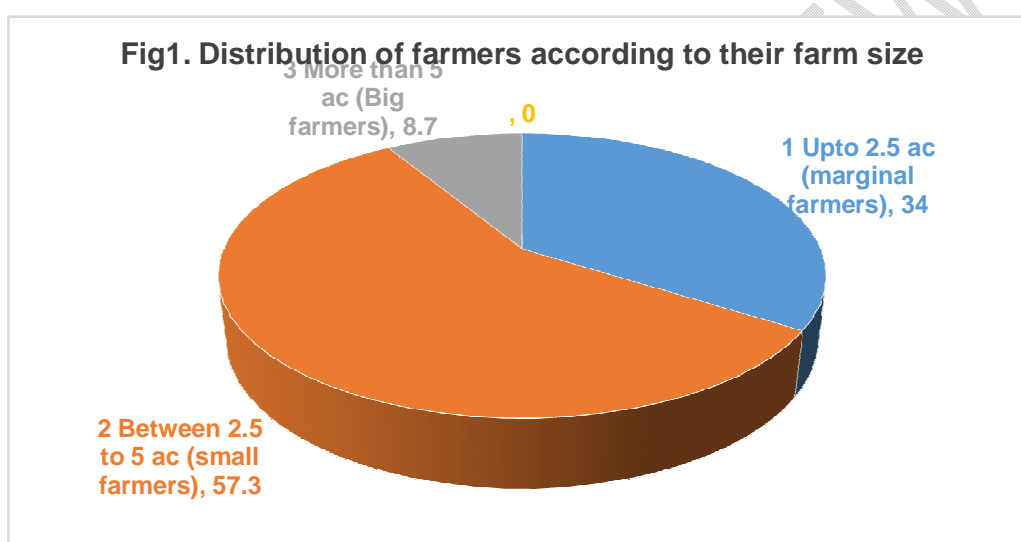
**Table 3. The distribution of respondents according to their farm size**

S.No	Category	Farm holding	Score
1.	Marginal farmer	Upto 2.5 acres	1
2.	Small farmer	Between 2.5 to 5 acres	2
3.	Big farmer	More than 5 acres	3

## Farm Size:

Table 4. Distribution of respondents according to their farm size (n=150)

S. No	Category	Number	Per cent
1.	Upto 2.5 ac (marginal farmers)	51	34.0
2.	Between 2.5 to 5 ac (small farmers)	86	57.3
3.	More than 5 ac (Big farmers)	13	8.7
	<b>Total</b>	<b>150</b>	<b>100.00</b>



The data presented in table 4 provides insights into the landholding patterns. Notably, the majority of respondents (57.3%) identified as small farmers, followed by (34%) who consider themselves as marginal farmers. A smaller proportion, (8.7%) fall under the category of big farmers.

## 3. RESULT AND DISCUSSION

### 3.1 Listing of respondents according to the role of Agri-Startups in facilitating technology transfer

Table 5. shows the frequency and percent of farmers in the role of Agri-Startups in Facilitating Technology Transfer

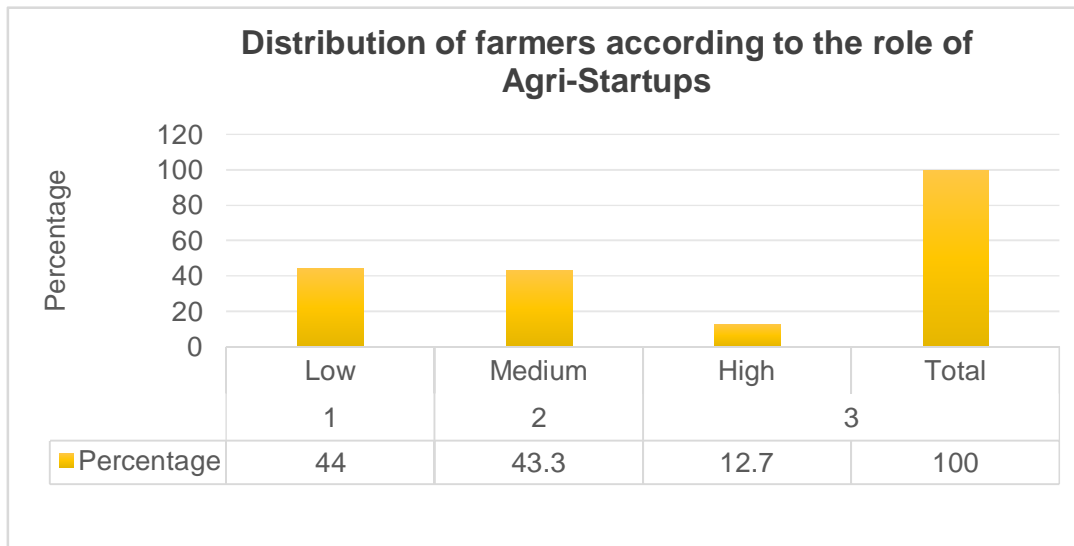
(n=150)

S.No.	Statements	Frequency	Percentage
<b>A.</b>	<b>Financial role of Agri-startups in technology transfer</b>		
1.	Agri-startups attract investment for agricultural technology development	109	72.7
2.	Agri-startups sources of initial capital for innovative agricultural ideas	70	46.7
3.	Agri-startups invest in creating new markets for agricultural technologies	77	51.3
4.	Agri-startups aim to generate financial returns through successful technology commercialization	74	49.3
5.	Agri-startups willing to take on higher risks associated with technological development in agriculture	66	44.0
<b>B.</b>	<b>Technological role of Agri-startups in technology transfer</b>		
6.	Agri-startups demonstrate practical applications through field trials to enhance productivity and sustainability	122	81.3
7.	Agri-startups facilitate the adoption of new technologies by farmers	87	58.0
8.	Agri-startups operate demonstration farms to showcase new agricultural technologies	65	43.3
9.	Agri-startups provide educational programs to farmers regarding new technologies	57	38.0
10.	Agri-startups focus on increasing productivity and sustainability through technology transfer	80	53.3
<b>C.</b>	<b>Marketing role of Agri-startups in technology transfer</b>		

11.	Agri-Startups identify market needs and opportunities to help farmers access relevant technologies that improve their farming practices.	108	72.0
12.	Agri-startups actively promote and market new agricultural technologies, ensuring that farmers are aware of and can adopt the latest innovations.	98	65.3
13.	Agri-Startups provide targeted marketing channels that connect farmers with the right products and services to meet their specific needs.	58	38.7
14.	Agri-startups offer after-sales support and services to farmers, ensuring satisfaction and continued success with the adopted technologies.	82	54.7
15.	Agri-startups assist farmers in differentiating their produce in the market by leveraging technology, enhancing competitiveness and profitability	62	41.3
<b>D.</b>	<b>Other role of Agri-startups in technology transfer</b>		
16.	Farmers examine the changes that Agri-startups bring to the agriculture industry.	105	70.0
17.	Farmers find agri-startups' technologies relevant and beneficial to their farming practices	70	46.7
18.	Farmers aware of the role of agri-startups in driving technological advancements in agriculture	59	39.3
19.	Farmers evaluate the effectiveness and practicality of technologies introduced by agri-startups	75	50.0
20.	Farmers view agri-startups as trustworthy resources for knowledge and encouragement when implementing new technology.	58	38.7

S.NO	Level	Frequency	Percentage
1.	Low	66	44.0
2.	Medium	65	43.3

3.	High	19	12.7
	<b>Total</b>	<b>150</b>	<b>100.00</b>



**Fig. 2. Comparison of farmers according to their overall response towards the role of Agri-startups**

### 3.1 Interpretation

- ✓ Regarding the functions and effects of Agri-startups in technology transfer and adoption, the great majority of farmers (44%) express a low degree of agreement.
- ✓ Very few farmers are doubtful or ignorant of the contributions made by agri-startups, as seen by the low percentage of farmers (43.33%) who express moderate levels of agreement.
- ✓ Similarly, just a small proportion of farmers (12.7%) express strong agreement, indicating that they strongly recognise and appreciate the role that agri-startups play in the adoption and transfer of agricultural technology. **These findings align with prior research by Kakara Aneesha [13] and Vipin Kumar [14], providing additional support to the current study's outcome. This suggest a consistent trend across different studies regarding to the role of Agri-Startups in facilitating technology transfer to farmers.**

#### 3.1.1 Financial Role

According to (72.7%) of farmers, agri-startups are powerful draws for funding for the development of agricultural technologies. This demonstrates how important it is for them to direct funding towards agricultural innovation. Furthermore, a sustainable approach to innovation is suggested by the fact that (44%) of farmers acknowledged that the goal of agri-startups is to make money through technological commercialisation.

### **3.1.2 Technological Role**

On the part of agri-startups in creating or implementing innovative agricultural technology, there was the greatest level of agreement (81.3%) noted. This emphasises how important a role they play in pushing agricultural technology innovation. Additionally, (38%) of farmers recognised the contribution of agri-startups to the adoption of new technology, emphasising the significance these companies play in the spread of innovations.

### **3.1.3 Marketing Role**

The marketing efforts of agri-startups were highly regarded; according to (72%) of farmers, they successfully market and promote agricultural innovations. This shows that agri-startups are not only coming up with innovative ideas but also making sure those ideas are successfully communicated to the intended audience.

### **3.1.4 Other aspects**

Agri-startup innovations were positively viewed by (70%) of farmers, and (38.7%) of them felt that these technologies were relevant and helpful to their farming methods. This suggests that farmers are largely receiving agri-startup advances positively.

According to the survey of 150 samples, Agri-startups are involved in technology transfer in a variety of ways. They excel in attracting capital, creating cutting-edge technology, and promoting their inventions.

## **4. CONCLUSION**

In conclude , the agricultural industry in Southern districts of Tamil Nadu is greatly benefiting from the technological transfer that Agri-startups are facilitating. This study identifies important areas for improvement while also demonstrating the revolutionary potential of Agri-Startups in transforming agriculture in the districts of Madurai and Dindigul, Tamil Nadu. Nonetheless, there is a noticeable discrepancy between invention and real-world adoption, as evidenced by the different levels of farmer agreement (44% low, 43.33% middle, and 12.7% high) regarding their overall role in technology transfer. Agri-Startups need to concentrate on closing this gap in order to have the most possible impact. They may do this by strengthening their educational initiatives, boosting post-purchase assistance, and providing thorough field testing to show the real benefits of their innovations. Through tackling these obstacles, Agri-Startups can realise their full potential as pivotal agents of agricultural modernisation, making

a substantial and long-lasting impact on the agricultural landscape of the area. The present study contributes to our understanding of the Agri-Startup ecosystem in rural India and offers significant perspectives for policymakers, agricultural extension agencies, and the startups themselves in influencing the progression of agriculture.

## RECOMMENDATIONS

- ✓ Agri-startups ought to put more effort into showcasing the useful advantages of their innovations in the field through longer field tests and presentations.
- ✓ Improve educational and assistance initiatives to forge closer ties with farmers and position Agri-startups as trustworthy providers of agricultural data.
- ✓ To increase relevance and adoption rates, concentrate on creating technologies that specifically solve regional agriculture issues.
- ✓ To guarantee the long-term viability of adopted technologies, bolster after-sales support.

## COMPETING INTERESTS

Authors have declared that no competing interests exist.

## DISCLAIMER (ARTIFICIAL INTELLIGENCE)

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc) and text-to-image generators have been used during writing or editing of manuscripts.

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