DIGITAL DIVIDE IN AGRICULTURE: A STUDY ON FARMERS' AWARENESS OF DIGITAL MARKETING PLATFORMS IN HARYANA

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ABSTRACT

Objective: The study aims to examine the level of awareness among farmers in Haryana regarding digital marketing platforms in agriculture. It also seeks to identify the factors influencing their adoption and explore the benefits and challenges associated with digital marketing usage in farming. **Methodology:** A descriptive and exploratory research design was used, employing structured surveys and stratified random sampling to collect primary data from 460 farmers across Haryana. Statistical tools such as chi-square tests, correlation, regression, and ANOVA were used to analyze the data. **Findings:** The study found that education, smartphone use, income, and access to digital devices significantly influence farmers' awareness of digital marketing platforms. Younger and more educated farmers showed higher levels of digital awareness, while older farmers lagged due to limited digital literacy. **Implications:** The findings underscore the need for targeted interventions such as digital literacy programs, infrastructure development, age-specific training, and financial support to bridge the digital divide. Collaborative efforts between government, NGOs, and private sectors are vital for inclusive and sustainable digital adoption in agriculture.

Keywords: Digital Marketing Platforms, Farmers Awareness, UTAUT, TAM

1.0 INTRODUCTION

In recent years, digital technology has made tremendous inroads into various aspects of life, including agriculture. What was once a sector defined by traditional practices is now undergoing a technological transformation, from precision farming to digital marketplaces (FAO, 2020). However, not all farmers are experiencing the benefits of this shift equally. There exists a significant gap, commonly referred to as the "digital divide," between those who have access to and can effectively use digital tools and those who cannot (World Bank, 2019). This divide is especially evident in the context of digital marketing platforms—online spaces that allow farmers to connect with buyers, obtain fair prices for their produce, and access market-related information without relying on intermediaries (eNAM Portal, 2023). In a state like Haryana, known for its robust agricultural output, this digital disconnect becomes an important issue to explore (Verma, 2022).

The core purpose of this research is to understand how digital technologies, specifically marketing platforms, are being perceived and used by farmers in Haryana. While many governmental and private initiatives aim to promote digital agriculture, the on-ground reality often reveals a slower pace of adoption (NABARD, 2021). This study focuses on the awareness levels of farmers regarding digital platforms that support the marketing and sale of agricultural products. It seeks to examine how much farmers know about these platforms, the extent to which they use them, and the various socio-economic and infrastructural factors that enable or hinder this process (Singh & Mehta, 2020). Beyond simply identifying a gap, the study intends to offer practical recommendations that can bridge it (Ali et al., 2020).

Haryana presents a particularly compelling case for this type of research. Located in northern India, the state has long been at the forefront of India's Green Revolution and continues to play a major role in feeding the nation (Agricultural Census, 2016). Despite this progressive image, the digital dimension of agriculture has not seen equally widespread adoption (Chand et al., 2021). Although mobile phones are widely used, and there is a growing presence of internet connectivity in rural areas, the leap from basic digital use to more complex, transaction-based activities like online marketing of crops remains limited (Mittal & Tripathi, 2009).

One of the key reasons for this limited adoption is a lack of awareness. Many farmers are either unaware of digital marketing platforms or do not fully understand how these platforms function (Desai & Patil, 2022). Digital awareness is often closely linked with factors such as age, education, landholding size, and proximity to urban centers (Rathore, 2021). For instance, younger farmers or those with higher levels of formal education are generally more comfortable navigating digital environments (Bala & Verma, 2022).

The broader national push for digital transformation, led by initiatives like Digital India, has certainly laid the groundwork for technological integration in rural areas (GOI, 2020). The government has introduced several digital services aimed at farmers, including portals for subsidies, weather updates, crop advisory, and market prices (Kumar et al., 2021). Despite these efforts, the effectiveness of such services is diminished if farmers are not digitally literate (Digital Green, 2021). There is also a cultural aspect at play. Many farmers have relied for generations on traditional marketing methods, and making a shift to unfamiliar digital systems can be intimidating (Meena & Singh, 2022).

2.0 LITERATURE REVIEW

ICT in agriculture has revolutionized how farmers manage their farms, access markets, and communicate (Kumar et al., 2021). Digital platforms such as eNAM, AgriBazaar, and KisanMandi allow for real-time price tracking and broader market access (Chand et al., 2021). These tools have reduced information asymmetry and increased income opportunities (Ali et al., 2020). Mobile apps and SMS services offer advisory, weather updates, and pest alerts, which increase efficiency and sustainability (Mittal & Tripathi, 2009). Financial tools such as digital payments and insurance products are also reducing dependence on traditional credit systems (World Bank, 2019). In Haryana, despite infrastructure and literacy advantages, adoption of digital tools remains limited due to lack of training and language barriers (Desai & Patil, 2022). Platforms often do not cater to rural sensibilities, making them inaccessible to a large user base (Rathore, 2021). Successful international cases (e.g., Kenya's M-Farm, China's

Rural Taobao) emphasize the importance of support systems in driving digital adoption (FAO, 2020). These systems must be inclusive to ensure benefits reach women and marginal farmers (Mehta & Kapoor, 2020).

2.1 Farmers' Adoption of Digital Platforms: National and Global Trends

Global adoption varies by access to infrastructure, policy support, and digital literacy (OECD, 2020). In China and Kenya, platforms enabled direct market access and pricing transparency (UNDP, 2021). In India, urban farmers adopt faster than rural counterparts. In Haryana, eNAM is gaining attention, but awareness and use remain low among older, less-educated farmers (eNAM Portal, 2023; NABARD, 2021). Perceived usefulness and ease of use, as framed by TAM, influence adoption (Davis, 1989). Lack of awareness and digital skills hamper usage despite available infrastructure (Digital Green, 2021).

2.2 Influencing Factors: Demographic, Technological, and Social

Younger, educated farmers adopt digital tools more readily (Bala & Verma, 2022). Older farmers and those with small landholdings face greater barriers (Ali et al., 2020). Internet connectivity and smartphone access are major challenges (GOI, 2020). Platforms need to be more localized and user-friendly (Saksena, 2018). Cultural resistance and lack of community usage deter adoption. Gender inequality further limits access for women farmers (Kaur & Sharma, 2020).

2.3 Government and NGO Initiatives in India (with Focus on Haryana)

Digital India, PMGDISHA, and eNAM aim to empower rural farmers (GOI, 2020; FICCI, 2022). Haryana has implemented HSAMB schemes to promote platform use (Haryana State Agriculture Marketing Board, 2022). NGOs like Digital Green provide video-based education and support but lack sustained engagement (Digital Green, 2021). Continuous support is needed to maintain momentum (Meena & Singh, 2022). Schemes like PM-KISAN support digital access but don't directly address literacy or training (Planning Commission, 2012).

2.4 Theoretical Frameworks (e.g., TAM, DOI)

TAM emphasizes perceived usefulness and ease of use as predictors of adoption (Davis, 1989). If platforms don't clearly benefit users or are hard to use, farmers avoid them (Kumar & Gupta, 2023). DOI explains adoption through five adopter categories and emphasizes communication and peer influence (Rogers, 1962). Community networks in rural India can drive or inhibit diffusion depending on leadership and visible success (Bhattacharya, 2018).

These frameworks help structure the research into why digital marketing tools are not widely adopted in Haryana despite apparent infrastructural readiness (Ali et al., 2020; Singh & Mehta, 2020).

3.0 SIGNIFICANCE OF THE STUDY

The growing integration of digital technologies into agriculture has introduced new possibilities for improving efficiency, transparency, and profitability in farming (Bhattacharya,

2018). However, these advancements are not equally accessible to all, and this imbalance is particularly evident among farmers in rural regions like Haryana (Mehta & Kapoor, 2020). The significance of this study lies in its focused examination of this gap—specifically, how awareness (or lack thereof) regarding digital marketing platforms shapes farmers' participation in the digital economy (Yadav, 2023). This study is especially relevant because Haryana occupies a critical position in India's agricultural landscape (Haryana State Agriculture Marketing Board, 2022). As a state that contributes significantly to national food security and agricultural exports, Haryana has the potential to serve as a benchmark for digitally enabled farming (Patil & Sharma, 2020).

To ensure clarity and consistency throughout this research, several key terms are defined below:

Digital Divide: The gap between individuals or communities who have access to modern information and communication technologies (ICTs), including the internet and smartphones, and those who do not (OECD, 2020).

Digital Marketing Platforms (in Agriculture): Online systems and mobile applications that allow farmers to market and sell their agricultural products directly to buyers, obtain real-time price information, and access other market-related services (FICCI, 2022).

Awareness: The degree to which farmers know about the existence, purpose, and basic functioning of digital marketing tools and platforms (Ali et al., 2020).

Adoption: The process by which farmers begin using digital marketing platforms after becoming aware of their availability (Kumar & Gupta, 2023).

Small and Marginal Farmers: Farmers who own less than two hectares of agricultural land (Planning Commission, 2012).

ICT: Tools that facilitate communication and the processing and transmission of information through electronic means (ITU, 2021).

eNAM: A pan-India electronic trading portal that connects existing APMCs to create a unified national market for agricultural commodities (eNAM Portal, 2023).

Digital Literacy: The ability to use digital tools effectively, including basic skills such as operating a smartphone, navigating mobile applications, using search engines, and understanding digital content (UNDP, 2021).

These definitions form the conceptual groundwork upon which the research is structured (FAO, 2020; Saksena, 2018).

4.0 RESEARCH OBJECTIVES AND HYPOTHESIS

4.1 Research Objective

The primary objective of this study is to examine the awareness levels of farmers in Haryana regarding digital marketing platforms in agriculture. More specifically, the study aims to address the following research objectives:

1. To assess the level of awareness among farmers in Haryana about available digital marketing platforms for agriculture.
2. To identify the factors influencing the adoption of digital marketing platforms among farmers.
3. To explore the perceived benefits and challenges of using digital marketing platforms in farming practices.

These objectives are designed to ensure that the research comprehensively addresses the issue of the digital divide in agriculture, with a specific focus on Haryana. By examining awareness levels, identifying influencing factors, and exploring the benefits and challenges of digital adoption, the study will provide a nuanced understanding of the barriers and opportunities present in the state's agricultural landscape.

4.2 Hypothesis

The hypotheses formulated in this study are designed to test the relationships between farmers' awareness of digital marketing platforms and various influencing factors such as educational background, access to technology, age, farm size, and exposure to government initiatives. Each hypothesis is rooted in the broader aim of understanding the digital divide in agriculture and how different factors affect farmers' ability to leverage digital tools effectively.

H1: There is a significant positive relationship between farmers' level of education and their awareness of digital marketing platforms.

H2: Farmers with better access to digital technologies (e.g., smartphones, internet connectivity) are more likely to adopt digital marketing platforms.

H3: Exposure to government and NGO initiatives positively influences the awareness and adoption of digital marketing platforms among farmers.

H4: Younger farmers are more likely to adopt digital marketing platforms than older farmers.

H5: Larger farm sizes are positively correlated with the adoption of digital marketing platforms.

H6: The perceived ease of use and perceived usefulness of digital marketing platforms significantly affect farmers' decision to adopt these platforms.

5.0 RESEARCH METHODS

Research Design: The research design adopted for this study is primarily descriptive and exploratory in nature, as it seeks to understand the level of awareness among farmers in Haryana regarding digital marketing platforms. Descriptive research is appropriate in this case because it allows for the collection and presentation of data that describes the characteristics of

the population under study, without altering the environment or conditions of the study. The main goal of this design is to identify patterns and gain insights into how farmers perceive and use digital platforms in agriculture.

The study employs a quantitative approach for the collection and analysis of data, primarily through the use of structured surveys. Quantitative research is useful when the objective is to measure the extent of awareness, adoption, and usage of digital marketing tools among farmers. Structured surveys will enable the researcher to collect standardized data from a large number of respondents, ensuring consistency and reliability in the analysis. The survey instrument includes both closed and open-ended questions, which allow for the collection of both numerical data and qualitative insights. This combination is intended to provide a well-rounded understanding of the factors influencing digital adoption and awareness among farmers in Haryana.

Data Collection Methods: Data collection for this study will be carried out using both primary and secondary data sources. Primary data will be collected through structured surveys and semi-structured interviews with farmers in Haryana, while secondary data will be gathered from various published sources such as government reports, academic articles, and industry publications.

Sampling Design: The study will employ a stratified random sampling method to ensure that the sample represents a diverse range of farmers in Haryana. Stratified sampling is particularly useful in ensuring that key subgroups (such as farmers with different levels of access to technology or education) are adequately represented in the study.

The strata will be based on the following characteristics:

1. Farm Size: Small (less than 2 acres), medium (2-5 acres), and large (more than 5 acres) farmers.
2. Geographical Area: Rural and semi-urban areas in Haryana, accounting for variations in internet access and digital infrastructure.
3. Technology Access: Farmers with varying levels of access to smartphones and internet services.

Sample Size: To ensure that the findings are statistically significant, the sample size for the study will be calculated based on the population of farmers in Haryana. According to Cochran's formula, with a confidence level of 95% and a margin of error of 5%, the required sample size for a population of approximately 2.5 million farmers is around 384 farmers. To account for non-responses and incomplete surveys, the sample size will be increased by 20%, bringing the total sample size to 460 farmers. The surveys will be distributed across multiple districts in Haryana to ensure that a diverse range of farmers is included in the study.

6.0 DATA ANALYSIS

6.1 Chi-Square Test Results: Education vs. Awareness

To explore the potential linkage between the educational attainment of farmers and their awareness of digital marketing platforms, a Chi-Square test of independence was conducted.

This statistical approach was selected for its suitability in determining associations between categorical variables—in this case, levels of education (ranging from no formal education to postgraduate degrees) and levels of awareness of digital marketing tools and platforms. The null hypothesis formulated for this analysis posited that there exists no statistically significant association between a farmer's educational background and their awareness of digital marketing platforms. Conversely, the alternative hypothesis proposed that a significant relationship does exist between these two variables.

Upon executing the test, the Chi-Square statistic (χ^2) was calculated to be 45.67, with a p-value of less than 0.01. This outcome provides strong statistical evidence against the null hypothesis, thereby affirming the presence of a significant association between education and awareness of digital marketing platforms among farmers in the studied region of Haryana. In simpler terms, the findings suggest that education plays a pivotal role in shaping farmers' awareness and potential engagement with digital tools for agricultural marketing.

A deeper interpretation of the cross-tabulated data revealed that farmers who had attained education beyond the secondary level—particularly those who completed higher secondary or undergraduate education—were considerably more likely to be aware of and make use of digital platforms for marketing their agricultural produce. This included platforms such as eNAM (Electronic National Agriculture Market), mobile-based market price apps, social media groups for farmer-to-consumer sales, and various private agricultural e-commerce interfaces. Notably, these educated farmers were not only aware of such platforms but often demonstrated a more nuanced understanding of how to navigate and leverage them effectively.

6.2 Correlation Analysis: Smartphone Use and Awareness

To further investigate the dynamics influencing farmers' awareness of digital marketing platforms, a Pearson correlation analysis was carried out between two key variables: the frequency of smartphone usage and the level of awareness of digital marketing tools. Given the increasing penetration of smartphones even in remote rural settings, and the parallel rise of mobile-based agricultural solutions, understanding this relationship is pivotal in mapping the digital landscape of Haryana's farming community.

The results of the Pearson correlation analysis revealed a strong and statistically significant positive correlation between smartphone use and awareness of digital marketing platforms ($r = 0.82$, $p < 0.01$). This coefficient suggests that as smartphone usage increases, so does the level of awareness of digital marketing tools among farmers. In statistical terms, the value of 0.82 implies a very robust relationship, bordering on near-linear association, which confirms that smartphone usage is a key enabler of digital awareness in the agricultural context.

This finding is not surprising when viewed against the backdrop of the rapid technological transformation in Indian agriculture. Over the last decade, smartphones have emerged as multifunctional tools in rural India—not only for communication but also for accessing real-time information on weather, crop advisory, market prices, government schemes, and increasingly, for direct-to-consumer marketing. For many farmers, smartphones represent their first and only point of digital contact with the broader agricultural economy beyond the physical market (mandi) system.

6.3 Regression Analysis: Predictors of Awareness

To comprehensively understand the multifactorial dimensions influencing farmers' awareness of digital marketing platforms in Haryana, a multiple regression analysis was employed. The objective was to isolate and evaluate the strength of various socio-demographic and economic factors in predicting awareness levels. The dependent variable in this model was the self-reported level of awareness of digital marketing platforms, which had been measured through a combination of closed-ended survey responses and a point-based awareness index developed specifically for this study. The independent variables considered included formal education level, age, annual household income, size of landholding, and access to digital devices such as smartphones, tablets, or personal computers.

The regression model yielded statistically significant results, with an R^2 value of 0.68, indicating that approximately 68% of the variance in awareness levels could be explained by the model. Among the predictors, education ($\beta = 0.35$, $p < 0.01$), income ($\beta = 0.28$, $p < 0.05$), and access to digital devices ($\beta = 0.42$, $p < 0.01$) emerged as the most significant. These findings confirm the intuitive yet critical understanding that awareness of digital marketing platforms is not merely a function of exposure, but is deeply rooted in structural and socio-economic realities.

The positive and significant coefficient for education implies that each incremental increase in educational attainment is associated with a meaningful increase in the likelihood of digital awareness. This finding reaffirms the role of formal education in enhancing digital literacy and interpretive skills, which are essential for navigating and making sense of digital platforms. Educated farmers are better equipped to understand the functional use of digital tools, evaluate the credibility of online information, and interact with technology-driven services with greater confidence.

Perhaps the most striking result was the strong effect size associated with access to digital devices. The regression coefficient of $\beta = 0.42$ indicates that mere physical access to a device—be it a smartphone, laptop, or tablet—substantially boosts the probability of being aware of digital marketing platforms. This points to the undeniable importance of physical infrastructure in digital adoption. However, access alone does not equate to meaningful use, making it essential to pair access with skill development.

6.4 ANOVA Findings: Awareness Across Different Age Groups

In addition to understanding the structural predictors of digital awareness, this study also aimed to examine the variance in awareness levels across different age cohorts of farmers. Given the general presumption that younger individuals are more technologically adept, an Analysis of Variance (ANOVA) was conducted to statistically test whether significant differences exist in the awareness of digital marketing platforms based on farmers' age categories.

The sample was divided into four distinct age groups for this purpose: Group 1 (18–25 years), Group 2 (26–35 years), Group 3 (36–45 years), and Group 4 (46 years and above). The dependent variable, awareness level, was operationalized through an aggregated index capturing familiarity with, access to, and basic understanding of various digital marketing platforms.

The results of the ANOVA were revealing. A significant difference was observed in the mean awareness levels among the different age groups, with $F(3,196) = 5.42$, $p < 0.01$, suggesting that age does indeed have a statistically significant impact on awareness. Post-hoc Tukey HSD tests were further applied to determine where these differences lay. The comparisons indicated that farmers in the youngest two cohorts (18–25 and 26–35 years) had significantly higher awareness levels than those in the 46 years and above category.

This generational divide may be attributed to several socio-technological factors. Younger farmers have typically grown up in an environment where digital devices and internet connectivity are increasingly integrated into everyday life. Many of them have had some level of exposure to digital tools during schooling or through peer networks. This exposure translates into greater ease of use and a more experimental approach toward adopting new digital tools, including marketing platforms.

Moreover, the younger generation often demonstrates a more entrepreneurial mindset, driven by a desire to modernize agricultural practices and reduce dependency on traditional intermediaries. Interviews with farmers in this age group revealed a conscious effort to explore alternative marketing channels that promise better price realization, wider reach, and reduced logistical burden. For many, digital marketing is not just a novelty but a necessity in an increasingly competitive agri-market landscape.

On the other hand, older farmers—many of whom had limited or no formal education in digital tools—expressed apprehension or resistance toward adopting unfamiliar technologies. For them, the traditional mandi system represents not only a marketing channel but also a culturally and historically embedded practice. In some cases, fear of fraud, lack of technical confidence, or concerns about navigating complex user interfaces acted as barriers to digital adoption.

These findings reinforce the argument that age-specific barriers and facilitators must be considered when designing interventions aimed at promoting digital marketing in agriculture. Training modules tailored for older age groups should focus on demystifying digital tools, emphasizing ease of use, and building trust in digital transactions. Community-based mentorship programs, where younger digitally literate farmers mentor older counterparts, could be particularly effective in bridging this generational gap.

Hypotheses Table

Hypothesis	Type of Relationship	Significance Level (p-value)	Test Statistic (t-value)
H1: There is a significant positive relationship between farmers' level of education and their awareness of digital marketing platforms.	Positive relationship	p < 0.05	t = 2.45
H2: Farmers with better access to digital technologies are more likely to adopt digital marketing platforms.	Positive relationship	p < 0.01	t = 3.78

H3: Exposure to government and NGO initiatives positively influences the awareness and adoption of digital marketing platforms.	Positive relationship	$p < 0.05$	$t = 2.93$
H4: Younger farmers are more likely to adopt digital marketing platforms than older farmers.	Negative relationship	$p < 0.05$	$t = -1.97$
H5: Larger farm sizes are positively correlated with the adoption of digital marketing platforms.	Positive relationship	$p < 0.04$	$t = 2.25$
H6: The perceived ease of use and perceived usefulness of digital marketing platforms significantly affect farmers' decision to adopt these platforms.	Positive relationship	$p < 0.01$	$t = 4.12$

7.0 FINDINGS

The empirical analysis undertaken in this study has brought to light several crucial insights into the dynamics shaping farmers' awareness of digital marketing platforms across Haryana. Drawing from a comprehensive dataset and using statistically rigorous methods—including chi-square tests, correlation analysis, regression models, and ANOVA—the findings reflect a nuanced understanding of how socio-economic, demographic, and technological variables interact to either facilitate or hinder digital inclusion in the agricultural marketing sphere.

Educational Attainment as a Critical Enabler: One of the most pronounced findings of the study is the statistically significant relationship between education and digital marketing awareness. Farmers possessing higher levels of formal education—especially those who had completed higher secondary and tertiary education—demonstrated a considerably greater awareness and understanding of digital platforms used for agricultural marketing. This association underscores the transformative role of education in enhancing digital literacy, which in turn enables individuals to access, interpret, and utilize digital technologies in meaningful ways. Education acts not merely as a cognitive tool but also as a confidence-building resource, equipping farmers with the analytical capabilities required to navigate online platforms, compare market prices, and engage directly with consumers or aggregators.

Smartphone Usage and Digital Connectivity: Another compelling outcome of the analysis is the strong positive correlation between the frequency of smartphone usage and awareness of digital marketing tools. As mobile phone penetration deepens across rural Haryana, smartphones are rapidly becoming the primary gateway to digital services. This study confirms that farmers who use smartphones more frequently are significantly more likely to be aware of digital marketing options. Smartphones serve as the first point of digital contact for most farmers, allowing them to explore agricultural price trends, use farming apps, connect with potential buyers, and participate in digital marketplaces. However, it is essential to note that access alone is not sufficient—quality of usage and the ability to translate digital exposure into practical applications are equally important, thus pointing to the need for digital training.

Economic Factors: Income and Device Access: The regression analysis highlighted income ad access to digital devices as strong predictors of digital marketing awareness. Farmers with higher household incomes were found to be more inclined to explore and adopt digital marketing tools. Higher income levels often translate into greater purchasing power for smartphones and better access to internet services. Moreover, wealthier farmers may have greater exposure to market opportunities and a higher risk tolerance, making them more open to experimenting with innovative tools. Access to digital devices also emerged as a significant standalone factor. Farmers who owned personal smartphones, tablets, or computers were substantially more aware of digital platforms, reaffirming the central role that technological infrastructure plays in facilitating digital inclusion.

Age-Based Variations in Awareness: The study also unearthed generational disparities in awareness levels. Younger farmers, particularly those in the age groups between 18 to 35 years, consistently exhibited higher awareness and more favorable attitudes toward digital marketing tools as compared to older farmers. These age-based differences can be attributed to greater familiarity with technology among the youth, often accompanied by better educational backgrounds and greater exposure to digital culture. In contrast, older farmers tended to rely on traditional channels and exhibited hesitancy toward adopting unfamiliar technological tools, often due to limited digital literacy or perceived complexity. This generational divide suggests that any strategy aimed at promoting digital inclusion must be cognizant of the differentiated needs and capacities across age groups.

8.0 CONCLUSION

Taken together, these findings emphasize that the adoption of digital marketing platforms in agriculture is not determined by a single variable but by a complex interplay of educational, technological, and socio-economic factors. Awareness is both a function of access and ability, shaped by the farmer's literacy, economic situation, exposure to technology, and openness to innovation. Therefore, any meaningful effort to bridge the digital divide must address these multiple dimensions simultaneously, rather than focusing narrowly on hardware access or app dissemination. Ultimately, the goal should be to build a digitally empowered rural farming community capable of leveraging technology for improved market participation, income diversification, and long-term resilience.

9.0 IMPLICATIONS FOR POLICY AND PRACTICE

The implications of the study's findings extend beyond theoretical insights and provide actionable recommendations for policymakers, development practitioners, agri-tech companies, and rural development agencies seeking to address the digital divide in agriculture. In light of the multi-dimensional barriers identified—ranging from educational gaps and economic disparities to infrastructural limitations and generational differences—an integrated and inclusive approach is essential to facilitate the widespread adoption of digital marketing tools among Haryana's farming population.

Educational Initiatives to Foster Digital Literacy: Given the statistically significant correlation between education and digital awareness, there is a compelling case for investing in digital literacy as a foundational pillar of agricultural development. This can be achieved

through community-based training programs focused on building farmers' capacities to use digital devices, access agricultural information online, and navigate e-marketing platforms. These initiatives should be designed in local languages and tailored to varying literacy levels, with the inclusion of audio-visual content, practical demonstrations, and peer-learning models to ensure accessibility and engagement. Partnering with Krishi Vigyan Kendras (KVKs), agricultural extension officers, and local NGOs can enhance outreach and cultural relevance.

Infrastructure Development and Connectivity Enhancement: A recurring theme across the data is the centrality of access—both in terms of devices and connectivity. Bridging the digital divide will require robust infrastructural interventions to ensure consistent internet connectivity in rural and remote farming areas. The government, in collaboration with private sector telecom providers, must prioritize the expansion of broadband infrastructure under initiatives like BharatNet. Additionally, local-level innovations such as community Wi-Fi centers, rural digital kiosks, and shared device hubs can offer interim solutions to reduce the cost and access burden for marginalized groups.

Age-Sensitive Training and Support Mechanisms: The age-related discrepancies in awareness call for the design of differentiated intervention models. While younger farmers may benefit from mobile app-based learning modules and online webinars, older farmers may require more hands-on, in-person assistance to overcome their hesitation toward digital tools. Intergenerational mentorship programs, where tech-savvy youth farmers act as trainers for older peers, can be highly effective. Such strategies not only promote knowledge transfer but also foster community solidarity and trust in digital systems.

Financial Incentives and Economic Support: Affordability remains a significant barrier, especially for small and marginal farmers. Financial interventions, including subsidies on smartphones, tax rebates for digital agri-inputs, and targeted grants for digital marketing training, can play a catalytic role in boosting adoption. Microcredit and low-interest loan schemes tailored specifically for digital technology adoption in agriculture should also be introduced through cooperative banks and rural financial institutions. Moreover, government-sponsored digital incentive programs—similar to PM-Kisan but focused on digital enablement—could offer conditional benefits tied to participation in digital training or platform use.

Public-Private Partnerships for Sustainable Scaling: The digital transformation of agriculture cannot be achieved by the public sector alone. Partnerships with agri-tech startups, digital platform providers, educational institutions, and civil society organizations are essential for scaling up interventions. Government agencies can serve as facilitators and regulators, ensuring that platforms remain transparent, secure, and inclusive. Meanwhile, the private sector can drive innovation, create user-friendly platforms, and offer value-added services such as logistics, payment systems, and buyer aggregation. Collaborative models that combine profit motives with social impact—such as cooperative-owned digital platforms—can ensure long-term sustainability.

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