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Transforming Rural Agriculture Through Technology: An Empirical Study on the Socio-Economic and Sustainable Impacts of Digital Platforms

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ABSTRACT
This study explores the transformative role of digital platforms in enhancing rural agriculture in India, with a focus on productivity, market access, financial inclusion, and sustainable development. Drawing on empirical evidence from farmers across Uttar Pradesh, Bihar, and Maharashtra, the research evaluates the impact of technologies such as mobile applications, online marketplaces, and IoT-driven advisory tools. The findings reveal that digital platforms significantly contribute to increased agricultural productivity and income by enabling informed decision-making, improving access to wider markets, and facilitating financial transactions. However, the study also identifies critical barriers such as low digital literacy, poor internet connectivity, and socio-cultural constraints that hinder widespread adoption, especially among smallholder and marginalized farmers. The paper highlights how digital platforms support the achievement of Sustainable Development Goals (SDGs), notably SDG 2 (Zero Hunger), SDG 8 (Decent Work), and SDG 12 (Responsible Consumption and Production). Based on the analysis, the study proposes targeted recommendations to bridge the digital divide and foster inclusive digital agriculture. The findings underscore the need for integrated policy frameworks, public-private partnerships, and user-centric innovations to fully realize the potential of digital transformation in rural agriculture.

Keywords: digital agriculture, rural India, financial inclusion, market access, SDGs, technology adoption, agritech platforms

1. INTRODUCTION

Agriculture in rural India remains a primary source of livelihood for more than half of the population (FAO, 2023). Despite its crucial role, the sector is plagued by low productivity, information asymmetries, fragmented market access, and vulnerability to climate shocks. These persistent challenges have led to cycles of poverty, indebtedness, and migration among rural farmers. The growing impacts of climate change have further exacerbated the precarious conditions under which rural agriculture operates, leading to unpredictable rainfall, pest infestations, and declining soil health (Chauhan & Sharma, 2020).

Over the past decade, digital platforms have emerged as promising tools to bridge these gaps. These platforms—ranging from mobile applications and e-commerce websites to Internet of Things (IoT)-based

monitoring systems and satellite-driven advisory services—offer new avenues for knowledge dissemination, real-time decision-making, financial inclusion, and value chain optimization (SDSN, 2022). Digital innovations like remote sensing, AI-driven crop advisories, and mobile-based trading portals empower farmers with tools that were previously unavailable or inaccessible to them.

India has witnessed a rapid increase in smartphone penetration and internet usage in rural areas, facilitated by initiatives such as BharatNet and Jio's low-cost data plans (Patel & Sharma, 2020). Simultaneously, the government has launched programs like the Digital India initiative, the Pradhan Mantri Gramin Digital Saksharta Abhiyan (PMGDISHA), and the Digital Agriculture Mission to enhance rural connectivity, digital literacy, and technological integration in farming (World Bank, 2020). These efforts have laid the groundwork for the expansion and adoption of digital platforms in agriculture.

However, the impact of digital platforms is not uniformly felt across regions and demographics. While tech-savvy, educated farmers in better-connected regions are early adopters, large sections of the farming population remain excluded due to barriers such as poor internet connectivity, lack of digital literacy, socio-cultural resistance, and economic constraints (Rajendran et al., 2020). The digital divide—both technological and social—continues to widen the gap between potential and actual benefits (Gupta et al., 2019).

Given this context, understanding the role and challenges of digital platforms in rural agriculture is critical to realizing their transformative potential. It is important to assess not only how these platforms improve agricultural outcomes but also who benefits from them, under what conditions, and at what cost (Sangeeta et al., 2022). An empirical investigation into the use, accessibility, and impact of digital platforms can provide actionable insights for stakeholders, including policymakers, agritech developers, NGOs, and extension workers.

This paper aims to explore how digital platforms are transforming rural agricultural practices in India, particularly in terms of productivity, economic inclusivity, and sustainability. It highlights the experiences of farmers across Uttar Pradesh, Bihar, and Maharashtra, drawing upon empirical evidence to offer policy and practical recommendations. Through a multidisciplinary lens combining technology adoption theories, field-level data, and policy analysis, the study contributes to the discourse on digital inclusion and sustainable rural development in the Indian agricultural landscape.

2. LITERATURE REVIEW

The digital transformation of agriculture has been a focal point of recent academic and policy discussions. Digital platforms—comprising mobile applications, online marketplaces, data analytics tools, and IoT devices—have been instrumental in enhancing agricultural productivity, reducing transaction costs, and improving farmers' livelihoods (FAO, 2023).

According to the Sustainable Development Solutions Network (SDSN, 2022), digital platforms have a proven capacity to improve crop yields by enabling real-time decision-making through weather alerts, pest management systems, and soil health diagnostics. For instance, platforms like eNAM and Kisan Suvidha have significantly improved price transparency and reduced dependency on intermediaries, allowing farmers to access broader markets and receive fairer prices (World Bank, 2020).

Studies by Rajendran et al. (2020) and Chauhan and Yadav (2021) underscore the potential of digital tools in disseminating critical agricultural knowledge. However, these benefits are not uniformly distributed due to disparities in digital literacy, affordability, and internet access. Many smallholder farmers in remote

regions face challenges in accessing and operating digital tools, which hampers widespread adoption (Patel & Sharma, 2020).

The gender digital divide is another crucial dimension. Gupta et al. (2019) found that women in rural areas often have limited access to mobile devices, digital literacy programs, and financial resources. Programs like Internet Saathi and Digital Green have made progress in addressing these challenges by providing training and localized content, yet systemic barriers remain.

Recent literature has also emphasized the importance of language localization and cultural relevance in the success of digital platforms. Without support for vernacular languages and locally contextualized content, farmers may distrust or underutilize these tools (Patel & Sharma, 2020).

From a theoretical standpoint, the Technology Acceptance Model (TAM) (Davis, 1989) and the Unified Theory of Acceptance and Use of Technology (UTAUT) (Venkatesh et al., 2003) provide useful frameworks for analyzing digital adoption. These models highlight perceived usefulness, ease of use, social influence, and facilitating conditions as determinants of user behavior. Additionally, Rogers' (2003) Diffusion of Innovations (DOI) theory explains the role of social systems, communication channels, and innovation attributes in technology dissemination.

In summary, while digital platforms present significant opportunities for transforming rural agriculture, realizing their full potential requires addressing infrastructural, educational, and socio-cultural constraints. The literature strongly supports the view that inclusive, accessible, and context-specific digital solutions are essential for sustainable agricultural development in India.

3. OBJECTIVES OF THE STUDY

- To evaluate the impact of digital platforms on agricultural productivity and farmer income.
- To investigate how digital platforms enhance market access and financial inclusion.
- To identify the key barriers that hinder the adoption of digital platforms in rural agriculture.
- To assess the contribution of digital platforms toward achieving Sustainable Development Goals (SDGs), particularly SDG 2 (Zero Hunger), SDG 8 (Decent Work), and SDG 12 (Responsible Consumption and Production).

4. DATA ANALYSIS

Data was collected 500 farmers from Haryana on demographics, digital platform usage, agricultural practices, and economic outcomes. Secondary data was collected on market prices, crop yields, and income levels were collected to assess the economic impact of digital platform usage.

4.1 DEMOGRAPHIC FACTOR:

Understanding the demographic characteristics of the study participants is essential to contextualize the research findings. The demographic profile of the farmers surveyed reveals important patterns related to age, education, income, and landholding size. These factors influence both the adoption of digital platforms and the farming practices of the respondents.

- **Age**: A majority of the farmers (60%) fell within the age group of 25 to 45 years. This group is generally more receptive to new technologies and digital tools compared to older farmers. Their higher likelihood of being tech-savvy makes them more inclined to use smartphones and digital platforms for farming purposes.
- **Education**: The educational background of the farmers showed a notable diversity. **40%** had completed secondary education, **35%** had attained higher secondary education, and **15%** had a

bachelor's degree. This educational variation reflects differing levels of digital literacy, which plays a crucial role in the adoption of digital platforms. Farmers with higher educational qualifications are generally more adept at using technology.

- **Income**: The income distribution of the farmers was skewed towards the lower-income group, with **58%** earning above ₹10,000 monthly, which is the median income threshold for rural areas in India. Farmers with higher incomes are likely to have better access to technology and resources that support digital platform usage.
- **Landholding**: Approximately **47%** of the surveyed farmers owned between 1–2 acres of land, and **30%** had holdings of 3–5 acres. This distribution suggests that the sample includes both small-scale and medium-scale farmers. Landholding size is often linked to farming income and the ability to invest in new technologies.

These demographic factors provide insights into the socio-economic characteristics of rural farmers, which are essential for understanding the extent of digital platform adoption.

4.2 TECHNOLOGICAL FACTORS

In assessing the technological factors influencing digital platform adoption, we looked at key elements such as internet access, smartphone ownership, and digital literacy. These factors directly impact the ability of farmers to utilize digital platforms effectively.

- **Internet Access**: A significant proportion of farmers (72%) reported having access to the internet, which is a critical factor for the adoption of online agricultural platforms. However, the level of access varies across regions, and some farmers still face issues related to connectivity and reliability, especially during peak agricultural seasons when access to real-time information is crucial.
- **Smartphone Ownership**: A high percentage (85%) of farmers owned smartphones, which is essential for using most agricultural apps. The widespread ownership of smartphones is an encouraging sign for the future of digital adoption, as it suggests that mobile-based agricultural services can be a powerful tool for farmers.
- **Digital Literacy**: In terms of digital literacy, **60%** of farmers reported basic digital literacy, and **25%** had intermediate skills. While digital literacy is improving, a substantial gap remains, particularly among older and less educated farmers. The gap in literacy limits the effectiveness of digital platforms and suggests the need for targeted educational interventions.
- **Perceived Impact of Digital Tools**: A notable **70%** of farmers agreed that digital tools improved their decision-making processes, particularly in areas such as crop selection, pest management, and weather forecasting. This highlights the potential of digital platforms in enhancing the efficiency of farming practices and supporting better crop management.

4.3 AWARENESS & EXPOSURE

Awareness of digital platforms is a crucial factor in their adoption. The survey results reveal that the majority of farmers are aware of the key platforms available, but their exposure and usage patterns vary.

- **Platform Awareness**: Approximately **78%** of the farmers surveyed were aware of platforms like **Kisan Suvidha** and **eNAM**. These platforms are popular tools in rural India that provide weather forecasts, market prices, and expert advice. Awareness of these platforms is a good indicator that digital tools are gaining traction in rural areas.
- **Sources of Awareness**: **45%** of the farmers learned about digital platforms through government programs. Government initiatives such as the **Digital India** campaign and state-led agricultural schemes have been instrumental in raising awareness among farmers about the benefits of technology.

Other sources of information include word of mouth (35%) and local agricultural extension services (20%).

- **Usage Frequency**: The frequency of usage varied, with **30%** of the respondents using digital platforms on a weekly basis, and **25%** using them occasionally. This pattern suggests that while many farmers are aware of digital tools, regular use is still limited. This could be due to a lack of confidence in using the platforms or the absence of continuous, reliable internet connectivity.

4.4 ADOPTION OF PLATFORMS

The study further explored the adoption of specific digital platforms and their usage patterns among farmers. The platforms identified were used for various agricultural tasks, including market access, weather updates, and agricultural advice.

- **Top Platforms**: The most commonly used platforms included **YouTube**, **WhatsApp groups**, and **Kisan Suvidha**. These platforms are accessible and offer a variety of services. **YouTube** is primarily used for instructional content on farming techniques, while **WhatsApp groups** are popular for local farmer communities to share market prices and farming tips. **Kisan Suvidha**, a government-run platform, offers weather updates and advice on pest control, making it valuable for decision-making in agriculture.
- **Main Uses**: The primary uses of digital platforms were **weather updates** (70%), **market prices** (68%), and **selling produce** (55%). These findings align with the needs of rural farmers, who depend on accurate weather information and fair market prices to optimize their productivity and income.
- **Platform Duration**: Of the farmers who used digital platforms, **40%** had been using them for over a year. The longer duration of use correlates with a greater familiarity with the platform's functionalities and its integration into daily farming practices.

4.5 SUSTAINABLE PRACTICES (LIKERT SCALE)

The study also sought to understand the role of digital platforms in promoting sustainable agricultural practices aligned with the SDGs.

- **SDG 2: Zero Hunger**: A majority of farmers (62%) agreed that digital tools helped them adopt more sustainable practices, such as crop rotation and organic farming. Additionally, **68%** reported an improvement in crop quality, which contributes to food security by increasing yield and reducing losses.
- **SDG 8: Economic Growth**: **65%** of respondents observed an increase in their income after using digital platforms, primarily due to better access to market prices and the ability to sell produce directly to buyers. Moreover, **52%** gained access to direct markets, cutting out middlemen and increasing their profit margins.
- **SDG 12: Responsible Production**: Digital platforms also facilitated more responsible production practices, with **60%** of farmers reporting better input usage, such as fertilizers and pesticides, due to access to expert advice. Additionally, **48%** of respondents maintained digital records of their farming activities, enabling better tracking of resource usage and adherence to sustainable farming practices.

4.6 DESCRIPTIVE ANALYSIS

To understand the impact of digital platforms on rural agriculture, data was collected from a sample of 500 farmers across multiple District of Haryana states who are users and non-users of digital agricultural platforms.

INTERPRETATION OF FINDINGS

- **Positive Correlation**: There is a clear positive correlation between the level of digital tool usage and

crop yield. Farmers who scored 4 or 5 in digital tool usage typically reported yields 20–25% higher than those who scored below 2.

- **Market Efficiency**: 76% of digitally connected farmers reported using platforms like e-NAM or DeHaat for price comparisons, resulting in better negotiation power and reduced dependency on middlemen.
- **Income Diversification**: Users of platforms that offered advisory and market services (e.g., DeHaat, e-Choupal) reported more diversified sources of income (e.g., poultry, horticulture), reducing their vulnerability to crop failure.
- **Knowledge Access**: Descriptive data also revealed that 70% of farmers using digital platforms accessed weather alerts and pest control advisories, contributing to smarter resource usage and less waste.

4.7 STATISTICAL ANALYSIS

Chi- Square test

Chi-Square Test: Association Between Digital Tool Usage and Education Level

Education Level	Uses Digital Tools	Does Not Use Digital Tools	Total
Educated	150	50	200
Uneducated	100	200	300
Total	250	250	500

To examine whether education level influences the adoption of digital tools, a chi-square test was conducted using a 2x2 contingency table:

The expected frequencies were calculated as follows:

- Expected frequency for Educated & Uses Digital Tools = (200 * 250) / 500 = 100
- Expected frequency for Educated & Does Not Use Digital Tools = (200 * 250) / 500 = 100
- Expected frequency for Uneducated & Uses Digital Tools = (300 * 250) / 500 = 150
- Expected frequency for Uneducated & Does Not Use Digital Tools = (300 * 250) / 500 = 150

The chi-square statistic was calculated using the formula:

$$\chi^2 = \sum \frac{(O - E)^2}{E}$$

Where:

- OOO = observed frequency
- EEE = expected frequency

Substituting the values:

$$\chi^2 = \frac{(150 - 100)^2}{100} + \frac{(50 - 100)^2}{100} + \frac{(100 - 150)^2}{150} + \frac{(200 - 150)^2}{150}$$

$$\chi^2 = \frac{2500}{100} + \frac{2500}{100} + \frac{2500}{150} + \frac{2500}{150}$$

$$\chi^2 = 25 + 25 + 16.67 + 16.67 = 83.34$$

With 1 degree of freedom (df = (2-1)(2-1)), the critical value at a 0.05 significance level is 3.841. Since 83.34 > 3.841, we reject the null hypothesis, concluding that there is a significant association between education level and the use of digital tools.

Correlation Analysis: Relationship Between Digital Tool Usage and Crop Yield

To assess the relationship between the extent of digital tool usage (measured on a scale of 1 to 5) and crop yield (measured in quintals per hectare), Pearson's correlation coefficient was calculated.

Data Overview

The dataset comprises the following variables:

- **Digital Tool Usage (X):** Measured on a scale from 1 (low usage) to 5 (high usage).
- **Crop Yield (Y):** Measured in quintals per hectare.

Sample data:

Digital Tool Usage (X)	Crop Yield (Y)
1	10
2	12
3	15
4	18
5	20

3. Pearson's Correlation Coefficient

Pearson's correlation coefficient (rrr) quantifies the linear relationship between two variables. The formula is:

Where:

$$r = \frac{n(\sum XY) - (\sum X)(\sum Y)}{\sqrt{[n\sum X^2 - (\sum X)^2][n\sum Y^2 - (\sum Y)^2]}}$$

- nnn = number of data points
- ∑XY\sum XY∑XY = sum of the product of paired scores
- ∑X\sum X∑X and ∑Y\sum Y∑Y = sum of X and Y scores, respectively
- ∑X2\sum X^2∑X2 and ∑Y2\sum Y^2∑Y2 = sum of squared X and Y scores, respectively

Substituting the values:

- ∑X=1+2+3+4+5=15\sum X = 1 + 2 + 3 + 4 + 5 = 15∑X=1+2+3+4+5=15
- ∑Y=10+12+15+18+20=75\sum Y = 10 + 12 + 15 + 18 + 20 = 75∑Y=10+12+15+18+20=75
- ∑XY=(1∗10)+(2∗12)+(3∗15)+(4∗18)+(5∗20)=10+24+45+72+100=251\sum XY = (1*10) + (2*12) + (3*15) + (4*18) + (5*20) = 10 + 24 + 45 + 72 + 100 = 251∑XY=(1∗10)+(2∗12)+(3∗15)+(4∗18)+(5∗20)=10+24+45+72+100=251
- ∑X2=(12)+(22)+(32)+(42)+(52)=1+4+9+16+25=55\sum X^2 = (1^2) + (2^2) + (3^2) + (4^2) + (5^2) = 1 + 4 + 9 + 16 + 25 = 55∑X2=(12)+(22)+(32)+(42)+(52)=1+4+9+16+25=55
- ∑Y2=(102)+(122)+(152)+(182)+(202)=100+144+225+324+400=1193\sum Y^2 = (10^2) + (12^2) + (15^2) + (18^2) + (20^2) = 100 + 144 + 225 + 324 + 400 = 1193∑Y2=(102)+(122)+(152)+(182)+(202)=100+144+225+324+400=1193

$$r = \frac{5(251) - (15)(75)}{\sqrt{[5(55) - (15)^2][5(1193) - (75)^2]}}$$

$$r = \frac{1255 - 1125}{\sqrt{[275 - 225][5965 - 5625]}}$$

$$r = \frac{130}{\sqrt{[50][340]}}$$

$$r = \frac{130}{\sqrt{17000}}$$

$$r = \frac{130}{130.38} \approx 0.997$$

Substitute these into the formula:

4.6 Summary

The data analysis reveals several important findings related to the adoption and impact of digital platforms in rural agriculture:

- There is significant awareness and access to digital platforms, especially among younger and better-educated farmers.
- Platforms like **Kisan Suvidha**, **YouTube**, and **WhatsApp** are frequently used for weather updates, market information, and connecting with buyers.
- Digital tools have a positive impact on farming practices, leading to improved productivity, higher income, and more sustainable farming techniques.
- However, the frequency of usage and digital literacy remain barriers to broader adoption, especially in less educated or older farmer groups.

These findings underscore the potential of digital platforms to drive transformation in rural agriculture, supporting the achievement of the SDGs. However, efforts are needed to overcome barriers such as digital illiteracy and limited internet access to ensure that the benefits of digital agriculture reach all farmers, regardless of their socio-economic status.

To assess the contribution of digital platforms toward achieving Sustainable Development Goals (SDGs), particularly SDG 2 (Zero Hunger), SDG 8 (Decent Work and Economic Growth), and SDG 12 (Responsible Consumption and Production)

Digital platforms in agriculture have demonstrated meaningful contributions toward several Sustainable Development Goals (SDGs). Firstly, with respect to **SDG 2 (Zero Hunger)**, digital advisory and information services promote sustainable and efficient agricultural practices that increase food production and enhance food security. By enabling farmers to optimize input use, reduce wastage, and improve crop yields, these platforms directly support hunger eradication efforts.

Regarding **SDG 8 (Decent Work and Economic Growth)**, digital marketplaces and agri-business platforms have created new employment opportunities within rural supply chains, including logistics, quality control, and value-added processing. These platforms enable small farmers and youth to engage in entrepreneurial activities, enhancing rural livelihoods and economic diversification.

In relation to **SDG 12 (Responsible Consumption and Production)**, many digital platforms encourage environmentally sustainable practices, such as organic farming, precision agriculture, and reduced chemical inputs. They also facilitate better resource management by providing data on water usage, soil health, and crop cycles, which helps minimize resource wastage and pollution.

Nevertheless, the full potential of digital platforms to advance SDGs hinges on scaling successful models, integrating these platforms into national policies, and fostering inclusive access. While evidence points to positive impacts, a systemic approach involving public-private partnerships and continuous innovation is essential to sustain these contributions.

CONCLUSION

In summary, digital platforms are transforming rural agriculture by enhancing productivity, increasing farmer income, broadening market access, and promoting financial inclusion. They also align well with critical SDGs by supporting sustainable agriculture and economic empowerment. However, adoption is uneven due to barriers such as limited digital literacy, poor infrastructure, language constraints, and trust issues. Addressing these challenges through focused capacity-building, infrastructure development, and policy support will be vital to maximize the benefits of digital agriculture and achieve inclusive rural development.

RECOMMENDATIONS

- **Enhance Digital Literacy and Training Programs**: To overcome the significant barrier of digital illiteracy, especially among women and older farmers, tailored training initiatives should be developed. These programs need to focus on practical, hands-on learning in local languages, covering how to use smartphones, digital platforms, and online payment systems. Collaborations with local agricultural extension services, NGOs, and community groups can help ensure wider reach and effectiveness.
- **Improve Rural Digital Infrastructure**: Governments and private sector stakeholders should prioritize expanding and upgrading internet connectivity in rural and remote areas. Reliable and affordable broadband access is crucial for seamless use of digital platforms. Investments in 4G/5G networks, public Wi-Fi zones, and power supply stability will significantly enhance farmers' ability to benefit from digital agriculture solutions.
- **Develop Local Language and Contextualized Content**: Digital platform developers must incorporate regional languages and dialects in their interfaces and advisory content. Customized content tailored to local agro-climatic conditions and farming practices will increase usability and farmer engagement. Involving local agricultural experts and community representatives in content creation can enhance relevance and trust.
- **Strengthen Trust and Security in Digital Transactions**: To address skepticism around digital payments and data privacy, clear and transparent communication about the security measures employed by digital platforms is needed. Educational campaigns should inform farmers about fraud prevention and safe digital practices. Regulatory frameworks must be enforced to protect users and build confidence in digital financial services.
- **Promote Inclusive Access to Digital Financial Services**: Policymakers and financial institutions should design and promote digital credit, insurance, and savings products that cater specifically to smallholder and marginalized farmers. Simplifying Know Your Customer (KYC) norms, offering flexible loan products, and leveraging alternative data for credit scoring can facilitate inclusion.
- **Encourage Public-Private Partnerships (PPP) and Stakeholder Collaboration**: The scalability and sustainability of digital agriculture initiatives require concerted efforts from government agencies,

private companies, financial institutions, and civil society. PPP models can leverage combined expertise and resources to expand digital service delivery, support infrastructure, and policy alignment.

- **Integrate Digital Platforms with National Agricultural Policies and SDG Frameworks**: Policymakers should formally integrate digital platforms into agricultural development strategies and SDG implementation plans. This includes incentivizing the adoption of sustainable farming practices through digital advisory, linking platforms to subsidy disbursements, and monitoring SDG progress via digital data analytics.
- **Foster Innovation and User-Centric Platform Design**: Continuous innovation is necessary to adapt to evolving farmer needs. User feedback loops, participatory design approaches, and iterative testing will ensure platforms remain accessible, relevant, and responsive. Special attention should be given to user experience (UX) design to simplify navigation for low-literacy users.

These recommendations aim to bridge the existing gaps in digital platform adoption in rural agriculture, ensuring that farmers of all backgrounds can benefit equitably. Effective implementation will not only improve agricultural productivity and incomes but also contribute to broader goals of sustainable rural development and economic inclusion.

REFERENCES

1. Chauhan, R., & Sharma, V. (2020). *Climate vulnerability and rural agriculture in India: An empirical analysis*. *Journal of Environmental Management, 264*, 110443. https://doi.org/10.1016/j.jenvman.2020.110443
2. Chauhan, R., & Yadav, A. (2021). *Role of ICT in agricultural knowledge dissemination: A study of digital adoption among Indian farmers*. *Indian Journal of Agricultural Economics, 76*(3), 450–465.
3. Davis, F. D. (1989). Perceived usefulness, perceived ease of use, and user acceptance of information technology. *MIS Quarterly, 13*(3), 319–340. https://doi.org/10.2307/249008
4. FAO. (2023). *Digital agriculture: Transforming farming through information and communication technologies*. Food and Agriculture Organization of the United Nations. https://www.fao.org
5. Gupta, R., Singh, S., & Meena, R. (2019). *Gender digital divide in rural India: Challenges and opportunities*. *International Journal of Gender Studies, 8*(2), 67–82.
6. Patel, S., & Sharma, K. (2020). *Digital empowerment in rural India: An assessment of BharatNet and digital inclusion policies*. *Information Technology for Development, 26*(4), 788–807. https://doi.org/10.1080/02681102.2020.1733546
7. Sangeeta, Aggarwal, P. K., & Sangal, A. (2022). Determinants of Financial Literacy and its Influence on Financial Wellbeing — a Study of the Young Population in Haryana, India. *Finance: Theory and Practice*, *26*(5). https://doi.org/10.26794/2587-5671-2022-26-5-121-131
8. Rajendran, S., Das, A., & Mishra, R. (2020). *Digital platforms and agrarian transformation in India: Evidence from case studies*. *Development in Practice, 30*(6), 765–778. https://doi.org/10.1080/09614524.2020.1750918
9. Rogers, E. M. (2003). *Diffusion of innovations* (5th ed.). Free Press.
10. SDSN (Sustainable Development Solutions Network). (2022). *Digital solutions for sustainable agriculture: Strategies for smallholder resilience*. https://www.unsdsn.org
11. Venkatesh, V., Morris, M. G., Davis, G. B., & Davis, F. D. (2003). User acceptance of information technology: Toward a unified view. *MIS Quarterly, 27*(3), 425–478. https://doi.org/10.2307/30036540
12. World Bank. (2020). *India: Enabling digital governance and transformation in agriculture*. World Ba

nk Group. https://www.worldbank.org