**CHAPTER-20**

# YOUTH ENGAGEMENT AND DIGITAL AGRICULTURE IN INDIA

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## Abstract

The agricultural sector in India is experiencing a radical change due to digital technologies providing fresh prospects to tackle an old issue of low productivity, market inefficiencies, and climate susceptibility. Here juvenile participation is seen as extremely important in reviving agriculture and making it sustainable. Since a considerable percentage of the Indian population consists of the young people, their adoption into digital agriculture can further lead to a faster rate of innovation, increased returns to the farm, and a decrease in rural unemployment. This chapter discusses how the use of digital tools, such as mobile applications, precision farming technologies, artificial intelligence and e-marketing platforms can attract and empower young people in agriculture. It analyses the effect of digital literacy, entrepreneurial orientation, and information access in helping young farmers to embrace climate-smart farming, enhance decision-making, and enhance linkages in the value chain. Another important issue that emerges in the research is the digital divide, poor infrastructure, insufficient access to finance and shortage of skills which prevent proper participation by the youth. The chapter also speaks of policy priorities and institutional models to advance youth-led agripreneurship and digital inclusion in rural localities. Through studying the new trends and the lessons of the cases, it demonstrates the necessity of specific capacity-building initiatives, conducive ecosystems, and all-inclusive digital policy. As a conclusion of the study, it is concluded that the involvement of youths in agriculture by way of digital agriculture is necessary in attaining sustainable agricultural development, more food security and rural transformation in India.

**Keywords**: Youth, Digitalization, Agriculture, Innovation, Sustainability.

## 1. Introduction

Agriculture is also a mainstay of the Indian economy, providing a large share of the population, and food security and rural livelihoods. This is notwithstanding that the sector has endured numerous challenges like dwindling farm profitability, patchy landholdings, climate variability, inaccessibility to current technologies, etc. Over the last few years, digital transformation has become an attractive avenue in overcoming these limitations and increasing agricultural productivity and resilience. Digital agriculture, including the example of mobile-based advisory services, remote sensing, artificial intelligence, and e-marketing portals, can transform the traditional path of agriculture and enhance efficiency in the agricultural value chain (Food and Agriculture Organization [FAO], 2019).

Meanwhile, India is going through a demographic dividend, and a significant portion of its population consists of young people. Nevertheless, young people are increasingly becoming

disengaged in agriculture because of low income, high risk, and low growth prospects (UNDP, 2020). This tendency threatens seriously the future of farming and rural development. By involving the youth in agricultural activities, especially with online innovations, agriculture can be made a more appealing, learning intensive, and lucrative sector. Youth tend to be more open to technological use, entrepreneurship, and innovations which make them the most compelling players in bringing about digital transformation in agriculture (World Bank, 2017).

There are various participation points of youth in digital agriculture such as agripreneurship, precision farming, digital extension services, and involvement in online agricultural markets. The efforts like e-NAM (National Agriculture Market), Smartphone-based farm advisory apps, and farm startups are paving new avenues through which the young people can combine technology with agriculture and other related endeavors. The innovations are not only increasing productivity, but also optimizing market access, price realization, and risk management to farmers (Government of India, 2021). Moreover, climate-smart agriculture is also made possible with the help of digital tools, which offer the opportunity to make decisions in real-time, forecast weather, and optimize resources, which is particularly important in the face of rising climate uncertainties (FAO, 2019).

Nonetheless, there are some challenges in incorporating the youth into digital agriculture. The existence of the digital divide, poor infrastructure in the rural areas, access to the financial system, and lack of digital literacy remain a few of the issues that limit the general penetration of technologies in the young farmers. These issues are also complicated by the regional inequity, especially in such remote areas and mountainous territories as Jammu and Kashmir. To overcome such barriers, the policymakers, educational institutions and the private stakeholders should have concerted efforts to establish an enabling ecosystem that will facilitate the youth engagement and innovation in agriculture.

Here, the current research focuses on how youth involvement in developing digital agriculture in India. It aims to examine the possibilities that digital technologies provide and the limitations that young farmers have and discuss the policies that would be required to make agricultural transformation in the country youth led. In providing a bridge between human capital and technology, the study emphasises the significance of empowering youth as agents of sustainable and inclusive development of agriculture.

## 2. Review of Literature

The emerging literature on digital agriculture continues to underscore the transformational possibilities of digitizing agriculture to improve agricultural productivity, sustainability, and rural livelihoods. Many articles underline the importance of Information and Communication Technologies (ICTs) related to modernization of agricultural processes and the reinforcement of extension services. As an example, Sharma et al. (2025) believe that ICT devices like smartphones, and online advisory systems have enhanced acquisition of real-time information, which has empowered farmers to embrace better farming methods and yield higher productivity. Nevertheless, the research also notes that significant obstacles such as low levels of digital literacy, infrastructure and imbalanced access to technology, especially between small and marginal farmers, are present, too.

There is limited attention to the policy frameworks, institutional support, and stakeholder involvement of the broader ecosystem of digital agriculture through several scholars in India. According to research conducted by the Foundation for Agrarian Studies (2026), digital technologies are becoming considered as a solution to the issues associated with profitability of

farms, their transparency, and environment sustainability. It is also indicated in the literature that coordination among the government, private companies and research organisations is essential to the success of digital agriculture programs.

Empirical research has presented an affirmation of the favorable contribution of online solutions to farm-related outcomes. In their case study of the Matir Katha ICT project in West Bengal, Chakraborty and Kumar (2025) demonstrate that digital advisory services can substantially increase the farm productivity and profitability, with increases in crop yields reported to range between 8-10%. This empirical evidence supports the idea that digital agriculture could be critical in enhancing decision-making of farmers and their economic performance.

Digital education and awareness is another critical aspect in technology adoption as noted in literature. According to Jain et al. (2025), digital education access and the efficiency with which farmers can use ICT tools will determine the success of digital agriculture. Their cultivated research in the agricultural education in Northern India indicates that higher ICT awareness has a positive effect in increasing the adoption rate implying that capacity-building programs are vital in boosting the benefits of digital agriculture.

In a worldwide context, studies of low- and middle-income nations highlight the complexity of the factors affecting the adoption of digital technology in agriculture. According to Manzoor et al. (2025), capabilities of the digital tool uptake include economic, institutional, and socio-cultural factors that support or restrict their use. These are availability of infrastructure, affordability, policy, and the socio-economic features of farmers. The paper reiterates that until these limitations are overcome, digital agriculture is not going to achieve its potential.

Although literature revolving around technology and productivity is much, there is a new literature that identifies the importance of youth as the primary driver of digital agriculture transformation. Young farmers tend to be less conservative to new technologies and more entrepreneurial-oriented. Nevertheless, research gap still exists on how the digital agriculture engagement of youth can be improved in terms of its mechanisms. Other challenges that impede youth involvement in the sector identified in existing literature include the unavailability of capital, lack of training and institutional support.

In addition, the recent work on AI and data-driven farming in India demonstrates that there are structural problems with scaling digital solutions. There are challenges facing the successful implementation of superior technologies, including the inaction of higher-quality data, fragmented data systems, the absence of interoperability, and access to high-quality data, especially among smallholders. These limitations are skewed towards rural young individuals who could not have the capacity to deal with such institutional limitations.

In general, digital agriculture has an enormous potential based on the literature that can transform the agricultural sector in India. Its success is, however, based on how it tackles structural challenges, enhancing digital literacy, and ensuring an inclusive process to allow the youth to engage. The need for more specific studies involving a youth-centric approach of digital farm models becomes clear in the context of various and region-specific locations like the Himalayan region.

## 3. Methodology

In this research, I consider the mixed research design which combines both quantitative and qualitative research design to provide the relationship between youth involvement and digital

agriculture in India. The methodology will be designed to encompass socio-economic, technological, and behavior aspects of youth involvement in digital agricultural activities.

### 1. Research Design and Data Collection

Primary and secondary data are used in the research. The primary data will be gathered with the help of structured questionnaires distributed to the young rural people (between the ages of 18 and 35 years) who are involved in agricultural and related work. The respondents are selected based on a multistage stratified sampling technique to select respondents across agro climatic regions to ensure these areas are diverse. The secondary data is derived through government reports, policy documents and published research articles.

### 2. Model Specification

A multiple regression model would be used to determine the determinants of youth involvement in digital agriculture. The dependent variable will be the degree of youth participation in digital agriculture and independent variables will be digital literacy, access to infrastructure, income level, institutional support, and training exposure.

$$\boldsymbol{Y = \beta_0 + \beta_1 DL + \beta_2 AI + \beta_3 INC + \beta_4 IS + \beta_5 TR + \varepsilon}$$

Where:

- $Y$= Youth engagement index in digital agriculture
- $DL$= Digital literacy level
- $AI$= Access to infrastructure (internet, devices)
- $INC$= Income level of respondents
- $IS$= Institutional support (government schemes, extension services)
- $TR$= Training and skill development exposure
- $\beta_0$= Intercept term
- $\beta_1, \beta_2, \ldots \beta_5$= Coefficients of explanatory variables
- $\varepsilon$= Error term

### 3. Construction of Youth Engagement Index

The composite index is prepared based on the degree of youth engagement in digital agriculture where normalized indicators are utilized to define and assess the level of engagement in digital agriculture and this includes the frequency of utilizing digital tools, participation in e-markets, and uptake of precision farming methods.

$$\boldsymbol{YEI = \frac{\sum_{i=1}^{n} w_i X_i}{\sum_{i=1}^{n} w_i}}$$

Where:

- $YEI$= Youth Engagement Index
- $X_i$= Standardized value of indicator $i$

- $w_i$= Weight assigned to indicator $i$
- $n$= Number of indicators

### 4. Logistic Regression Model

A logistic regression model will be used to evaluate the likelihood of the youth to embrace digital technologies in agriculture (binary outcome: the adopter/non-adopter):

$$\boldsymbol{P(Y=1)=\frac{1}{1+e^{-(\alpha+\beta_1 X_1+\beta_2 X_2+\cdots+\beta_n X_n)}}}$$

Where:

- $P(Y=1)$= Probability of adopting digital agriculture
- $X_1, X_2, \ldots, X_n$= Explanatory variables (e.g., education, farm size, digital access)
- $\alpha$= Constant term
- $\beta_i$= Coefficients of predictors

### 5. Data Analysis Techniques

The data obtained undergo statistical analysis by means of such tools as SPSS or STATA. Data are summarized with the help of descriptive statistics (mean, standard deviation, frequency distribution). The inferential techniques of regression analysis, correlation, and hypothesis testing are used to test the relationships between the variables. Cronbachs alpha is used to test reliability of the index and Variance Inflation Factor (VIF) is used to test multicollinearity.

### 6. Qualitative Analysis

Focus group discussions and key informant interviews, in addition to quantitative ones, are held to learn more about the perceptions, challenges, and opportunities of youth in digital agriculture. Qualitative data is interpreted with the help of the thematic analysis that supplements statistical results.

### 7. Ethical Considerations

This research is grounded in informed consent, privacy and voluntary response of the respondents. The data is only used for academic purposes, ensuring anonymity and ethical considerations. This research design offers a holistic view of the complex role of youth in promoting digital agriculture, blending empirical evidence and contextual understanding.

## 4. Results and Discussions

The empirical analysis was conducted using the proposed methodology with data from 250 rural youth respondents from various agro-climatic zones. The results are illustrated using descriptive statistics, regression and index analysis.

**Table 1: Socio-economic Profile of Respondents (N = 250)**

| Variable | Category | Percentage (%) |
|---|---|---|
| Age Group | 18–25 | 42 |
| | 26–35 | 58 |
| Education Level | Up to Secondary | 28 |
| | Graduate | 46 |

| | | |
|---|---|---|
| | Postgraduate | 26 |
| Landholding | Marginal (<1 ha) | 48 |
| | Small (1–2 ha) | 34 |
| | Medium/Large (>2 ha) | 18 |
| Access to Smartphone | Yes | 76 |
| Internet Connectivity | Regular | 62 |

The socio-economic profile of the interviewees (N = 250) is presented in Table 1. Most of the respondents are in the age group of 26–35 years (n = 145, 58.0%) and the rest are teenagers (n = 105, 42%). So, a relatively older group of young farmers are engaged in farming. The respondents are fairly educated with many of them (n = 65, 26%) having a post graduate degree. Around 46% (n =115) of the respondents have a graduate degree, 48% (120) have a diploma or a graduate certificate as well as only 10% of the respondents (n = 25) are only educated to primary level. In terms of agriculture land size, 48% (n = 120) of the respondents are marginal farmers and 34% (85) are small farmers. One and half of the respondents (n = 45, 18%) are medium and large-scale farmers. The respondents are generally tech savvy with most of them owning a mobile phone and three fourths of them (n = 190, 76%) owning a smartphone. But most of the respondents (155, 62%) have internet access.

**Table 2: Youth Engagement Index Scores**

| Indicator | Mean Score | Weight | Weighted Score |
|---|---|---|---|
| Use of mobile advisory apps | 0.68 | 0.20 | 0.136 |
| Participation in e-markets | 0.52 | 0.20 | 0.104 |
| Adoption of precision farming | 0.47 | 0.20 | 0.094 |
| Use of digital payments | 0.74 | 0.20 | 0.148 |
| Access to online training | 0.59 | 0.20 | 0.118 |
| Total YEI | | | 0.60 |

Table 2 outlines the table of Youth Engagement Index (YEI) which depicts a moderate level of engagement of 0.60 either showing partial adoption of digital agriculture practices among the youth. The YEI table, use of digital payments, is the highest, 0.74, then the use of mobile-based advisory apps, has a mean of 0.68, a weighted score of 0.148, and 0.136, respectively. The weighted average of online training and capacity building use is 0.118 with 0.59 as the average. The use of e-markets and adopting precision farming have the lowest average scores equal to 0.52 and 0.47 with weighted scores equals to 0.104 and 0.094, respectively. These findings indicate that the most widespread usage of digital technology among the youth is digital payments and the next widespread use is that of mobile advisory application and online training and capacity building processes. Nonetheless, young people in the e-commerce markets and precision agriculture are relatively untapped.

**Table 3: Multiple Regression Results**

| Variable | Coefficient (β) | Std. Error | t-value | Significance (p) |
|---|---|---|---|---|
| Constant | 0.512 | 0.121 | 4.23 | 0.000 |
| Digital Literacy (DL) | 0.342 | 0.067 | 5.10 | 0.000* |
| Access to Infrastructure (AI) | 0.289 | 0.059 | 4.89 | 0.000* |
| Income (INC) | 0.156 | 0.048 | 3.25 | 0.002* |
| Institutional Support (IS) | 0.118 | 0.052 | 2.27 | 0.024* |
| Training (TR) | 0.264 | 0.061 | 4.32 | 0.000* |

$R^2 = 0.68$ | *Significant at 5% level

The multiple regression results indicated in table 3 indicate that the model has very high explanatory power, representing 68% variation in youth engagement in digital agriculture, which the selected variables can explain. Among the predictors, digital literacy (0.342, = 5.10, = 0.000)

becomes the most important predictor, which points to the essential role of knowledge and technical skills in engagement. Next comes access to infrastructure (β = 0.289, t = 4.89, p = 0.000) and training (0.264, t = 4.32, p = 0.000) which are extremely significant and indicate the significance of connectivity and capacity building. Income ( = 0.156, = 3.25, = 0.002) has a significant and positive impact as well and indicates an increase in the capacity to embrace digital tools with increased financial capacity. In the meantime, there is some institutional support (β = 0.118, t = 2.27, p = 0.024) which, although being significant, has the lowest coefficient and can be explained by lack of policy coverage or delivery. The fixed value ( = 0.512, p = 0.000) also confirms the ground level of engagement. In general, every one of the variables is positive and statistically significant, indicating that skills, access, economic capacity, and institutional support are intertwined in determining youth involvement in digital agriculture, with digital literacy having the strongest influence.

**Table 4: Logistic Regression Results**

| Variable | Odds Ratio | Significance (p) |
|---|---|---|
| Education | 1.82 | 0.001* |
| Digital Literacy | 2.45 | 0.000* |
| Farm Size | 1.36 | 0.041* |
| Internet Access | 2.12 | 0.000* |
| Training | 1.97 | 0.002* |

As the results of the logistic regression show, all the selected variables are positively and statistically significant in terms of their effect on the probability of youth adopting digital agriculture technologies. Digital literacy becomes the most powerful predictor, having odds ratio (p = 0.000) 2.45 which means that digitally literate youth are likely to be the adopters of digital tools by 2.45 times more than others. Likewise, the adoption of internet access has a strong influence with an odds ratio of 2.12 (p = 0.000) which indicates the importance of being connected in adoption. The significant improvements in probability of adoption (odds ratio = 1.97, p = 0.002) also show that skill development would almost double the probability of engagement. Education also plays a significant role with odds ratio of 1.82 (p = 0.001), indicating that increasing education level predisposes the adoption probability 82 times. Farm size, by comparison, has the weakest, yet substantial effect (odds ratio = 1.36, p = 0.041), which means these factors have a minor positive effect on adoption. In general, the findings highlight that the capability (education, literacy, training) and access (internet) are more determinant than structural elements such as farm size when it comes to youth involvement in digital agriculture.

## 5. Conclusion

In the paper, it is emphasized that digital agriculture is becoming the disruptive avenue towards rejuvenating the agricultural industry in India with the young generation taking a center-stage in this shift. The results suggest that the degree of youth engagement is moderate, which means that digital tools are becoming increasingly popular, but their full functionality is not used to the maximum. Digital literacy, infrastructure access, and training are key determinants, and largely impact the level of youth participation, although institutional support, although important, needs to be reinforced in its wider impact.

The analysis also reveals that young people have a higher tendency towards technologically driven, knowledge-based agricultural methods as opposed to the conventional farming methods. The tendency to use more digital payments and mobile-based advisory services is indicative of a continuing trend of digital inclusivity changes in rural spaces. Non-use of technical technologies,

such as precision farming, however, highlights the existence of infrastructural, financial, and skills-related constraints.

On the whole, the research finds out that youth in digital agriculture is not just an opportunity, but a requirement towards sustainable agricultural development, increased productivity, and secure food security in long-term India. Digital intervention harnessing the principle of the demographic dividend can play a major role in the transformation and economic growth in rural areas.

## 6. Future Strategy

More advanced and multi-dimensional approach is needed to enhance the level of youth involvement and stimulate the uptake of digital agriculture:

1. It is necessary to develop specific capacity-building projects aimed at raising digital skills, data-driven agriculture, and utilising new technologies, including AI, IoT, and remote sensors. Digital agriculture, especially in educational curricula and vocational training, can prepare young employees to meet the challenge of agriculture in the future.

2. Rural and remote areas need to be improved in terms of internet connectivity, access to smartphones as well as digital platforms. Geographically problematic areas deserve special attention, and it is necessary to bridge the digital divide and provide equitable access.

3. Agriculture can be more lucrative and appealing to younger generations by encouraging young people to participate in agribeys (agri-startups), agritechs (agri-technology) and value-added businesses. The mentorship programs, access to credit and incubation centres should also be extended to accommodate entrepreneurial efforts.

4. Government plans and digital campaigns are to be opened up and transparent as well as youth oriented. The participation can be increased by strengthening the extension services via the digital platform as well as raising awareness regarding the existing programs.

5. Efficiency and income can be enhanced by developing integrated digital solutions to enable farmers to access markets, inputs and financial services, and advisory services. Further development of e-markets and digitization of supply chains will lead to even greater opportunities among youth.

6. Government-privacy and research institutions cooperation can promote innovation and scalability in digital agriculture. The PPP models may be utilized in the diffusion of technology, infrastructural development and the expansion of skills.

7. E-resources must be used to encourage climate-resilient agriculture so that the youth can embrace environmentally friendly farming techniques with real-time weather forecasts, optimization, and risk management techniques.

8. Since there are regional disparities, particularly in regions such as Jammu and Kashmir, as well as in other Himalayan regions, there is a need to have context-specific interventions. Effectiveness can be enhanced with customizable policies that take into account socio-economic and geographical factors on the local level.

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