



# STUDY ON EFFECTIVENESS OF DIGITAL INCLUSION IN AGRICULTURE SECTOR IN MUZAFFARPUR DISTRICT OF BIHAR

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## ABSTRACT

Digital inclusion in Indian agriculture aims to bridge the technological gap by integrating digital tools and platforms to empower farmers. Through mobile applications, internet connectivity, and training initiatives, farmers gain access to crucial information on weather forecasts, market prices, and best agricultural practices. This inclusion enhances productivity, reduces post-harvest losses, and fosters sustainable farming methods. Additionally, it facilitates financial inclusion by enabling access to credit and insurance services. Overall, digital inclusion revolutionizes Indian agriculture, promoting efficiency, resilience, and equitable growth in rural communities.

**Keywords:** - *Digital Inclusion, Technology, Agriculture, Weather forecasting, Rural communities*

## INTRODUCTION

Agriculture and food have many challenges. The need for food will also increase, as the global population is expected to grow from 7.6 billion in 2018 (UN DESA, 2019) to over 9.6 billion in 2050 (UN DESA, 2017). At the same time, the supply of natural resources such as fresh water and agricultural products is increasingly limited. Productivity isn't just an issue; Although agriculture now produces enough to feed the world, 821 million people still face hunger (FAO, 2018). Processes such as rapid urbanization also have significant effects on food

production and consumption patterns. The agriculture-food sector is very important for living and working. There are more than 570 million small business owners worldwide (Lowder et al., 2016), and agriculture and food processing account for 28% of the global workforce (ILOSTAT, 2019).

### The Digital Agriculture Revolution

Historically, agriculture has undergone many changes that have increased productivity, yield, and profitability to previously unattainable levels. Business forecasts for the next decade show that the “digital transformation of agriculture” will

be the latest innovation that will help agriculture meet the needs of the population in the world of the future. Digitalization will change every part of the agri-food chain. Managing the resources of the entire system can be very efficient, personal, smart and efficient. It will work instantly in a hyper-connected manner based on data. As value chains become more intimate and integrated at the most detailed level, different fields, crops and animals will be able to be managed according to their food quality. Digital agriculture will create systems that are efficient, predictable and able to adapt to changes such as climate change. This will lead to greater food security, profitability and sustainability. In the context of the Sustainable Development Goals, digital agriculture has the potential to deliver economic benefits through increased agricultural productivity, efficiency and productivity, better communication and participation, and social and cultural benefits through better use of the environment from climate change. The benefits of digitizing the agri-food industry are complex but will require major changes in agriculture, rural economies, communities and natural resource management. This will be a challenge that will require coordination and collaboration to realize the full benefits.

#### OBJECTIVES OF THE STUDY

- To study about the socio-economic status of respondents in the study area.
- To Identify the key challenges and opportunities for digital inclusion in the agriculture sector.
- To Assess the current state of digital inclusion among farmers in Muzaffarpur district.
- To Identify the constraints faced by the marketers while promoting the Digital Platform in Agriculture Sector.

#### REVIEW OF LITERATURE

**Barik and Sharma (2019)** reported in their analysis that financial inclusion depicts that, among every population group, ownership of bank account has speedily increased from previous time periods. Though there are financial inclusion gaps existing among the different population groups, there is no doubt that a significant amount of progress has been undertaken than the earlier period. The recent government schemes like PMJDY have facilitated the poor and the marginalized people to open a bank account with zero or minimum balance. As a consequence of this, enormous progress has happened in India. This progress has assisted to fill-up the financial inclusion gaps between the different population's groups (i.e., between male and female, poor and rich and young and adult).

**Manta (2019)** conducted a study on 'Financial Inclusion and Gender Barriers for Rural Women' and concluded that the attainment of women's financial inclusion will remain elusive unless a gendered approach is adopted by regulators and financial institutions. Rural women all over the world face similar type of barriers to financial inclusion as patriarchal structures are highly prevalent in developing countries. Rural women represent a different market segment of the entire population with diverse features and financial needs. Thus, rural women must be served with different set of financial products and services which are homogenous with their day-to-day needs.

**Kumar and Gupta (2019)** expressed in their study that digitalization is a powerful instrument for farmers' development. According to this study, other demographic

characteristics such as education level, household income, age demographic, and amount of farmland are related to digitalization.

**Morton and Chaudhary's (2021)** review of the literature on digital agriculture for smallholder farmers in developing countries found that digital technologies can have a significant positive impact on smallholder farmers' productivity, income, and resilience. However, they also found that there are a number of challenges that need to be addressed in order to ensure that smallholder farmers can benefit from digital agriculture. One of the main challenges is the limited access that smallholder farmers have to digital technologies. This is partly due to the high cost of devices and services, and partly due to the lack of infrastructure in rural areas. Another challenge is the lack of digital literacy among smallholder farmers. Many smallholder farmers do not have the skills needed to use digital technologies effectively.

**Dontha et al., (2022)** suggested that Digital Inclusion and Agricultural Productivity: A Cross-Country Analysis The authors conclude that digital inclusion has the potential to significantly improve agricultural productivity. However, they also note that there are a number of challenges to digital inclusion in the agriculture sector, such as lack of access to the internet and devices, lack of digital skills, and language barriers. These challenges need to be addressed in order to ensure that all farmers can benefit from digital inclusion.

**Gartner's (2023)** Hype Cycle for Emerging Technologies is a graphic representation of the maturity and adoption of technologies and applications, and how

they are potentially relevant to solving real business problems and exploiting new opportunities. The 2023 Hype Cycle for Emerging Technologies identifies 25 must-know emerging technologies designed to help enterprise architecture

**Hamdan, (2023)** Digital Inclusion and Food Security in Rural Areas: A Systematic Review of the Literature Hamdan concludes his review by arguing that digital inclusion is essential for achieving food security in rural areas. He recommends that governments and policymakers invest in digital infrastructure in rural areas, and that they provide training and support to rural residents to help them use digital technologies effectively.

## **MATERIALS AND METHODS**

Muzaffarpur district of Bihar was selected for the study in which mainly 5% villages of Aurai block were selected. For the selection of cultivators from families was listed and 10% farmers of total population were randomly selected from each village and then farmers were classified.

### **Collection of data**

The two main sources from which the data were gathered are the primary and secondary sources. The original and primary data is the one that needs to be gathered from government agencies, vendors, stakeholders, and farmers. Additionally, the information was gathered from online portals and research papers as secondary data.

### **Research instrument**

Pre-structured schedule was prepared. It contained both open-ended and closed-ended questions. Survey was conducted to finalize the schedule, while the secondary data was analysed by using tables and charts.

**Study approach**

The research approach was descriptive. Interview schedule was used as an instrument for collecting information,

which had open and close-ended questions. The objective was to gather preliminary information that helped to define problems and to reach conclusion.

**DATA INTERPRETATION**

**Objective 1: - To study about the socio-economic status of respondents in the study area.**

**Table 1: Distribution of respondents on the basis of age**

Age (in years)	Size of Respondents					Overall	Percentage
	Marginal	Small	Semi-medium	Medium	Large		
18-30	3	6	2	4	1	<b>16</b>	<b>16%</b>
30-40	5	8	7	5	3	<b>28</b>	<b>28%</b>
40-50	2	4	9	8	7	<b>30</b>	<b>30%</b>
Above 50	8	1	4	5	8	<b>26</b>	<b>26%</b>
<b>Total</b>	<b>18</b>	<b>19</b>	<b>22</b>	<b>22</b>	<b>19</b>	<b>100</b>	<b>100%</b>

Table 1 reveals about age-wise distribution of respondents in which 16% of the farmers were in the age group of less than 30 years. The age group of 30-40 years was 28%, age group of 40-50 were 30% and age group of above 50 was 26%.

**Table 2: Distribution of respondents on the basis of literacy**

Literacy Level	Size of Respondents					Overall	Percentage
	Marginal	Small	Semi-medium	Medium	Large		
Illiterate	1	3	6	2	4	<b>16</b>	<b>16%</b>
High School	6	4	5	7	8	<b>30</b>	<b>30%</b>
Intermediate	5	7	8	9	6	<b>35</b>	<b>35%</b>
Graduate, Professional and others	1	4	3	6	5	<b>19</b>	<b>19%</b>
<b>Total</b>	<b>13</b>	<b>18</b>	<b>22</b>	<b>24</b>	<b>23</b>	<b>100</b>	<b>100%</b>

Table 2 reveals literacy levels of respondents in which 16% of the farmers in the study area were illiterate, followed by those with High School education 35%. The Intermediate level education percentage was 35% only and 19% of respondents were Graduate, professionals and others.

**Table 3 Distribution of respondents on the basis of family size**

Size (in nos.)	Size of Respondents					Overall	Percentage
	Marginal	Small	Semi-medium	Medium	Large		
Less than 4	2	1	5	4	6	<b>18</b>	<b>18%</b>
4 to 6	4	3	2	3	1	<b>13</b>	<b>13%</b>
6 to 8	6	9	4	7	5	<b>31</b>	<b>31%</b>
8 and above	7	10	6	7	8	<b>38</b>	<b>38%</b>
<b>Total</b>	<b>19</b>	<b>23</b>	<b>17</b>	<b>21</b>	<b>20</b>	<b>100</b>	<b>100%</b>

Table 3 reveals about the family size of respondents in which 18% of farmers were having family size of less than 4 followed by 13% of farmers with family size of 4 to 6, 31% of farmers with a family size of 6 to 8 and 38% of farmers with family size of 8 and above.

**Table 4: Distribution of respondents on the basis of family members engaged in farming activity.**

Number of Members	Size of Respondents					Overall	Percentage
	Marginal	Small	Semi-medium	Medium	Large		
Below 2	6	4	7	10	5	<b>32</b>	<b>32%</b>
02 to 04	7	11	3	7	9	<b>37</b>	<b>37%</b>
04 to 06	5	6	8	1	4	<b>24</b>	<b>24%</b>
Above 6	2	1	3	1	0	<b>7</b>	<b>7%</b>
<b>Total</b>	<b>20</b>	<b>22</b>	<b>21</b>	<b>19</b>	<b>18</b>	<b>100</b>	<b>100%</b>

Table 4 reveals about the number of family members engaged in farming activity in which 32% of the sample farmers had utilized 1 to 2 members of their family in cultivation, 37% utilized 2 to 4 members in cultivation, 24% of the sample utilized 4 to 6 members of their family in cultivation and 7% of farmers utilized more than 6 six members of family in cultivation practices.

**Table 5: distribution of respondents on the basis of occupation**

Sr. No.	Particular (Occupation)	Farmers Size					Total	Percentage
		Medium	Small	Semi-medium	Medium	Large		
1	Agriculture	7	4	8	5	3	27	27%
2	Horticulture	4	5	3	4	6	22	22%
3	Animal Husbandry	2	4	7	8	5	26	26%
4	Salaried	1	5	4	2	4	16	16%
5	Business / Profession	1	3	2	1	2	9	9%
	<b>Total</b>	<b>15</b>	<b>21</b>	<b>24</b>	<b>20</b>	<b>20</b>	<b>100</b>	<b>100%</b>

Table 5 reveals about the occupation of respondents in which 27% of the respondents were having agriculture as their occupation followed by 22% were having horticulture, 26% were having animal husbandry, 16% were salaried and 9% were in business/profession.

**Table 6: Distribution of respondents on the basis of income**

Sr. No.	Income	Sample farmers					Total	Percentage
		Marginal	Small	Semi-medium	Medium	Large		
1	Below 50000	3	4	2	3	1	13	13%
2	50001 to 100000	2	7	6	1	2	18	18%
3	100001 to 150000	6	4	5	3	9	27	27%
4	150001 to 200000	1	3	8	7	4	23	23%
5	Above 200000	4	2	5	3	5	19	19%
	<b>Total</b>	<b>16</b>	<b>20</b>	<b>26</b>	<b>17</b>	<b>21</b>	<b>100</b>	<b>100%</b>

Table 6 reveals about the income level of farmers in the research area to study about the socio-economic conditions of respondents in which 13% were earning below Rs. 50000 followed by 18% were earning Rs. 50001 to 100000, 27% were earning 100001 to 150000, 23% were earning Rs. 150001 to 200000 and 9% were earning above Rs. 200000.

**Objective 2: - To Identify the key challenges and opportunities for digital inclusion in the agriculture sector.**

**Table 7: Challenges for digital inclusion in the agriculture sector**

S. No.	Challenges	No. of Respondents	Percentage
1	Access to Technology	21	21%
2	Digital Literacy	32	32%
3	Infrastructure	14	14%
4	Language and cultural barriers	17	17%
5	Cost	16	16%
	<b>Total</b>	<b>100</b>	<b>100%</b>

Table 7 reveals about challenges for digital inclusion in the agriculture sector in which 32% respondents responded for digital literacy followed by 21% responded for access to technology, 17% responded for language and cultural barriers, 16% for cost and 14% for infrastructural barriers.

**OPPORTUNITIES FOR DIGITAL INCLUSION IN THE AGRICULTURE SECTOR**

**Table 8: Opportunities for digital inclusion in the agriculture sector**

S. No.	Opportunities	No. of Respondents	Percentage
1	Crop management	11	11%
2	Automatic irrigation	14	14%
3	Livestock management	12	12%
4	Indoor vertical farming and smart greenhouses	13	13%
5	Drone farming	17	17%
6	Farm automation and robots	7	7%
7	Farm management	15	15%
8	Produce monitoring	11	11%
	<b>Total</b>	<b>100</b>	<b>100%</b>

Table 8 reveals about the opportunities for digital inclusion in the agriculture sector in which 17% respondents responded for drone farming followed by 15% for farm management, 14% for automatic irrigation, 13% for Indoor vertical farming and smart greenhouses, 12% for livestock management, 11% for crop management, 11% produce monitoring and 7% for farm automation and robots.



**Objective 3: - To Assess the current state of digital inclusion among farmers in Muzaffarpur district.**

Digital inclusion among farmers has become increasingly critical as technology continues to reshape the agricultural landscape. From precision farming to market access, digital tools offer numerous opportunities to improve efficiency, productivity, and sustainability in agriculture. However, achieving widespread digital inclusion among farmers remains a complex challenge with various barriers to overcome.

One of the primary barriers to digital inclusion in agriculture is access to technology and connectivity. While access to smartphones and internet connectivity has improved globally, rural areas still face significant challenges in terms of reliable and affordable internet access. Many farmers lack access to high-speed internet, limiting their ability to leverage digital tools and services effectively. Additionally, the cost of smartphones and other digital devices can be prohibitive for farmers with limited financial resources.

Even when internet access is available, digital literacy poses another barrier to inclusion. Many farmers, particularly those in rural and remote areas, may lack the necessary skills and knowledge to effectively use digital tools and navigate online platforms. Language barriers and educational disparities further exacerbate this issue, making it difficult for some farmers to access and benefit from digital resources.

Moreover, the relevance and accessibility of digital agricultural information are crucial factors in promoting digital inclusion among farmers. Information and communication technology (ICT) platforms must be tailored to the specific

needs and contexts of agricultural communities, providing relevant and localized content in accessible formats. Language localization and user-friendly interfaces can enhance the usability of digital platforms for farmers with varying levels of literacy and technological proficiency.

Government policies and initiatives play a crucial role in promoting digital inclusion among farmers. Investments in rural infrastructure, such as broadband expansion and ICT training programs, can help bridge the digital divide and improve access to technology in agricultural communities. Subsidies or incentives for purchasing digital devices and software can also make technology more affordable and accessible for farmers, particularly smallholders with limited resources.

Collaboration between public and private stakeholders is essential for advancing digital inclusion in agriculture. Public-private partnerships can facilitate the development and dissemination of digital solutions tailored to the needs of farmers, leveraging the expertise and resources of both sectors. Agricultural extension services, NGOs, and farmer organizations can also play a vital role in promoting digital literacy and facilitating technology adoption among farmers through training programs and capacity-building initiatives. Furthermore, fostering an enabling environment for innovation and entrepreneurship in agriculture can spur the development of digital solutions that address the specific challenges faced by farmers. Support for Agri-tech startups and innovation hubs can accelerate the adoption of digital technologies in agriculture,



driving economic growth and sustainable development in rural areas.

However, achieving digital inclusion among farmers requires more than just access to technology and digital literacy. It also entails addressing broader socio-economic challenges, such as gender disparities, land tenure issues, and access to finance. Women farmers, in particular,

often face additional barriers to digital inclusion due to cultural norms and unequal access to resources and opportunities. Promoting gender-sensitive approaches to digital inclusion and empowering women farmers can help ensure that digital technologies benefit all members of agricultural communities.

**Objective 4: - To Identify the constraints faced by the marketers while promoting the Digital Platform in Agriculture Sector.**

**Table 9: Constraints faced by the marketers while promoting the digital platform in agriculture sector.**

S. No.	Challenges	No. of Respondents	Percentage
1	Limited Awareness and Understanding	13	13%
2	Poor Infrastructure and Connectivity	9	9%
3	Cost and Affordability	8	8%
4	Digital Literacy and Skills Gap	13	13%
5	Language and Cultural Barriers	10	10%
6	Trust and Reliability	7	7%
7	Fragmented Markets and Value Chains	6	6%
8	Regulatory and Policy Constraints	15	15%
9	Limited Tailoring to Local Contexts	8	8%
10	Resistance to Change	11	11%
	<b>Total</b>	<b>100</b>	<b>100%</b>

Table 9 reveals about the constraints faced by the marketers while promoting the digital platform in agriculture sector in which 15% respondents responded for regulatory and policy constraints followed by 13% for digital literacy and skills gap, 13% for limited awareness and understanding, 11% for resistance to change, 10% for language and cultural barriers, 9% for poor infrastructure and connectivity, 8% for cost and affordability, 8% for limited tailoring to local contexts, 7% for trust and reliability and 6% for fragmented markets and value chains.

**CONCLUSION**

Digital inclusion in the agriculture sector is essential for leveraging the potential of digital technologies to improve productivity, sustainability, and livelihoods for farmers. However, achieving digital inclusion faces several

challenges that need to be addressed comprehensively.

One of the primary barriers to digital inclusion is access to technology and connectivity. Rural areas often lack reliable and affordable internet access, limiting farmers' ability to leverage digital tools effectively. Additionally, the cost of smartphones and other devices can be

prohibitive for farmers with limited financial resources.

Digital literacy poses another barrier to inclusion. Many farmers lack the necessary skills and knowledge to use digital tools effectively. Language barriers and educational disparities further exacerbate this issue, making it difficult for some farmers to access and benefit from digital resources.

Moreover, the relevance and accessibility of digital agricultural information are crucial. Information and communication technology (ICT) platforms must provide localized content in accessible formats, tailored to the specific needs and contexts of agricultural communities.

Government policies and initiatives play a crucial role in promoting digital inclusion. Investments in rural infrastructure and ICT training programs can help bridge the digital divide. Subsidies or incentives for purchasing digital devices can also make technology more accessible for farmers. Collaboration between public and private stakeholders is essential for advancing digital inclusion. Public-private partnerships can facilitate the development and dissemination of digital solutions tailored to farmers' needs. Agricultural extension services and farmer organizations can also play a vital role in promoting digital literacy and facilitating technology adoption.

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