Agri-Drone entrepreneur: A case study of TKS Aerospace Private Limited in Virudhunagar District of Tamil Nadu

Jaffar Sadiq Ali. A[1] and [2]G. Srinivasan

[1,2]Department of Agricultural Economics, Faculty of Agriculture,
Annamalai University, Annamalai Nagar – 608 002 (India)
Corresponding Author Mail ID: *jaffarjack1997@Gmail.Com*

Abstract

Agriculture is India's primary source of income and plays a significant part in the country's progress. An agricultural drone is an unmanned aerial vehicle used in farming to aid in crop production and crop growth monitoring. Sensors and digital imaging capabilities can provide farmers with a more detailed view of their farms. This information might help improve agricultural yields and farm efficiency. TKS Aerospace launched drones for farming community at the budget friendly. A drone provides digital, informative, precise field management for grain crops such as rice, cotton, corn and so on. Sensors and virtual imaging capabilities can provide farmers with a richer image of their fields. Using the drone, collecting information from it could show helpful in enhancing crop yields and farm efficiency. The results revealed that the occupational structure showed that the majority of the sample farmers were practicing farming alone 56.66 percent followed by farming and agricultural labour 43.33 percent. It is observed that the majority of the sample farmers were highly experienced in banana cultivation 53.33 percent, in case of non- adopters the majority of the farmers were medium experience (93.33 percent). Regarding the annual income, majority of the adopters and non-adopters (76.66 percent, 90 percent) fell in the annual income range of 1-3 lakh, the proportion of higher income. Smart agriculture is assisting farmers in increasing efficiency while decreasing negative environmental implications. The agriculture sector has firmly and openly adopted digital agriculture technology in order to influence the overall outcome.

Key words : Agricultural technology, Drobotics, Efficiency, Farming, SWOT analysis.

$\mathbf{A}$griculture is India's primary source of income and plays a significant part in the country's progress. Agriculture is one of the most significant sectors of the Indian economy.

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[1]Ph.D. (Agri-Business) Student, [2]Associate Professor

India produces the most wheat, spices, rice and bajra. According to the 2021-22 Survey on Indian Economy, more than 60 per cent of India's total workers are employed in the agricultural sector and totally backs roughly 18.8 per cent to the GDP. This is the primary source of income for most rural households. As a result, agriculture is regarded as a fundamental pillar of the Indian economy. India has over 1.2 billion inhabitants and the agriculture sector accounts for almost 55 per cent of total land area[1].

Artificial Intelligence in agriculture :

The future of the Indian farming system and agricultural business is dependent on creative ideas and technology breakthroughs that use advanced computer tools to boost yields and better resource usage. Crop models and decision-making tools are increasingly being utilized in agriculture to boost yield and resource efficiency. There is an enormous scope for Artificial Intelligence (AI) to revolutionize agriculture by integrating advanced technologies to forecast agricultural productivity. AI technologies can assist farmers in increasing yields by estimating crop production, selecting crop varieties, soil and nutrient management, plant disease and pest management, weed management, commodity price forecasting and providing real-time information on agro-product marketing.

Internet of Things (IoT) :

The Internet of Things (IoT) has made significant inroads into agriculture, revolutionizing the way farms and agricultural operations are managed. IoT in agriculture involves the use of connected devices and sensors to collect and transmit data from various aspects of farming and crop management in real-time. This includes soil moisture sensors, weather stations and automated machinery.

IoT technologies are driving a revolutionary change in agriculture that affects a wide range of industries. Some examples are the implementation of smart irrigation systems that judiciously manage the water resources whereas the smart greenhouses equipped with sensors and actuators that create the optimal environment for plant growth. It also plays a pivotal role in supply chain and cold chain management, ensuring that agricultural products are transported and stored with precision, maintaining their quality. Drone surveillance facilitates crop health monitoring, while livestock monitoring and pest and disease tracking ensure the well-being and protection of both crops and animals. These applications collectively emphasize the profound impact of IoT on agriculture, leading to increased efficiency, higher productivity and a more sustainable future for the industry.

Agri-Drone :

An agricultural drone is an unmanned aerial vehicle used in farming to aid in crop production and crop growth monitoring. Sensors and digital imaging capabilities can provide farmers with a more detailed view of their farms. This information might help improve agricultural yields and farm efficiency. Agricultural drones let farmers see their fields from the sky. This bird's-eye view can reveal many issues such as irrigation problems, soil variation and pest and fungal infestations. According to recent research, the global drone

market within agriculture would grow at 35.9 per cent CAGR and reach $5.7 billion by 2025.

Applications of Drones in agriculture :

- ✓ Soil and field analysis
- ✓ Crop monitoring
- ✓ Irrigation monitoring
- ✓ Avoid overuse of chemicals
- ✓ Livestock management
- ✓ Geo fencing

Soil and field analysis :

Agricultural drones may be used for soil and field studies to aid in effective field planning. They can be used to mount sensors to assess soil moisture content, topographical conditions, soil conditions, soil erosion, nutrient content and soil fertility.

Crop monitoring :

Agricultural surveillance is the monitoring of agricultural development from the moment seeds are sown until harvest. This involves applying fertilizer at the appropriate time, inspecting for pests and monitoring the impact of meteorological conditions. Crop surveillance is the only option for a farmer to secure a timely harvest, particularly with seasonal crops. Any mistakes at this time might lead to crop failure. Crop surveillance aids in the knowledge and planning of the upcoming farming season. Drones may assist in effective crop monitoring by checking the field with infrared cameras, and farmers can take active actions to enhance the state of plants in the field based on their real-time information.

Irrigation monitoring :

Another traditionally troublesome area for farmers has been monitoring and management of irrigation. With several miles long irrigation network, there's always a possibility of issues arising. Today, drones fitted with thermal imaging equipment can effectively monitor the whole irrigation network and detect problems in real time. Farmers are better able to optimise drainage and make contingency plans for concerns using real-time information provided by drones.

Avoid overuse of chemicals :

Drones have the potential to be very useful in decreasing pesticide, insecticide and other chemical abuse. These compounds do aid in crop protection. However, excessive usage might be harmful. Drones can detect minute symptoms of pest assaults and offer precise data on the extent and scope of the attack. This can assist farmers in calculating the quantity of pesticides needed to protect crops rather than harm them.

Livestock management :

Drones may be used to monitor and manage large livestock since their sensors feature high-resolution infrared cameras that can spot a sick animal and take appropriate action. As a result, the influence of drones on precision dairy farming will soon become the new normal.

Geo fencing :

Thermal cameras mounted to drones may readily identify animals or humans. As a

result, drones can protect crops from external damage caused by animals, particularly at night.

Agripreneur :

Agriculture-related rural entrepreneurship has taken several forms. Young people who want to make a difference in agriculture are pursuing entrepreneurial options such as using cutting-edge technology to farming. Taking steps to reduce the dangers involved with farming. Agropreneurship is simply making sustainable business ventures off agro-commodities; good and services. As a matter of fact, agriculture is more than farming.

TKS Aerospace Private Ltd. :

TKS Aerospace launched various drones for farming community at the budget friendly. Drones provides digital, informative, precise field management for grain crops such as rice, cotton, corn and so on. Sensors and virtual imaging capabilities can provide farmers with a richer image of their fields. Using the drone, collecting information from it could show helpful in enhancing crop yields and farm efficiency.

➢ Drone spraying is proven to be faster than traditional methods in spray applications. Optimized precision control allows the drone pilot to spray seeds or fertilizers uniformly all over the land.

➢ Equipped UAV drone used to spread solid and liquid particles such as Fertilisers and Pesticides. It covers larger areas in short span of time and it is focused to reduce the labour, time and chemical usages.

Company's services and its benefits :

TKS Aerospace are here to provide drones as a service in order to familiarize their products with farmers. Company's services include the pay acre model and payday rental model. Famers and Industries can rent the spray drone anywhere according to their requirement. You can monitor crops, spray pesticides and seeds. The team of experts at TKS Aerospace are here to provide service and repair**.** It also build customised according to the needs of the farmer or Industries. Drones are primarily used by farmers and they helped over 4,820 satisfied clients, 10,000 total acres and 5,236 lands are sprayed by their drones.

✓ Reduce chemical and water usage
✓ Drift elimination
✓ Multi functionality
✓ Better Compatibility
✓ All in one Smartphone

Drone spare accessories and its Price rate:

The drone spare accessories used by the company are imported, with the major parts sourced from Bangalore, India. Additionally, other essential components are imported from China and Korea, known for their expertise in drone technology. By sourcing these parts from different regions, company ensures the availability of high-quality and reliable accessories for their agricultural drones. As for the pricing, the minimum rate for an agricultural drone offered by the ranges from 3.50 to 4.75 lakhs. This pricing reflects the advanced features, performance capabilities and durability of their drones, making them a valuable investment for farmers seeking

efficient and technologically advanced solutions for their agricultural needs.

Company's goal for drone rental pricing :

The company offers rental drones to farmers at a rate of 700 rupees per acre. This rental service provides farmers with access to advanced drone technology, enabling them to efficiently survey their fields, gather valuable data, and make informed decisions to optimize their agricultural practices. By offering affordable rental rates, the company aims to make drone technology accessible to a wide range of farmers, regardless of their farm size or resources. This cost-effective solution allows farmers to leverage the benefits of drone technology without the need for significant upfront investments in purchasing drones. With the rental drones priced at 700 rupees per acre, farmers can maximize their productivity, make data-driven decisions and enhance their overall agricultural output. It provides them with a cost-effective tool to improve crop health monitoring, identify potential issues and implement targeted interventions, leading to improved yields and sustainable farming practices.

Drone capabilities :

S. No.	Particulars (1 Acre)	Knapsack spraying	Tractor spraying	Drone Spraying
1	Time consuming (minutes)	180	90	10
2	Usage of water (lit/ac)	200	200-300	10-20
3	Usage of fuel (lit)	5	10	Battery used
4	Usage of pesticides (ml/lit)	100	75	30-50
5	Duration of working break (minutes)	30-45	15-20	3-5

Mission :

➢ Engage the youngster in drone technology especially in agricultural sector.
➢ To provide knowledge of UAV in schools and colleges through workshops and training programs.
➢ To provide drone services in various sectors through innovative research and development for the betterment of mankind.

Vision :

TKS Aerospace is a pioneer in manufacturing and supplying high quality agricultural drone in India at the reasonable price. The company motto is to "Bring technology to the society". It achieves this goal with their team work and solving real time problems faced by human work force in the society. They ensure quality through their products with standard benchmark materials & uniqueness in technology.

Future scope :

In order to secure the necessary funds

for our company's future endeavors in transportation and seed sowing, it is essential to establish a swift tie-up with the FPO (Farmers Producer Organization). The FPO plays a vital role in supporting and empowering farmers by providing financial assistance and facilitating various agricultural activities. By collaborating with the FPO, they can effectively elaborate on our company's offerings and showcase how their services in transportation and seed sowing align with their objectives. It should emphasize the efficiency, reliability and cost-effectiveness of our transportation solutions, which enable timely delivery of agricultural inputs and produce. Additionally, they can highlight our expertise in seed sowing techniques, promoting higher crop yields and improved farming outcomes. Through this tie-up, it can demonstrate how the company's initiatives align with the FPO's mission of enhancing farmers' livelihoods and promoting sustainable agriculture. By showcasing the mutual benefits of collaboration, it can work towards securing the necessary funds and establishing a strong partnership that will drive company's growth and contribute to the overall agricultural development in the region. Based on this view the main objectives of the study were i) To evaluate the socio- economic character of drone adopters and non-adopters in the study area, ii) To examine the constraints faced by drone entrepreneur in marketing and farm usage.[2]

This study is conducted in Virudhunagar district of Tamil Nadu. Primary data collection was carried out through which 60 farmers from 30 drone adopters and 30 non drone adopters based on the usage of digital technology in agriculture. The ultimate sample size was fixed as 60 multistage random sampling methods were used to select the sample farmers from the study area.

Tools of analysis :
Percentage analysis :

Percentage analysis is used to assess the socio-economic characteristics o sample farms.

SWOT analysis :

SWOT analysis is an acronym for the internal strengths and weaknesses of a firm and the environmental opportunities and threats facing that firm. SWOT analysis is a historically popular technique through which managers create a quick overview of a company's strategic situation. It is founded on the premise that an effective strategy results from a good "fit" between a company's internal resources (strengths and weaknesses) and its external environment (opportunities and threats). A strong fit optimizes a company's strengths and prospects while decreasing its shortcomings and threats. This simple assumption, when applied correctly provides sound, perceptive consequences for the formulation of a successful strategy.

SWOT is a strategic planning technique used to help a person or organization identify the strengths, weakness, opportunities and threats related to business competition or project planning.

i) *Strengths* :

A firm's strength is a resource or capability that it controls or has access to that offers it an advantage over competitors in

serving the needs of the clients it serves. The firm's resources and competencies contribute to its strengths.

ii) *Weaknesses :*

A weakness is a constraint or shortcoming in one or more of a firm's resources or competencies in comparison to its competitors that puts it at a disadvantage in satisfying client needs effectively.

iii) *Opportunities :*

An opportunity is a major favourable situation in a firm's environment. Key trends are source of opportunities. The discovery of a previously unknown market niche, changes in competitive or regulatory situations, technical advancements and enhanced buyer or supplier connections could all create opportunities for the company.

iv) *Threats :*

A threats is a significant unfavorable condition in a company's surroundings. Threats are significant hurdles to the company's present or planned status. Threats to a firm's success include the entry of new competitors, slow market development, enhanced bargaining power of important buyers or suppliers, technological advancements and new or updated legislation.

Strengths and weakness are frequently internally related while opportunities and threats commonly focus on environmental placement.

Strength-Characteristics of a company or initiative that provide it an advantage over competitors.

Weakness – Characteristics of the firm that put it at a disadvantage in comparison to others.

Opportunities – Elements of the surroundings that the company or project could use to its advantage.

Threats – Environmental factors that may pose problems for the business or project.

Garrett's Ranking Technique :

Garrett ranking technique is used to analyse major source of information about accessing ICT tools by respondents.

The ranking was calculated through the following formula

Percent position $= \dfrac{100\,(R_{ij} - 0.5)}{N_j}$

Where,

$R_{ij}=$ Rank given for the ith variable by j^{th} respondents

$N_j =$ Number of variable ranked by j^{th} respondents

By referring the Garrett's table, the per cent position estimated were covered into scores. For each parameter, the scores by various respondents were added and the mean value was calculated. The mean thus obtained for each of the attribute were arranged in descending order. The attribute with the highest mean value was considered as the most important parameters and the others would follow in the order[3].

Socio-economic and personal characteristics of Adopters and Non-adopters of Drone technology in agriculture :

Socio-Economic and personal characteristics were conducted to identify the demographic particulars such as age of the sample farmers, education, gender, occupational status, experience in farming, annual income and farm

Table-1. Socio-Economic and Personal characteristics of respondents in study area

S. No.	Variables	Category	Drone adopters Frequency	Drone adopters %	Non-adopters Frequency	Non-adopters %
1	Farmer's Age	<30	13	43.33	6	20.00
		31-40	10	33.33	12	40.00
		40-60	7	23.33	9	30.00
		>60	-	-	3	10.00
	Total		30	100.00	30	100.00
2	Education	Primary school	5	16.67	10	33.33
		Middle school	6	20.00	7	23.33
		Higher secondary school	8	26.66	9	30.00
		Degree	11	36.66	4	13.33
	Total		30	100.00	30	100.00
3	Gender	Male	27	90.00	22	73.33
		Female	3	10.00	8	26.67
	Total	30	100.00	30	100.00	
4	Occupational status	Farming alone	17	56.66	23	76.66
		Farming and agricultural labor	13	43.33	7	23.33
		Farming and business	-	-	-	-
	Total	30	100.00	30	100.00	
5	Experience in farming	Low experience <10 years	3	10.00	-	-
		Medium experience 10-20 years	11	36.66	28	93.33
		High experience>20 years	16	53.33	2	6.66
	Total		30	100.00	30	100.00
6	Annual Income	1-3 lakhs	23	76.66	27	90.00
		Above 3 lakhs	7	23.33	3	10.00
	Total		30	100.00	30	100.00
7	Farm size category	Marginal farmers (Below 2.5 acre)	1	3.33	2	6.66
		Small farmers (2.5-5 acre)	23	76.66	25	83.33
		Large farmers (Above 5 acre)	6	20	3	10
	Total		30	100.00	30	100.00

size with the help of samples collected during the survey were analyzed and presented below in table-1.

From the above table 1, it is inferred that the demographic particulars such as age of the sample farmers, education, gender, occupational status, experience in farming, annual income and farm size. It is observed that among the drone adopters in the study area, that majority of them belonged to the age group of 30 years (43.33 per cent) followed by 31-40 years which constituted (33.33 per cent), followed by 40-60 years which constituted (23.33 per cent). Hence it is clearly understood that the members were aged comparably more than the non-adopters. The result also revealed that majority of the drone adopters completed degree (36.66 per cent), followed by higher secondary school (26.66 per cent). The gender

Table – 2. SWOT Analysis

Strength	Weakness
➢ Drones can cover a big area quickly, making them an efficient tool for activities like mapping, surveying, and inspections. ➢ As compared to traditional methods, can save money on labor, time, and resources because they require fewer workers and equipment. ➢ Drones are a versatile tool that may be utilized in a variety of industries such as agriculture, construction, film production, and search and rescue. ➢ Drones can access difficult-to-reach areas without human interaction, lowering the chance of accidents and injury. ➢ Drones may collect and send data in real time, enabling for quick decision-making and analysis.	➢ Drones have a limited operating range and can only function within a set radius of the operator. ➢ Drones have limited battery life, which limits their operational period. ➢ Weather variables such as wind, rain and severe temperatures can have an impact on drones, limiting their use. ➢ Drones can malfunction or crash, putting people and property at danger.
Opportunities	**Threats**
➢ Drone technology is predicted to gain popularity in a variety of areas, including agriculture, construction and transportation. ➢ Drone technology research and development can lead to new and enhanced features and applications. ➢ Customization of drones to suit business needs has the potential to open up new market opportunities.	➢ Drones are subject to rules and regulations that limit their use and adoption. ➢ Drones can be considered obtrusive and create privacy concerns. ➢ With the emergence of new firms and technology, the drone market is becoming increasingly competitive. ➢ Drones are susceptible to cyber security concerns such as hacking and data breaches.

details of the sample farmers of drone adopters indicated that majority of the sample respondents were male (73.33 per cent) with only a very negligible female farmer participation (10.00 per cent). In case of non-adopters only male farmers were there (26.67 per cent) because most of the female worked as a labour and also farming practices in the study area. Occupational structure showed that the majority of the sample farmers were practicing farming alone 56.66 per cent followed by farming and agricultural labour 43.33 per cent. It is observed that the majority of the sample farmers were highly experienced in banana cultivation 53.33 per cent, in case of non-adopters the majority of the farmers were medium experience (93.33 per cent). Regarding the annual income, majority of the adopters and non-adopters (76.66 per cent, 90 per cent) fell in the annual income range of 1-3 lakh, the proportion of higher income. The average farm size of the sample respondents revealed the majority of the respondents belonged to small and marginal farmers (<5 acre) which contributed 76.66 per cent of the respondents of the drone adopters and 83.33 per cent where non-adopters. Respondents having greater than 5 acres of land constituted 20 per cent in drone adopters and 10 per cent in non-adopters.

SWOT Analysis :

SWOT analysis is conducted to identify the critical driving and retarding factors of success. Table-2, discuss the major prospects of SWOT of Drones using by this company.

Garrett's Ranking Technique :
Constraints faced by Drone Entrepreneurs in marketing :

An attempt was made to identify the problems faced by Drone Entrepreneurs in Marketing and the results are presented in Table - 3, along with the ranks assigned to them by the Garrett's ranking technique.

From the results of the table 3, it showed that majority 79.12 per cent of high cost of accessories followed by lack of fixed customers represents 71.14 per cent. The next major constraints they takes time to adopt some traditional peoples represents 61.94 per cent, Arguments from neighbour pesticides shops represents 58.03 per cent. The meager percentage of the respondents expressed lots of doubts to change represents 47.98 per cent respectively.

Constraints faced by farmers usage :

An attempt was made to identify the problems faced by Farmers usage and the results are presented in Table-4, along with the ranks assigned to them by the Garrett's ranking technique.

Table-3. Problems faced by Drone Entrepreneurs in Marketing

S. No.	Particulars	Mean Score	Rank
1	High cost of accessories	79.12	I
2	Lack of fixed customers	71.14	II
3	Takes time to adopt some traditional peoples	61.94	III
4	Arguments from neighbour pesticides shops	58.03	IV
5	Lots of doubts to change	47.98	V

Table-4. Problems faced by Farmers Usage

S. No.	Particulars	Mean Score	Rank
1	Highly expensive	88.97	I
2	Lack of adoption to new technologies	72.85	II
3	Lack of technological knowledge	54.03	III
4	Chemicals spread to neighbours land	47.98	IV
5	Lack of Govt. subsidies & schemes	36.15	V

From the results of the table 4, it showed that majority 88.97per cent of highly expensive followed by lack of adoption to new technologies represents 72.85 per cent. The next major constraints is lack of technological knowledge represents 54.03 per cent, Chemicals spread to neighbours land represents 47.98 per cent. The meager percentage of the respondents expressed lack of Govt. subsidies & schemes represent 36.15 per cent respectively.

TKS Aerospace Private Ltd. stands as an exemplary business model that other drone entrepreneurs can look up to and follow. With its success and expertise in the drone industry, the company has set a high standard for innovation, efficiency and customer satisfaction. One aspect that makes TKS Aerospace, a great business model is its focus on delivering exceptional quality. The company ensures that its drones are built with cutting-edge technology and adhere to rigorous standards, guaranteeing reliable performance and customer satisfaction. By prioritizing quality, it has built a strong reputation and gained the trust of its customers. Moreover, company's rental drone services at an affordable rate of 700 rupees per acre showcase their dedication to supporting farmers. By making advanced drone technology accessible and cost-effective, the company helps farmers enhance their agricultural practices, improve yields and promote sustainable farming methods. Smart agriculture is assisting farmers in increasing efficiency while decreasing negative environmental implications. The agriculture sector has firmly and openly adopted digital agriculture technology in order to influence the overall outcome. Smart technology is assisting in the control and management of any unwelcome natural situation. Implementing technology-enabled ways might help detect illnesses or climatic changes sooner and respond more intelligently. It would pave the way for other input merchants who are only interested in making a profit by recommending excessive amounts of fertilizer and pesticides to farmers. The production cost is decreased since the inputs are offered at a low margin, resulting in a larger net profit per unit area.

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