iJRASET
International Journal For Research in Applied Science and Engineering Technology



INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 14 **Issue:** V **Month of publication:** May 2026

DOI: https://doi.org/10.22214/ijraset.2026.82375

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International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538
Volume 14 Issue V May 2026- Available at www.ijraset.com

A Study on Farm Ease: Digital Transformation of Agricultural Services in Rural India

Alok Ravishankar Pandey[1], Dr. Zahir Aalam[2]
[1]*Department of Computer Engineering Thakur College of Engineering & Technology, Mumbai, India*
[2]*Dean (TP &IL), Thakur College of Engineering & Technology Mumbai, India*

Abstract: ***Digital revolution in agricultural sector is substantially altering the conventional agriculture sector in India as there is assimilation of the technology-based solutions in the lives of the rural people. Online applications like FarmEase, which is an online agricultural service project, are designed to close historical disparities between farmers and necessary services, comprising of access to markets in real time, customized weather predictions, professional advisory service, and effective input sourcing systems. Using mobile technology and data analytics, FarmEase aims at enabling small and marginal farmers to make informed decisions with credible and timely information. This paper will look at how the introduction of FarmEase has affected the agricultural output, the level of the rural farmers, and the general access of the rural farmers to agricultural services. The study concentrates on some villages within Madhya Pradesh and takes a mixed research design to determine a thorough evaluation by involving quantitative surveys, qualitative interviews, and secondary data analysis. The data of the surveys focuses on the quantifiable transformation of the crop yield and income, whereas interviews focus on the experience, perception and the problems related to the adoption of digital use by farmers. The analysis is also supported by secondary data, which is the records of FarmEase usage. The results will be used to assess the role of digital transformation with the help of FarmEase in enhancing the outcome of farming and determining the primary factors affecting the success of this technology in rural agrarian development.***

Keywords: Digi agriculture, FarmEase, rural farmers, agricultural productivity, farm income, digital advisory services, technology adoption.

I. INTRODUCTION

The rural economy of India still depends on agriculture as its backbone which has sustained livelihood to almost half the national population of the country and has played a major role in the national food security. Although significant, the agricultural sector has continually been plagued with structural problems which include fragmented land sizes, climatic fluctuations, poor access to real time information, and poor market connections. The farmers who are mostly affected by the fluctuations at the prices, unpredictable weather conditions and less extension services are known as the small and marginal farmers who are the majority of the farmers who are cultivating the land. These limitations tend to lead to poor productivity, high-level of incomes and ineffective use of resources[1].

The recent years have seen the fast growth of the digital technologies which provide new possibilities to deal with these old challenges. Due to the spread of smartphones, cheap internet connectivity, and data-intensive apps, there has been an opportunity to create digital agriculture platforms to serve farmers all the way up through the agricultural value chain. Mobile technology and analytics process platforms such as farmEase are used to provide timely information associated with weather forecasts, market prices, crop advisory services, and availability of agricultural inputs. They are such platforms aiming at minimizing the information asymmetry, enhancing decision-making, and improving the farm-level outcomes [2].

Digital agricultural services also resonate with the rest of the policy vision of India to enhance inclusive growth and rural development by other means like Digital India and e-Governance reforms. With the application of technology in traditional farming, applications such as FarmEase can be used to increase productivity, stability of income and sustainable farming. Nonetheless, these platforms can only have a tangible effect based on the rates of adoption, usability, digital literacy, and local socio-economic factors[3]. Consequently, to understand how effective and prospective digital platforms are, it is necessary to study how they can change rural agriculture.

A. Background of the Study

Digital agricultural platforms have come to the limelight across the world as a useful instrument of boosting agricultural productivity and resilience.

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In the developing economies, extension services, climate insights and market intelligence are increasingly being availed to the farmers through technology-based solutions. These platforms make them less reliant on traditional intermediaries and allow farmers to make an informed choice on how to plan, use inputs, and market crops[4]. In India, the topicality of such platforms is increased by the size of the agricultural industry and the pre-eminence of smallholders.

The last ten years have seen a sudden increase in the penetration of mobile phones and availability of internet in rural India. As a result of government efforts, like Digital India, e-NAM (National Agriculture Market), and other agri-tech start-up policies, the digital transformation of the rural area has become even faster. The platforms such as FarmEase have developed within this changing ecosystem as integrated solutions that provide real-time market prices, localized weather updates, advisory services of experts and digital procurement of agricultural inputs. Such services are aimed at solving information lapses and operational inefficiencies of the farmers at the grassroots level [5].

FarmEase is specifically designed to serve small and marginal farmers with region and crop-specific data using a simple online platform. The platform is expected to work together with data analytics and localized content to enhance the productivity of farms, minimize risks related to climate uncertainty, and expand income opportunities. Yet, digital literacy, availability of infrastructure and trust in technology are major factors that affect adoption and effectiveness[6]. This paper is placed in this environment and aims at evaluating the role of FarmEase to the digital transformation of agricultural services in rural India with specific reference to the selected villages in Madhya Pradesh.

B. Research Objectives

1) To assess the degree of FarmEase adoption among the rural farmers.
2) To determine the effect of the FarmEase on crop productivity and income.
3) To examine the perception farmers have regarding digital agricultural services.
4) To suggest measures on improving adoption and impact.

C. Research Questions

1) What is the percentage adoption of FarmEase by farmers?
2) What is the impact of FarmEase on the agricultural productivity?
3) What are the difficulties of using FarmEase among the farmers?

II. LITERATURE REVIEW

Specifically in the developing nations where information asymmetry and lack of resources impact agricultural output. The current literature largely concurs that agricultural decision-making can be revolutionized by the use of digital tools which can enhance access to appropriate, precise, and usable data by farmers in a timely manner. According to Smith et al. (2022), digital platforms which provide weather forecasts, market prices, and crop advisories allow farmers to make sound decisions about sowing, irrigation, and harvesting and minimize the risks of production and losses after harvesting[7]. These tools are particularly useful in areas that are susceptible to both climate change and fluctuations in the market.

A number of works concentrate on mobile-based advisory services which are one of the key elements of digital agriculture in India. According to Rahman and Sinha (2021), mobile advisories have increased reach, but their effect on productivity and income is ambiguous[8]. Low digital literacy, language differences, inconsistent internet access and the absence of trust in digital suggestions are also common limiting factors to effective use. Likewise, Mittal and Mehar (2016) state that not only people have access but farmers should be capable of comprehending and utilizing the offered information[9]. This underscores the role of usability, localization and capacity-building in digital agricultural projects.

The market information systems have also been studied to analyze their effects in improving the bargaining power of farmers. Research indicates that real-time price data assists farmers to identify the best markets, minimize the use of intermediaries, and achieve high prices of their products. Aker (2011) establishes that the price dissemination through mobile devices is very effective in enhancing market efficiency and the income that farmers receive in the developing economies[10]. The inclusion of price information with logistics and advisory services on a platform is deemed to be more effective than a standalone solution in the Indian context since they solve several restrictions at the same time. Farmer perception and trust can be considered another important dimension of the literature. Farmers have confidence in the accuracy and relevance of information and this strongly contributes to digital adoption. According to Qiang et al. (2012), the formation of trust in digital platforms is a slow process that is conditioned by previous experiences, social influence by peers, and institutional support[11].

Those platforms that are backed by government agencies or other reputable private organizations are going to acquire acceptance much faster. Trust and continued use is further boosted by the ease of use and support in the local language as well as customized recommendations.

Although the literature on digital agriculture continues to increase, there exist a number of limitations. A large part of the literature available is on pilot projects or individual service applications or short-term evaluations. Empirical evidence on integrated digital platforms, which have multiple services like weather advisories, market access, extension support and input procurement, is relatively limited. Furthermore, there are limited geographical studies on actual implementation and effect on a village level, especially in central states of India such as Madhya Pradesh.

A discrepancy between technological potential and actual outcomes is also a gap identified in the literature. Although theoretically, digital platforms can positively impact productivity and income, education, land holding size and access to infrastructure are socio-economic factors that mediate outcomes to a large extent. Digital transformation in agriculture should be assessed and considered not only based on the technological implementation but also based on inclusivity and usability as noted by World Bank reports [12].

A. Gap Identified

Despite the theoretical advantages of digital agricultural tools in the past, there is a scanty research on the practical impact of integrated platform such as FarmEase in rural Indian settings. Particularly, the villages-level empirical studies that simultaneously measure the adoption patterns, productivity, income, and farmer perceptions are lacking. This paper aims to fill this gap by giving a critical analysis of FarmEase as an online agricultural services platform in rural Madhya Pradesh.

III. METHODOLOGY

A. Research Design

The current research is a mixed-method research design that will be used to achieve an in-depth insight into how FarmEase will influence the practices of agriculture in rural India. It combines quantitative and qualitative research, which gives an opportunity to triangulate data and increase data validity. Key variables including adoption levels, crop yield, and income differences between FarmEase users and non-users can be measure because of the quantitative data that will be gathered using structured surveys. On the contrary, qualitative data collected during interviews will shed more light on how farmers perceive, experience, and struggle with the utilization of digital agricultural platforms.

In particular, the mixed-methods design is ideal in the research of digital transformation in agriculture because it can relate not only quantifiable results but also contextual and behavioral aspects of the adoption of technologies. The use of both numerical patterns and narrative descriptions makes the study balanced in analyzing the effectiveness of FarmEase in rural environments[13].

B. Study Area and Sampling

The research took place in ten villages of the Bhopal and Sehore villages of the Madhya Pradesh state, where most people have an agrarian livelihood and where the population of people using digital technologies has been increasing. These districts were chosen because they combine both old farming methods and new adoption of digital agricultural systems, and thus are applicable in measurement of the effect of the use of FarmEase.

The study sampled a total of 200 farmers (100 users and 100 non-users of FarmEase) to enable them to compare the two. The sampling method that was used was stratified random sampling and this ensured that there was sufficient representation of the various categories of farmers according to landholding size, age and use of technology. The approach minimizes sampling bias, and increased the sample representativeness. The study excludes the impact of other factors on the agricultural outcomes by allowing adopters and non-adopters to be within the same geographic setting[14] .

C. Data Collection Tools

There were several data collection instruments that were used to have a wide and effective data collection. Quantitative data regarding the demographic data of the farmers, status of adoption of FarmEase, crop yield and income per year was collected using a structured questionnaire. The questionnaire has close-ended and Likert-scale questions to make statistical analysis easier. In-depth interviews were also done with some farmers to supplement the survey data to understand their experiences, perceived benefits and problems associated with the use of FarmEase.

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The interviews were a qualitative source of information regarding the problems of usability, trust, and digital literacy. Also, secondary data was gathered through platform analytics of FarmEase, comprising the usage frequency, the number of logins, and accessed services. This multi-tool method enhances the validity of the data because it incorporates self-report data with actual utilization data[15].

D. Variables

Variable	Type	Measurement
FarmEase Adoption	Independent	User vs Non-user
Crop Yield	Dependent	Quintals per hectare
Annual Farming Income	Dependent	INR per annum
Info Accuracy Satisfaction	Dependent	Likert scale (1–5)
Frequency of Use	Independent	Number of logins per month

E. Data Analysis Techniques

- Descriptive statistics (percentages, mean, standard deviation).
- Competitive analysis based on t-test to assess difference between users and non-users.
- Regression to establish the effect of adoption of FarmEase on productivity and income [16].

IV. RESULTS AND ANALYSIS OF FARMEASE ADOPTION

A. Demographic Characteristics of FarmEase Users and Non-Users

Attribute	FarmEase Users	Non-Users	Total
Average Age	42	44	43
Education (above 5th class)	65%	40%	52.5%
Farm Size (hectares)	3.2	3.4	3.3

The demographic profile indicates moderate differences between FarmEase users and non-users. FarmEase users are slightly younger on average, suggesting greater openness to adopting digital tools among younger farmers. A higher proportion of users have education above the 5th class, highlighting the role of basic education in digital adoption. Farm size is relatively similar across both groups, indicating that differences in productivity and income are less influenced by landholding size and more likely associated with access to digital services and information provided through FarmEase.

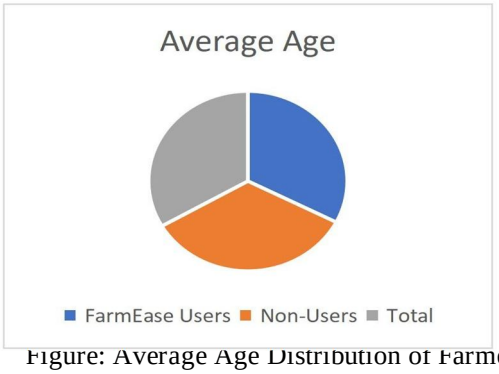


Figure: Average Age Distribution of Farmers

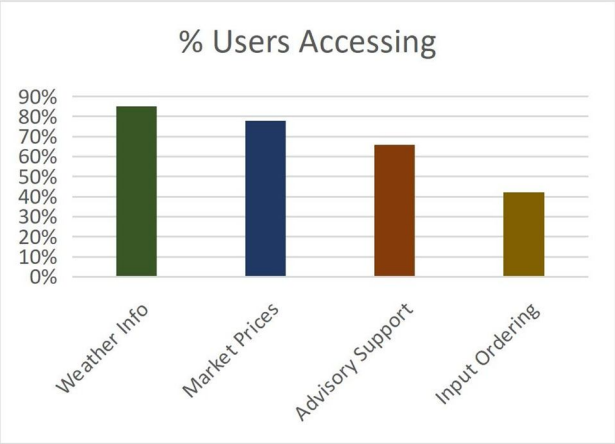
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Volume 14 Issue V May 2026- Available at www.ijraset.com

The pie chart is used to display the average age of users and non-users of FarmEase and the sample of the whole farmers used in the study. The users of FarmEase are somewhat younger than the non-users, which indicates that younger farmers could be more prone to the use of digital agricultural solutions. The non-users represent a slightly older population, which can be connected to the reluctance to move toward technology usage because of the lack of online digital skills. The total mean age is between the two groups which is a sign of a balanced sample. Such age distribution shows that demographic variables are a significant determinant of digital adoption and that age-aware training and outreach efforts are vital in the promotion of digital agriculture.

B. FarmEase Usage Patterns

Service Category	% Users Accessing
Weather Info	85%
Market Prices	78%
Advisory Support	66%
Input Ordering	42%

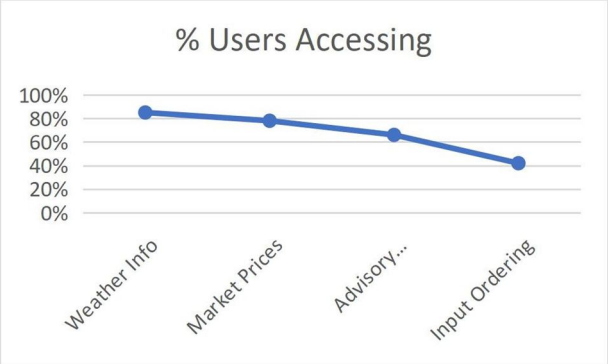
The usage pattern of the services reveals that the most utilized service is the weather information (85 percent), which underscores the high reliance of farmers on timely updates of the weather so that they can plan the sowing, irrigation, and harvesting processes. Information about market prices (78%) is also popular that indicates the role of real-time price awareness when deciding on bargaining power and income. Advisory support (66%): this proves to be highly engaging, which shows trust in expert advice on managing crops. Input ordering (42%) however has less usage and this indicates some form of obstacles, which could be logistical, familiarity with payments or a desire to deal with conventional suppliers. Generally, this trend points to the fact that there is a preference of information based services over transactional services.



FarmEase Service Usage Distribution

The bar chart shows the percentage of the users of FarmEase who are accessing various services provided by the platform. The service that is most used is weather, which implies that farmers are very dependent on climate-related information to control risks in their agriculture. Market price information is also highly used, indicating the role of real time price consciousness on improving income decisions. Advisory support shows the intermediate activity, which implies an increase in confidence towards the use of professional online information on crop management. However, input ordering logs the least usage, potentially because of low familiarity with digital payments, logistical reasons, or local preference. In all, the chart shows that informational services are easily adopted compared to transactional services.

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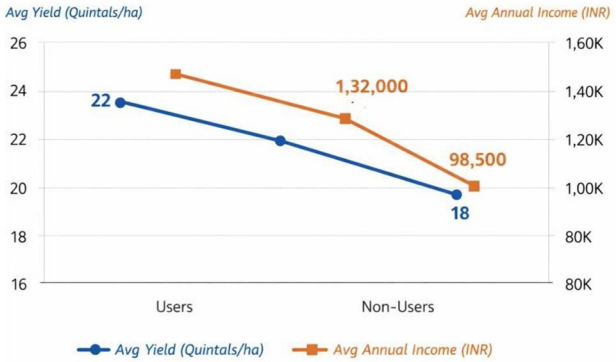
FarmEase Service Access Trends

The line chart has been used to depict the percentage of users who use different services in FarmEase and a definite pattern of preference is observed among farmers. Weather information has the greatest usage thus highlighting the importance of this in risk management of climate related hazards and in planning agricultural operations. Market price data are then closely followed, with respect to the need of farmers in the real time pricing to enhance the selling decisions and income to be obtained. There is moderate use of advisory support which implies selective use of expert advice based on the conditions of crops. The lowest access rate is captured under input ordering and this reflects restrictions like limited knowledge on digital payment system, logistic difficulties or still reliance on local suppliers of inputs. In general, the trend reveals the increased use of informational services as opposed to transactional features.

C. Impact on Productivity and Income

Indicator	FarmEase Users	Non-Users
Avg Yield (Quintals/ha)	22	18
Avg Annual Income (INR)	1,32,000	98,500
Satisfaction with Info	4.2 (out of 5)	3.1 (out of 5)

A comparison between indicators of users and non-users of FarmEase shows that there is an evident positive effect of the adoption of digital platforms. There are also increased average crop yields by FarmEase users who report to have a better management of their farms which is backed by timely information and advisory. Their agricultural revenue is also significantly larger per annum implying a better access to market and higher price recovery. Moreover, users are much more satisfied with the accuracy of information, which denotes that they trust the site and its reliability and relevance. On the contrary, non-users are less productive, have lower income, and satisfaction. In general, the results indicate that FarmEase is a valuable contribution to the improvement not only of the economic performance but also the level of information confidence in rural farmers.



Farm Ease vs Non-Users: Yield and Income

The line graph has brought to the fore the comparative difference between the average crop yield and annual income of FarmEase users and non-users. The users of FarmEase register increased yields and much greater levels of incomes, which points to the fact that the provision of the digital advisory services, weather forecasts, and price fluctuations has a positive impact on farming. The downward movement of the user to non-user in both yield and income shows the economic and productivity benefits of adopting digital platforms. The fact that the two lines move in parallel is an indication of a close association between an increase in productivity and increase in income. In general, the graph supports the finalization that FarmEase is part of more efficient and profitable agricultural practice.

V. FARMEASE USAGE PATTERNS AND AGRICULTURAL OUTCOMES DATA

Table A: Usage Frequency of FarmEase Features

Farmer ID	Weather (logins)	Price Info	Advisory Messages Sent	Inputs Ordered
001	12	10	6	2
002	15	12	8	1
003	8	6	5	3
...	...	...	...	...
100	10	9	7	1

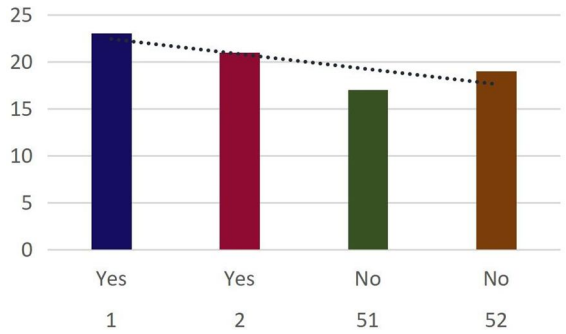
The table features frequency of usage of various features of the FarmEase among sampled farmers. The most common number of logins is recorded in weather information and market price services, which means that farmers are using these features on a daily basis. Advisory messages are viewed in moderation, which could be an indicator that there is selective use of expert advice depending on the needs of the crops. There is less frequent input ordering, indicating poor usage of transactional services as compared to informational services. Altogether, the tendency indicates that farmers use FarmEase to obtain information in a timely manner, but not to buy inputs, which proves that the platform is more effective as an information and decision-support tool.

Table B: Crop Productivity & Income

Farmer ID	FarmEase User?	Yield (q/ha)	Income (INR)
001	Yes	23	1,40,000
002	Yes	21	1,25,000
051	No	17	90,000
052	No	19	1,05,000

The table reveals evident productivity and income disparity in crop productivity and income levels between users and non-users of FarmEase. FarmEase gives higher yields, which are approximately 21-23 quintals per hectare, and the level of annual income increases. Non-users on the other hand demonstrate relatively poor yields and income implying poor access to timely market and advisory information. This trend indicates that the adoption of FarmEase promotes more farm management activities and enhanced economic results. The deviation in the two categories also shows that as much as digital platforms are improving performance, other variables like the type of crop produced, utilization of inputs, and level of management of the farm still bring differences to the productivity and income derived.

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Comparison of Crop Yield by FarmEase Adoption

The bar chart illustrates crop yield levels for selected FarmEase users and non-users. Farmers using FarmEase show higher yields, with values above 20 quintals per hectare, indicating improved agricultural performance supported by digital advisories and timely information. In contrast, non-users record comparatively lower yields, reflecting traditional farming practices with limited access to real-time data. The declining trend line from users to non-users visually emphasizes the productivity gap between the two groups. Overall, the chart reinforces the positive association between FarmEase adoption and enhanced crop productivity, while also indicating variability in yields across individual farmers.

A. Result

The findings indicate that there are distinct differences between FarmEase users and non-users in terms of demographic, usage and outcome indicators. Users of FarmEase were also relatively younger and highly educated with 65 per cent having education beyond the 5 th standard as compared to 40 per cent of non users. Behavioral trends reveal that the most popular services were weather information (85%), market price updates (78%), which demonstrated that timely and actionable information was the most popular with farmers. FarmEase users indicated better average yield of crop (22 quintals/ha) and annual agricultural income (INR 1,32,000) was significantly higher than that of non-users (18 quintals/ha) and (INR 98,500), respectively. User satisfaction with the accuracy of information was also much greater. The obtained results indicate that the adoption of FarmEase positively affects productivity, the level of incomes, and access to trustworthy agricultural information in rural communities.

These results suggest that there is a positive correlation between FarmEase usage and the number of features used, crop yield, and farm revenue, which confirms the beneficial influence of the given platform on the productivity and the decision-making processes of farmers.

VI. DISCUSSION

1) The More Adoption, the More the better results:It was reported that users of FarmEase achieved better crop yields and a higher annual income, which is the evidence that the availability of digital consulting services and real-time information about the market helps farmers to make informed decisions and improve their performance in agriculture.

2) Service Usage Trends: The most often used services were weather predictions and market price changes, which served as an indication of the great interest of farmers in timely available information on climate conditions and the precision of the prices to minimize risks.

3) Challenges: It was found that limited digital literacy and unreliable internet connectivity were also significant obstacles and limited successful usage of the platform, especially among more old-fashioned and less-educated farmers.

4) Perception: FarmEase was rated highly in general perception as most of the users reported that they were satisfied and trusted information on the site to be accurate, helpful, and applicable to their farming requirements.

VII. RECOMMENDATIONS

1) Carry out digital literacy training at villages.

2) Collaborate with telecommunication companies in order to have improved connections.

3) Customize local languages and dialects.

4) Combine AI-based predictive recommendations- disease, pest predictions.

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VIII. CONCLUSION

The current paper discussed the application of FarmEase as a technological agricultural service tool and how it has influenced the agricultural activities in Madhya Pradesh rural regions. The results show clearly that digital transformation with such a platform as FarmEase can contribute greatly to increasing the rates of agricultural productivity, the level of income of the farmers, and reinforcement of access to the stable sources of the agricultural information. FarmEase will solve several problems of small and marginal farmers by providing a combination of services, including weather forecasts, market price services, advisory service, and input purchasing services.

The comparative study of the users and non-users of FarmEase shows that there is a significant difference in the outcomes. The farmers with FarmEase had increased crop yield and significant higher annual revenue, which implies the timely availability of information and informed decision-making have a positive impact on farm performance. The increased levels of satisfaction among the users also suggest the trust to the quality and utility of the services of the platform. The patterns of usage show that farmers are more interested in weather and market data, which confirms the significance of real-time information when it comes to the agricultural risk management strategy and profit maximization.

Along with these positive results, the study also indicates the positive effect of digital platforms does not apply equally to all farmers. Education levels and digital literacy as well as the frequency of use of the platforms affect adoption and effectiveness. The less educated non users, were mostly less educated and could not be involved in the digital farming programs due to technological access and comprehension.

Altogether, the research concludes that FarmEase is a viable model of the digital transformation of rural Indian agricultural services. Nevertheless, in order to reach a broader and more comprehensive impact, one should seek to enhance digital literacy, enhance rural connectivity, and establish intuitive interface in local languages. Under the right policy backing and special capacity building interventions, the digital platforms such as FarmEase can play a significant role in enhancing sustainable agricultural practices and rural economic development.

IX. SUGGESTIONS

1) Build Digital Literacy Initiatives: Specific village-level training needs to be arranged to enhance the digital capability of the farmers. Practical demonstrations, tutorials in the local language, and local peer learning models can be used to build confidence in the use of FarmEase features beyond the access to the basic information.

2) Enhance Internet and Technical infrastructure.: Good internet connection is very fundamental to the successful use of the platform. Telecom providers and local authorities should be collaborated with in order to enhance the network coverage so that they are not interrupted to receive weather updates, market prices, and advisory services.

3) Encourage Service Adoption, Transactions: Farmers can be motivated to use input ordering facilities by special incentives like discounts or cashback offers or bundled services. The establishment of trust in online payments and prompt delivery will contribute even more to the acceptance of transactional services.

4) Customize Advisory Content: The advisory services need to be more localized and crop-specific to cater to the short-term needs of farmers. Practical application and relevance of suggestions and improved understanding can be achieved with the help of voice-based or visual advisories that allow incorporating the regional experts.

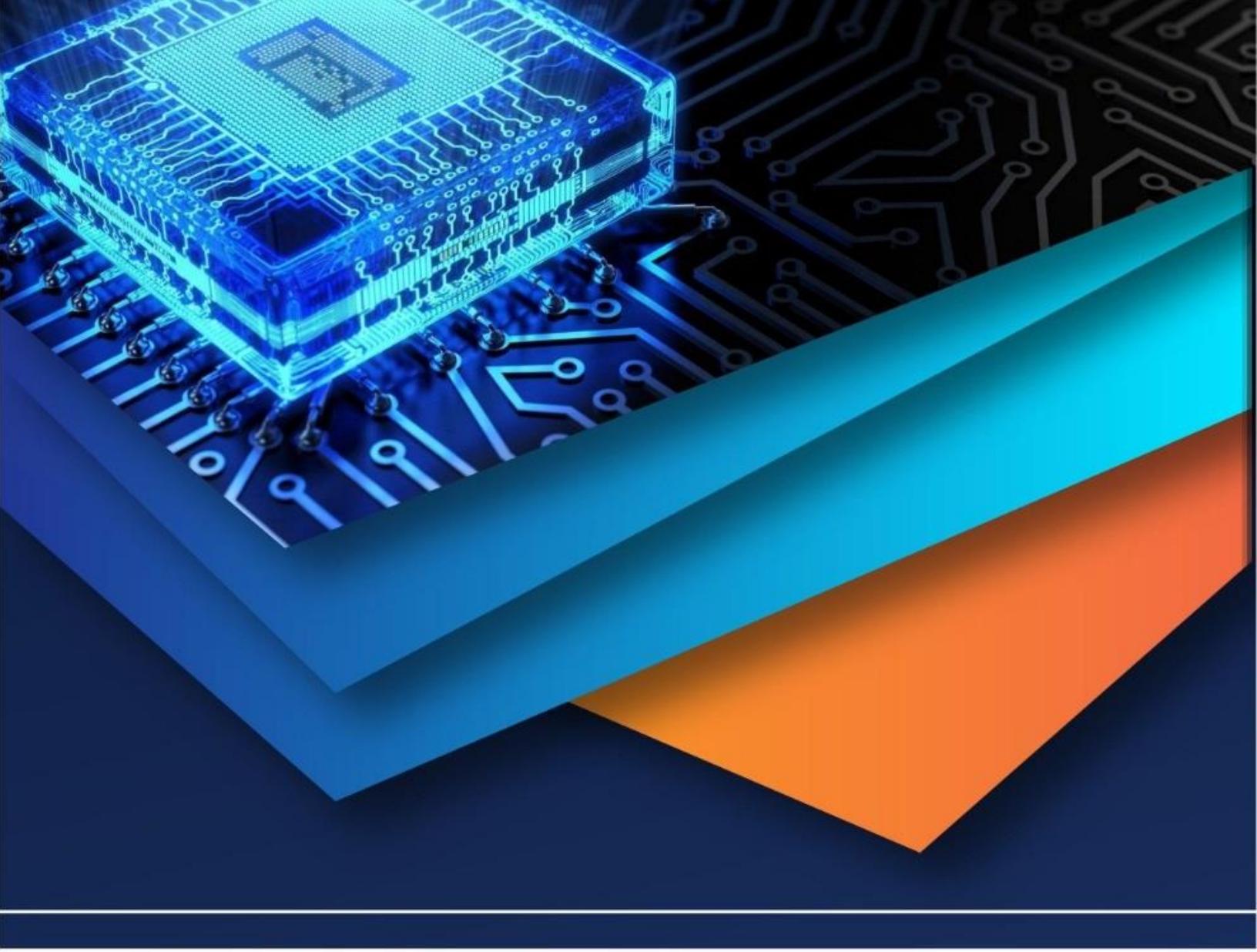
5) Increase Platform Awareness and Reach: FarmEase can be adopted in large numbers by conducting regular awareness campaigns using farmer cooperatives, extension officers and local institutions. Existing users can be used to generate success stories that would inspire non-users by showing them real productivity and income improvements.

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