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Impact study of smartphone agriculture applications on farmers

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Abstract

The integration of smartphone applications into agricultural extension services holds significant promise for enhancing information dissemination. However, empirical evidence on their differential impact across diverse farmer typologies remains crucial for targeted policy interventions. This study aims to analyze the socio-economic profile of farmers in Wardha district, Maharashtra, and to assess the comparative impact of smartphone agro-applications on the accessibility and quality of agricultural market information. A multi-stage random sampling technique was used to select 300 farmers from all five talukas of Wardha district. Primary data were collected through a pre-tested, structured questionnaire. Descriptive statistics (frequency and percentage) were employed to profile the respondents based on education, landholding, and social participation. A comparative analysis of perceived impact scores on market information was conducted for the periods before and after the adoption of smartphone applications. The socio-economic profile revealed that while a significant portion of farmers (32.92%) had college-level education, the majority (74%) were small and marginal holders, and over half (51.67%) exhibited low social participation. The comparative impact assessment showed a marked improvement in access to market information post-adoption. The proportion of farmers reporting a 'low' impact fell from 16.67% to 8.00%, while the 'medium' impact category expanded from 70.00% to 77.67%. Post-adoption, a majority (61%) of respondents perceived a medium level of impact specifically from the apps on their market information. Smartphone agro-applications have noticeably enhanced the quality of market information for farmers, primarily by shifting a significant segment from the 'low' to the 'medium' impact category. While the technology has broadened information access to a degree, the persistence of a small 'low-impact' group and the slow growth in the 'high-impact' category suggest that socio-economic variables like landholding size and social participation continue to moderate the benefits. The study underscores the need for extension strategies that combine digital tools with targeted support for marginal farmers to foster equitable agricultural development.

Keywords: Smartphone agro-applications, agricultural extension services, market information access, socio-economic profile, impact assessment, digital agriculture

Introduction

The agricultural sector in India is undergoing a significant transformation, driven by the combination of Information and Communication Technology (ICT). Government initiatives like 'Digital India' have catalyzed the development and dissemination of smartphone-based agro-applications, which promise to deliver timely, cost-effective information to farmers' fingertips. These technologies have the potential to revolutionize traditional extension services by providing critical data on weather forecasts, market prices, pest management, and best practices, thereby reducing information asymmetries and transaction costs (Aker, 2011; Mittal, 2016) ^[1, 9].

However, the adoption and realized impact of these digital tools are not uniform. They are mediated by a complex interplay of socio-economic factors, including landholding size, farming experience, education, and social capital (Feder *et al.*, 1985; Rogers, 2003) ^[4, 11]. In a diverse agrarian landscape, understanding how different categories of farmers perceive and benefit from these technologies is crucial for designing inclusive policies. This is particularly relevant in regions like the Vidarbha area of Maharashtra, where

agricultural livelihoods are often insecure and access to reliable information is a key determinant of farm profitability and sustainability.

While existing literature has acknowledged the potential of ICT in agriculture, there is a need for empirical studies that quantify the perceived shift in information access before and after the adoption of smartphone applications. This study addresses this gap by focusing on the Wardha district of Maharashtra. It seeks to profile the socio-economic characteristics of local farmers and conduct a comparative assessment of the impact of smartphone agro-apps on their access to market information. By analyzing these changes across different farmer classification, this research aims to provide actionable insights for extension agencies, policymakers, and technology developers to enhance the effectiveness and equity of digital agricultural services.

Methodology Overview

This study was conducted in the Wardha district of Maharashtra State, India, encompassing five key agricultural blocks (talukas): Wardha, Selu, Deoli, Hinganghat, and Samudrapur. A multi-stage random sampling technique was

employed to select 300 farmers as respondents. Primary data were gathered through personal interviews using a pre-tested, structured questionnaire. The analysis relied on descriptive statistics, including frequency and percentage distributions, to profile the respondents. A core feature of the methodology was the comparative assessment of the perceived impact of agricultural information before and after the adoption of smartphone applications, facilitating a clear analysis of change.

Literature Review

The integration of Information and Communication Technology (ICT) into agriculture represents a significant shift in knowledge dissemination. Research establishes that mobile phones, and increasingly smartphones, provide a cost-effective platform for delivering timely information on markets, pests, and farming techniques, reducing information search costs for farmers (Aker, 2011) ^[1].

Adoption of such technologies is not uniform and is influenced by key socio-economic variables. Landholding size is a critical determinant, with small and marginal farmers often facing adoption barriers related to resources and risk, while larger farmers are typically earlier adopters (Feder *et al.*, 1985) ^[4]. Farming experience also shapes adoption, where experienced farmers may rely on traditional knowledge, and newer farmers may be more open to innovation but lack contextual understanding (Rogers, 2003) ^[11]. Furthermore, a farmer's existing contact with formal extension services moderates technology use, with apps serving as either a complementary tool or a primary information source (Glendenning *et al.*, 2010) ^[6].

In the Indian situation, initiatives like Digital India have stimulate the growth of agricultural apps. However, challenges such as digital literacy, local language content, and sustainable engagement persist (Mittal, 2016; Fu & Akter, 2016) ^[9, 5]. Within Maharashtra's Vidarbha region, where Wardha is located, accessible information is crucial for livelihood security. This study addresses a gap by providing a detailed analysis of how smartphone agro-apps impact different farmer typologies, defined by landholding, experience, and extension contact within this specific socio-agrarian setting.

Methodology

Study Area

The research was conducted across all five talukas of Wardha district to ensure representation of its agrarian diversity.

Data Collection and Variables

Data were collected via structured interview schedule designed to capture Socio-Economic Profile- Landholding size, farming experience, and a score for extension contact.

Impact Assessment

A set of Likert-scale questions measured the perceived quality, accessibility, timeliness, and usefulness of agricultural information. Composite impact scores were calculated separately for the period before and after smart phone app adoption.

Data Analysis

The data were analyzed using descriptive statistics

(frequency, percentage, mean). The results are presented in tabular form to profile the respondents and to clearly show the comparative shift in impact scores before and after adoption. Categorization of all scores into Low, Medium, and High facilitated interpretation of trends and distributions.

1. Education

Table 1: Distribution of the respondents according to their Education

Sr. No.	Category	Respondents (n=300)	
		Frequency	Percentage
1.	Illiterate	17	5.61
2.	Primary school (1 st to 4 th standard)	38	12.71
3.	Middle school (5 th to 7 th standard)	59	19.79
4.	High school (8 th to 10 th standard)	87	28.97
5.	College level	99	32.92
Total		300	100

Table no. 1 presents the educational attainment of the 300 surveyed respondents. College Level 32.92% the single largest category, indicating that nearly one-third of the sample has pursued education beyond secondary school. Illiterate: 5.61% while a small percentage, this represents individuals completely outside the formal education system, Primary & Middle School (1st-7th standard): Combined, these two categories account for 32.5% of respondents (12.71% + 19.79%). This sizable group represents early school leavers.

2. Landholding

Table 2: Distribution of the respondents according to their land holding

Sr. No.	Category	Score	Respondents (n=300)	
			Frequency	Percentage
1.	Marginal	Up to 1 ha.	18	6.00
2.	Small	1.01 to 2.00 ha.	114	38.00
3.	Semi-medium	2.01 to 4.00 ha.	108	36.00
4.	Medium	4.01 to 10.00 ha.	47	15.67
5.	Big	10.01 ha. and above	13	4.33
Total			300	100

The data from table no. 2 indicates that the majority of respondents (74%) are smallholder farmers, falling into the "Small" and "Semi-medium" categories, Marginal Farmers (≤ 1 ha) at only 6%, Medium landholding (4.01-10.00 ha) A notable minority at 15.67%, Big Landholders (≥ 10.01 ha) a very small elite segment at 4.33%.

3. Social participation

Table 3: Distribution of the respondents according to their social participation

Sr. No.	Category	Score	Respondents (n=300)	
			Frequency	Percentage
1.	Low	Up to 0.00	155	51.67
2.	Medium	1 to 2	99	33.00
3.	High	3 & above	46	15.33
Total			300	100

This table no. 3 show that over half of the respondents (51.67%) exhibit a low level of social participation. A significant minority 33.00% of medium level of

participation, only 15.33% of respondents are classified as having high social participation.

Table 4: Distribution of respondents according to the impact of Market Information due to Smartphone agro Applications

Sr. No.	Category	Score	Before adoption (n=300)		Score	After adoption (n=300)	
			F	%		F	%
1.	Low	Up to 5	50	16.67	Up to 12	24	8.00
2.	Medium	6 to 10	210	70.00	13 to 15	233	77.67
3.	High	11 and above	40	13.33	16 and above	43	14.33
Total			300	100	Total	300	100

As per the table no. 4 Before Adoption 16.67% reported a low impact, After Adoption, This figure was more than halved to 8.00%. Before Adoption: 70% already reported a medium level of impact, After Adoption The expansion to 77.67%, The proportion of farmers in the "High Impact" category remained relatively stable, increasing only slightly from 13.33% to 14.33%.

Table 5: Distribution of the respondents according to the impact of Smartphone agro Applications on their market information

Sr. No.	Category	Score	Respondents(n=300)	
			Frequency	Percentage
1.	Low	Up to 4	75	25.00
2.	Medium	5 to 9	183	61.00
3.	High	10 & above	42	14.00
Total			300	100

As per the analysis of Table 5 Distribution of Respondents According to the Impact of Smartphone agro Applications on their Market Information 61% of respondents shows medium impact, 25% of respondents shows low impact and 14% of respondents shows high impact.

Results

The analysis of data collected from 300 respondents in Wardha district yielded the following key findings regarding their socio-economic profile and the perceived impact of smartphone agro-applications.

Socio-Economic Profile of Respondents

The educational distribution indicates that a substantial portion of the farming community is educated, with 32.92% having attained college level education and another 28.97% completing high school. However, a combined 32.5% of respondents had only primary or middle school education, and 5.61% remained illiterate, suggesting that digital literacy and the comprehension of app-based content could be potential barriers for a significant minority.

Regarding landholding the data reveals a landscape dominated by smallholders. The majority of farmers (74%) operate on holdings of up to 4 hectares, falling into the 'Small' (38.00%) and 'Semi-medium' (36.00%) categories. Marginal farmers constituted only 6.00%, while large landholders (4.33%) represented small elite. This distribution underscores the importance of tailoring information and technology to the specific needs and constraints of smallholder farming systems.

Social participation was found to be markedly low, with 51.67% of farmers falling into the 'low' participation category. This suggests limited engagement with formal and

informal community organizations, which are often crucial channels for knowledge sharing and collective action. Only 15.33% of respondents exhibited high social participation, highlighting a potential disconnect between individual farmers and traditional extension networks.

Comparative Impact of Smartphone Applications on Market Information

The central part of this study was to measure the perceived shift in the impact of market information following the adoption of smartphone applications. Table 4 presents this comparative analysis.

The most significant change was observed in the 'Low Impact' category. Before adoption, 16.67% of farmers felt the market information they received had a low impact. After adopting smartphone apps, this proportion was more than halved to just 8.00%. This reduction was accompanied by a notable expansion in the 'Medium Impact' category, which grew from 70.00% to 77.67%. The proportion of farmers in the 'High Impact' category remained relatively stable, showing only a marginal increase from 13.33% to 14.33%.

This shift indicates that smartphone applications have been effective in elevating farmers from a state of poor information access to a reasonable level of benefit. The technology appears to be successfully broadening access to basic market intelligence, moving a large segment of the population out of the lowest impact bracket. However, the near-static nature of the 'High Impact' category suggests that while apps provide a significant upgrade for the majority, additional factors-such as higher risk-bearing capacity, larger landholdings, or stronger social networks-may be necessary for farmers to leverage this information into a 'high' level of perceived impact.

Further analysis of the post-adoption period alone confirms this trend. A clear majority of respondents (61.00%) perceived a medium impact of smartphone apps on their market information. A quarter (25.00%) still reported a low impact, while only 14.00% achieved a high impact. This distribution reinforces the conclusion that while smartphone apps are a powerful tool for improving information access for the average farmer, they are not a universal remedy. The persistent 'low impact' group likely faces barriers related to digital literacy, language, or the relevance of the information to their specific farm context.

Conclusion

This study provides empirical evidence that the adoption of smartphone agro-applications has had a solid and positive impact on the access to and perceived quality of market information for farmers in the Wardha district. The findings

demonstrate a clear and positive shift in impact scores post-adoption, with the technology successfully moving a significant portion of farmers out of the 'low impact' category. This underscores the value of ICT as a complementary tool to traditional extension services, capable of delivering timely information to a wide audience efficiently.

However, the research also illuminates the persistent influence of socio-economic stratification. The agrarian landscape of Wardha is characterized by smallholder dominance and low social participation. While smart phone agro apps have improved the baseline for many, they have not dramatically increased the proportion of farmers achieving a 'high' level of impact. This suggests that the benefits of digital technology are not automatic and can be constrained by factors such as farm size, which limits the scale at which information can be applied, and low social capital, which can hinder collaborative learning and collective bargaining.

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