Samir Ranjan Dash
Senior Scientist and Head,
Krishi Vigyan Kendra,
Jharsuguda, OUAT,
Bhubaneswar, Odisha, India

Prasannajit Mishra
DEAN, Extension Education,
OUAT, Bhubaneswar, Odisha,
India

Digitalization in agriculture: The extension next strategy for enhancing farmer's income

Samir Ranjan Dash and Prasannajit Mishra

Abstract
There is plenty of information and advanced technologies in agriculture and allied sectors in the public domain that covers many parts of extended know-how concerning new approaches for implementation, but it is frequently dispersed, making it difficult for extension people to use. The scenario opens the scope for innovations and opportunities as the country is going to witness a change leading to transformation in agriculture and allied sectors in the coming years. Digital transformation will provide access to finance through exposure and awareness due to digitization, forecasts on climate change enable smart decision-making, accessibility of new agricultural technologies, new farm \ equipment and inputs for better soil fertility, access to markets, access to information, small holdings utilization and enable predictive analysis. Planning, capacity building, identification of the appropriate stakeholders, governance and monitoring systems and the provision of a single platform for buyers and sellers are all necessary. This digitalized, platform will improve prices, lower risks, increase productivity, and enhance a sustainable technology transfer system. Farmers in India require encouragement and motivation to use this tested yield-enhancing, cost-effective, and environmentally friendly technologies at a time when these technologies have already been created by national, regional, and worldwide research institutions. The success of digital agriculture in India will, be determined by several aspects, including supportive government policies, low-cost technology, simple operations and access, and simple system maintenance. The widespread adoption of digital agriculture in India would thus require a multi-stakeholder strategy, with the government playing a crucial role in the digitalized ecosystem.

Keywords: Digitalization in agriculture, extension networking, social media, extension converges

Introduction

Global agriculture has witnessed a paradigm shift in recent decades and the extension mechanism must stay ahead and equip farmers by developing their management and decision-making skills; helps rural people develop leadership and organizational skills. As an after-effect of globalization, agriculture had to change rapidly to keep pace with the global economy, but lack of infrastructure, low productivity, the poor scale of extension coverage, and low-quality or unskilled manpower became major challenges that continue to persist. In a world where information drives change, the extension needs to be adept with the latest digital media to influence and facilitate farmers. From the very beginning, agriculture is contributing a major portion to our national income. Agriculture has formed a large part of our national income since the beginning. In 1950-51, the share of agriculture and allied activities in national income was approximately 59 percent. Although the share of agriculture gradually decreased along with the growth of other economic sectors, that share remained very high compared to the developed countries of the world. In India, more than two-thirds of our working population is directly engaged in agriculture and depend on it for their livelihood. Indian economy is growing rapidly and it is among the fastest growing economies in the world. India's economy ranks 7th largest economy in terms of nominal GDP and 3rd largest economy in terms of purchasing power parity (PPP). The average growth rate of the economy has been around 7% over the last two decades. India's economy has attracted global interest due to accelerated development in industrialization and automation, explosive growth in customer base, and ease of doing business due to reduced regulatory and market barriers. Indian economy is divided into three main parts namely the agricultural sector, industrial sector, and service sector.

However, the reality is harsh as only one extension worker is available for every 2,879 farmers in India (Mukherjee and Maity, 2015) [10].

Correspondence
Samir Ranjan Dash
Senior Scientist and Head,
Krishi Vigyan Kendra,
Jharsuguda, OUAT,
Bhubaneswar, Odisha, India

A large number of positions in the public extension system in India are vacant, leaving the extension workers personnel to overwork, thus decreasing their efficiency (Mukherjee and Maity, 2015) [10], and ((Suchiradipta and Saravanan, 2016) [14]. According to a recent study, only 41 percent of farm households received assistance from either the state or a private assistance service, and the state extension mechanism covered only 11 percent of households that received extension support (Bera, 2014) [1]. The basic philosophy is the democratization of information, communication, and information management. Agricultural Information is an aid in effective decision-making, and policy-making, needed for the policymakers, decision-makers, managers, etc. An abundance of information is publicly available involving new extensions and knowledge application methods, but this information is often fragmented and presented in complex academic languages. Therefore, it is difficult for farmers or client communities, who often have very little time and/or only basic normal education, find it difficult to use this information. The main problem with the extension mechanism is the lack of technical human resources. In India's public extension system, a large number of positions are unfilled, resulting in overworked extension workers, and reducing their effectiveness (Mukherjee and Maity, 2015) [10]. In addition to authorized work, the extension system is also entrusted with several development activities, which ultimately dilute the focus on expansion and reduce efficiency. As statistics show, most of the farmers are still unreachable. Information and communication technologies (ICTs) can play a greater role in agricultural extension systems because they can reach large numbers of people individually and simultaneously in very less time. Although television and radio have long been used to disseminate agricultural information (Purushothaman *et al*., 2003) [11], recent developments in mobile, computer, and network technologies offer new ways of technology transfer. The growth of mobile subscriptions in the last decade has also increased the use of web-based services and applications such as web portals and mobile applications. According to ICRA Ltd. (Investment Information and Credit Rating Agency Ltd.) January 2017 update, India had 1,078 million mobile phone subscribers as of October 30, 2016, growing at 7.5 percent annually (ICRA Research Services, 2017). The unique mobile phone user frequency in 2016-2017 was 35 percent, while the share of mobile web traffic is 79 percent. The number of Internet users grew by 40 percent in India, while the global growth was 9 percent, making the growth 4 times higher in India (ET tech, 2016) [3].

Digitization of agriculture means the integration of advanced digital technologies such as artificial intelligence, big data, robotics, unmanned aerial systems, sensors, and communication networks into the production system of agricultural enterprises through the Internet of Things (IoT). Digitization of agriculture can be defined as ICT and data ecosystems that support the development and delivery of timely, targeted (localized) information and services to make agriculture profitable and sustainable (socially, economically, and environmentally). Traditional extension services are limited by a lack of extension personnel, expertise, up-to-date information on market access, timeliness, and information retention. Digitization can therefore be critical to overcome such limitations using various Information and Communication Technology (ICT)

tools; Decision support systems, databases, agriculture-based applications, KIOSK. These improved approaches not only support the extension and farming communities but also improve their skills and raise them to increase the GDP of the country (Manjunath *et al*., 2021) [8]. A digitally knowledgeable and empowered population can transform an entire economy. Automation of economic sectors leads to better performance and growth of economic sectors, which in turn affects the growth rate of the country. Digitization leads to cost savings, increased production, better employment, increased productivity and literacy, etc. In the agricultural and industrial sectors, digitization helps to improve all processes, be it purchasing, sales, inventory management, business relations, employment, product innovation, development, etc. (Karamvir and Gupta, 2017) [7]. As of January 2022, there were. 62 billion social media users worldwide. This number corresponds to 58. percent of the entire world population, although it is worth noting that social network "users" do not necessarily represent unique individuals Digital media refers to internet-based digital tools for sharing and discussing information among people. It refers to the user-generated information, opinion, video, audio, and multimedia that is shared and discussed over digital networks (Merriam-Webster, 2015) [9]. Aspects of social media that make them an important and accessible tool in development communication are their easy access through mobile phones, mass-personal communication, and mass-self communication, a larger set of weak ties to ensure receipt of novel ideas, a high degree of connectedness, and link ability and content sharing across multiple platforms (Hemsley and Mason, 2013) [5]. A rapidly growing population requires a 50% increase in food production to feed everyone. Digital media readiness refers to an individual's access to digital media and the ability to create opportunities using digital media. Social media readiness refers to a user's intention to use social media to create value for multiple purposes (Suchiradipta and Saravanan, 2016) [14]. Social capital can be defined as trust, inclusion, and community participation, and social media can help build sustainable communities that include extension workers, farmers, managers, researchers, and decision-makers, using its interactive platform to build and leverage social capital for the greater benefits of the society At the same time, traditional efficient practices, scarcity of irrigation water, less productive lands, double cultivation, lack of crop rotations and lack of time for soil recovery put pressure on fertility and yield, followed by the traditional method of cultivation with the presence middleman that prevents farmers from getting the best price for their product. Under such circumstances, the concept of the digitalization of the agriculture sector becomes more vital. There is a necessity of empowering the rural community by creating digital infrastructure, providing various digital services, and promoting digital literacy.

Objective

The objective of the study is to analyze whether or not the digitalization of Agriculture in India can cope with the complicated problems and challenges of an existing system for enhancing farmers' income and identify the strength, possibility, and opportunity of digitalization in the agriculture sector to address the existing system of extension for effective technology transfer and to analyze the opportunities and gaps for Digitalization and Social

media use which can be advantageously used in agricultural extension in India. The objective of this study is to discuss the strategy for how integrating digital media into agricultural extension and to explore how the concerns of 'Sustainable Development can be addressed by 'Community Informatics' and 'Digital Media interventions. Social media use which may be advantageously utilized in agricultural extension in India and how to combine digital media and all stakeholders in agricultural extension and to discover how the issues of 'Sustainable Development may be addressed by 'Community Informatics' and 'Digital Media' interventions.

Discussion

Digital extensions are web-based electronic communication tools that allow users to interact personally and informally, creating, sharing, retrieving, and exchanging information and ideas in any format (text, images, video, etc.) that can be discussed upon, archived, and used by anyone in virtual communities and networks. Digital and Social media platforms like Face -book, YouTube, Twitter, and Google+ have higher levels of use among Indians compared to the US, UK, and European countries. These developments have opened up new avenues for improving the reach of extension services for needy farmers and other stakeholders. These potentials make digitalized extension systems a highly relevant and beneficial platform for extension personnel to engage with their clients and peers. Lack of connectedness with farmers has long been cited as a serious lacuna of extension services and digitalization of the extension delivery system gives ample opportunities to solve this issue. There are shortcomings at the personal (lack of interest in digital and social media, negative attitude, or organizational restrictions), infrastructural (lack of internet connectivity for target clients or the extension personnel), and policy level (organizational policies that restrict the use of social media for official purposes) that hinder the use of social media. Limited access to ICT and internet facilities in rural areas, suitable only for educated online clients, unwillingness to embrace social media among some farmers and extension workers, we are facing challenges such as infringement of personal privacy and copyright infringement. The success of digital extension systems depends on the commitment level of extension workers and community members in using social media for technology acceptance. However, despite these problems, social media is becoming more and more popular among rural people. Top of Form.

Digitalization and Social media can be advantageously used in agricultural extension

Digital media enable users to interact face-to-face with others, individually or in groups, exchange information, share ideas and opinions, and influence decision-making by creating, storing, searching and exchanging forms. Digital media is a web-based electronic communication tool that allows us to promote information (text, image, video, etc.) in the virtual world. Digital extension and social media have huge potential that social media can provide for consultants to reach people. India is a huge social media market that is constantly expanding into rural areas, expanding its reach not just to farmers, but to farmers and young people at large. India is a huge market for digital and social media that is constantly expanding into the rural areas and that improves the scope of reaching not only the farmers but the farm families and youth altogether for higher impact.

The advantages of a digital extension system are as follows.

- Success in agriculture and rural development is determined by the action of millions of rural families on an individual basis whose decisions are shaped by the information, knowledge, and technologies available to them
- Improvement in speed and effectiveness of agriculture extension at a reasonable cost
- Minimizing constraint of human resources in the public extension system
- More interactive, enables one-to-one conversation, and demands immediacy in response
- Delivering information to target stakeholders at any time from any place
- Manages Perceptions: By presenting the facts
- Highly cost-effective
- Simultaneously reaches large numbers of clients
- Location and client specific, problem-oriented
- User-generated content and discussion among the community members
- Easily accessed from mobile phones
- Increases internet presence of extension organizations and their client reach
- Democratization of information by making it accessible to all
- Brings all stakeholders into a single platform
- It uses data mining and analysis, artificial intelligence, the internet of things, and other ways to assist farmers in taking correct and precise decision right from the selection of crops to the number of pesticides.
- Digital technologies can support trade in agriculture and food products, by connecting private sector suppliers to new markets, and enabling new ways for governments to monitor and ensure compliance with standards and to provide faster and more efficient procedures that are essential for perishable.
- The high potential of digital applications for agriculture generates enthusiasm about the future of food production. Nevertheless, social, ethical, political, cultural, and environmental concerns associated with digitalization loom large.

Digitalization of agriculture as a platform for ToT-SWOC analysis

Strength	Weakness
Democratization of information	Duplication of information
Voice of the community	Lack of social media readiness
User generated content	Information explosion
Easy access	Limited interest of audience
Extended reach	Stereotyped thinking
Social capital	
Opportunities	**Challenges**

Possibility of translating ideas/information into action	Cost effectiveness
Forming special interest groups	Lack of infrastructure
	ICT Literacy- User related barriers
Collaboration	Quality content
Fostering innovation	Ensuring participation and continuous engagement
Crisis communication	
Developing innovation competencies	Institutionalizing social media
Can act as catalyst for resource mobilization	Measuring impact
	Privacy concerns
	Satisfying heterogeneous users

Digital Extension: A multipronged approach is needed at different levels

Individual level
- Extension personnel must take personal initiative to use digital dissemination media as part of their work within the norms of their organization's policies.
- Continuous engagement at the individual level is needed for mass influence and fruitful discussions.
- Public influence and fruitful debate require ongoing engagement at the individual level.
- Encourage farmers, agri-preneurs, and agribusinesses to engage directly with consumers.
- Sharing research results can close the gap between research and practice.

Organizational level
- Formulation of constructive digital and social media policy, guidelines, and synchronized strategies.
- Encouraging the use of digital media to promote organizational goals, actions, and success.
- Organizing workshops and practical training to create awareness & skills to use it.

Infrastructural level
- Basic infrastructure like power supply and access to network services is necessary.
- Strengthening Internet and IT infrastructure in the remote rural area.
- Markets, infrastructures, roads, and transportation need to be created in rural areas for the transformation of information into practical use.

Policy level
- Regulation of data tariffs.
- Effective implementation of social and digital media framework & guidelines
- Promoting the use of digital and social media at the government level can encourage faster adoption.
- Major digital media awareness campaigns are needed for increasing the use of social media technical literacy.

How to amalgamate digital media into agricultural extension?
Internet-based services are increasingly reshaping and restructuring people's daily lives rather than dividing them into online and offline experiences. Rural people are utilizing social or digital media to connect with friends and family, to get the latest news, and to get information from their peers. Connecting that to agriculture and leveraging it to bridge the farmer-extension gap can prove to be a boon to the agriculture sector and the farm families.
A few points for engaging with the farming community through social media are given below:
- A thorough planning is needed before using online tools through social media, specifically about objectives, target audience, channels, and approaches. Posting information at the right times when target audiences are most probably active online. Interacting in real-time to keep the interest of the involved clients alive. Sharing only relevant posts or information. Focusing on specific platforms based on clients' preferences and engaging them constantly rather than engaging in several platforms but failing to engage properly. Keeping a holistic view in mind while sharing information rather than focusing on a single enterprise as most smallholders have multiple enterprises on their farm. Tagging individual clients to whom the information might be specifically useful and sharing for all so that the intended audience receives it personally while others can also be benefited.
- To tackle literacy issues, use more pictures and videos, even audio if possible, which is easier through Facebook and What's App.
- Connecting farmers and consumers on the same platform for increased interaction. Also, that would increase the new market for the produce.
- Social media use in agriculture extension systems should aim for steady growth that requires time, budget, patience, the right subject matter, and commitment from extension professionals. Regular monitoring and evaluation of the information shared, clients' preference of information, etc., should be meticulously conducted to most effectively capture, synthesize, and interpret the information consumption habits and preferences.

Current initiatives under digital agriculture in India
The Digital Agriculture Mission 2021-2025 aims to support and hasten projects based on new technologies, like AI, block chain, remote sensing, and GIS technology, and the use of drones and robots in agricultural farm operations. The demand for digitization in Indian agriculture is well understood and acknowledged; likewise efforts have also been made toward digitizing the prevailing value chain. In September 2021, the Union Minister of Agriculture & Farmers Welfare, Mr. Narendra Singh Tomar, announced the initiation of the Digital Agriculture Mission 2021–2025, while signing five memoranda of understanding (MoUs) with CISCO, Ninjacart, Jio Platforms Limited, ITC Limited, and NCDEX e-markets Limited (NeML), to forward digital agriculture through pilot projects.
The Ministry of Agriculture & Farmers Welfare has developed major digital applications to boost technology adoption among farmers:
- National Agriculture Market (eNAM): - Launched in April 2016, the National Agriculture Market (eNAM) is

a pan-India electronic trading portal that links the existing Agricultural Produce Market Committee (APMC) mandis, to create a unified national market for agricultural commodities. eNAM helps farmers sell products without the interference of any brokers or mediators, by generating competitive returns from their investment.

- Direct Benefit Transfer (DBT) Central Agri Portal: - Launched in January 2013, the DBT Agri Portal is a unified central portal for agricultural schemes across the country. The portal helps farmers adopt modern farm machinery through government subsidies.

- In June 2021, The Ministry of Agriculture and Farmers Welfare signed an MoU with Microsoft to implement a pilot program for 100 villages in 6 states. Under the MoU, Microsoft will create a 'Unified Farmer Services Interface' through its cloud computing services. This is a major part of the ministry's plan to create 'AgriStack' - a unified platform that provides end-to-end services across the agriculture food value chain to farmers. For this, the government plans to create unique farmer IDs for farmers across the country to integrate them with various government schemes to create digital agricultural ecosystems.

Importance of digitalization in the agriculture extension system

Digitalization in agriculture can help track produce from farms to the table and in this chain reduce wastage and improve food safety. It helps in marketing by addressing price discovery issues and solving current problems with profitable customers and building sustainable partnerships to improve agricultural productivity. A comprehensive digital platform improves food availability, affordability, consumer awareness, quality, safety, and accessibility to food. Using the Internet and Information Technology (IIT) in organizations significantly increases the efficiency of selecting the sales channel, and the impact on agricultural income is also prominent. (Fuhong *et al*. 2021) [4] reported that the supportive and non-agricultural incomes of smallholder and marginal farmers in China exceeded 30%, with a significant positive impact on product sales and marketing channel selection. Digitization improves rural connectivity, provides cost-effective access to data and information, empowers rural youth to reach their full potential, and helps farmers achieve just Key to increasing profitability and providing value-added services through access to markets and rural businesses. Spatial data infrastructure and low-cost smart phones and tablets support bi-directional data and information flow for local consumers. Advanced agribusiness helps farmers manage production and market risks using cloud-enabled spatial/temporal databases integrated through application programming interfaces (APIs). This enables a rich and dynamic data ecosystem that provides advanced analytics that inform farmers on the best economic options to maximize profitability and minimize risk. Digital Agriculture can leverage social media platforms to improve human capital and capabilities. Digital Green uses participatory videos where farmers teach other farmers how to best manage their farms. Digital agriculture will go forward with the achievement of the Sustainable Development Goals by 2030 and it will support the goals of the National Food Security Act efficiently, effectively, and equitably.

Scope for digitization in Agriculture in India

To meet the challenges of climate change, the use of ICT in agriculture is necessary, not an option, but a very useful and practical way to improve the situation of smallholder farmers with complex diverse, and risk-prone systems. It is proved that the digitization of agriculture creates opportunities for non-traditional actors in the agricultural value chain. It provides reliable data for research and policymaking, filling current information gaps. Better data will enable both governmental and non-governmental organizations to design farmer-friendly strategies and planned interventions. It also brings transparency to agricultural supply chains, removing the huge inequality that exists and guaranteeing adequate income to the farmers. Digitization of agriculture or e-agriculture is seen as an emerging field focused on enhancing agricultural and rural development through improved information and communication processes.

Capacities required for digital extension

The use of digital extensions and social media requires technical and organizational competencies such as knowledge and skill to use appropriate tools. Organizations should ensure their customers are social media savvy and provide basic technical support for their use of social media and digital enhancement tools. Training should be tailored to specific target groups such as advisory staff, researchers, farmers, and other grass root level stakeholders. It is important to have a clear understanding of the work area of the counselling organization and the lives and livelihoods of its members and the need for information evaluation and dissemination. It also requires regular contact with customers to keep them interested. In the social media and digital age, this can be done through direct messages and customer likes. A clear understanding of the extension organization's domain of work and clientele's lives and livelihoods, as well as their needs for assessing and sharing the information, is important. Engagement with the clientele is also needed regularly to hold their interest. On social media and in the digital era this can be done by using direct messages or "liking "posts from clients.

Governance

Social media policy is usually specific to the communication goals of the organizations and policy should be built on principles such as keeping content up to date, commenting and providing feedback on time, encouraging relevant and meaningful content, following and engaging audiences, providing accurate information and avoiding arguments and comments on legal matters. There were technological, organizational, institutional, and capacity challenges that may restrict the impact of digital and social media.

Costs

Cost-effectiveness is one of the major advantages of social media.

At a very low cost, the information can reach a larger clientele of a group with a communication strategy that is scalable across geography (local, regional, national, global).

Evidence of impact and potentiality scalability

The impact of social media is mostly determined by the user base and level of participation, continuous engagement,

discussions, and creation and sharing of content which can help to increase the membership number and enable feedback from members as well as provide evidence of social media impact. The facilitation of social media platforms is the key factor in achieving audience growth and scalability.

Issues of scalability
Most social media platforms are free to use. Eligibility depends on the member's ability to provide content and content value to support her targeted online engagement. The sustainability of social media depends on the ability of stakeholders (individuals, groups, and organizations) to respond to the dynamic information needs of their customers and create networking opportunities that lead to agricultural growth. You may be able to claim operating income through various service information.

Organizational use of digital media: Dos and Don't s
Digital media in agricultural extension systems offer a range of opportunities to promote rural development, but their potential for managing organizations has not yet been explored. Organized use of social media, on the other hand, is very different from personal use. Individuals can share their views on social media, but when associated with an organization, an individual's views may also be considered the views of the organization, which can be a cause for concern. In addition, organizational followers and individual followers have very different demographic features, which can create conflicts of interest between them. As companies become more social media savvy, it becomes increasingly important to include a social media policy that gives employees clear instructions on their use of social media. Organizations should identify goals, objectives, and goals before engaging with customers and the public through social media. Understanding how social media helps an organization accomplish its mission is a prerequisite for devising an organization's social media strategy Top of Form. Organizations also need to work on and think about how they engage, what platforms they choose, and who they engage with. Social media information requires a unique and ongoing engagement with all stakeholders, as different types and customers need to be treated differently. Just having a Facebook or Twitter page doesn't help advisory staff or farmers. Successful use of social media includes the quick response to inquiries, effective programming with event creation tools, and development and analysis of surveys on specific aspects. Promoting your social media pages is also important for building awareness and reaching potential audiences. The bottom Promotion of the social media page is also important to increase visibility and reach the potential audience. But the most important part of engaging online is to know the audiences better and accordingly decide the strategies.

All development sectors including agriculture need their voice – to create awareness, for advocacy, to bring in change. Digital and Social media have several implications for extension, and these are mentioned below:

- Digital and Social media provide tools to extension professionals for sharing information and being a part of discussions and debates on extension. It also helps them to be aware of the ongoing developments in the agriculture sector and stay updated.
- With increasing awareness among urban consumers about the farm-to-plate journey that food makes in today's world, agricultural practitioners and professionals can use social media for building informed communities and thus increase the visibility of farmers (increase information access to consumers about farm conditions, mechanism of food production, plights of farmers, etc.)
- The reach of extension personnel in rural areas (which is estimated to be around 1200-1500 farmers per extension personnel currently) can increase manifolds with the use of platforms like Facebook, WhatsApp, and YouTube.
- The professional development of extensionists is an important aspect, which social media can help with. Networking, sharing ideas and opinions, and even conducting research can ultimately help in the career advancement of extension professionals and they become more competent to serve the clients better.
- With the increasing visibility of agriculture-related issues today, many young people from non-agricultural and urban backgrounds are interested in agribusiness and creating job opportunities for other rural operators. Extension professionals can take advantage of this and effectively reach and engage with them through digital media. Also, digital media can be used to convince a large number of young farmers who are leaving the agriculture sector to return to better farming practices.
- Digital and Social media provide insights and evidence required to influence policy and policymakers. It has long been established that social media can create and shape public opinion. When used efficiently in agriculture, social media can bring out the plights of farmers for developing immediate and effective interventions.
- Capacity development is another issue that can be conveniently addressed through social media for field functionaries, rural youth, and farmers. With technological advancement, platforms like.
- As end-to-end extension becomes more important to the overall development of farming communities, social media has become a big platform for dialogue among commonly disadvantaged groups, such as women and marginalized groups. And as a common platform for all stake holders engaged in agricultural development. Communication has moved to more open forums, leading to two-way dialogue via social media. The Government of India's Digital India project focuses on using social networks in agriculture to improve farmer's access to information and provide timely services. While it is true that infrastructure needs to be built to realize the full potential of information collected from social media, this platform will not work if the necessary interventions to maintain the infrastructure are not available.

Challenges for digital India Few of the challenges faced in the successful implementation of the Digital India Programme are cited below
1. **Lack of education:** The majority of the population in the country is still not qualified enough to use digital devices and technologies effectively. Also, most of the people are not capable of using a simple mobile phone.
2. **Lack of infrastructure and required technology:** The Digital India campaign needs quality infrastructure for

effective implementation and India still lacks the basic infrastructures needed to drive digital development, particularly in the agriculture and rural development sectors. The technological infrastructure and technology required for the campaign are not yet so readily available in the rural area.

3. **Financial and technical issues:** India is still a developing country. For a plan like this, huge financial resources are required and the country somehow lacks in that area. It requires financial assistance from other sources. Technical issues like appropriate bandwidth, firewalls, filters, anti-virus software, protection from hackers, and buffering are some of the technical issues the country has to face.

4. **Attitude of citizens as well as government personnel:** For successful implementation of the program, a wholesome effort is required of both the citizens and the government personnel. Moreover, the older generation is set in their ways and finds the traditional methods of doing things easy and convenient.

5. **Cyber crimes and Lack of confidence:** Cyber safety is still not given as much importance as it should be given. People find it risky to make transactions online due to safety issues. Cyber laws are not paid that much regard too. Also, most people still lack confidence in machines and prefer hand-done things. Inept cyber services are also one of the reasons for this.

6. **High costs:** Electronic devices and internet services are still by and large very costly for an average Indian citizen. When a lot of people don't have enough money for basic life necessities, spending on electronic devices get out of the picture.

7. **Training needs:** The personnel who are working on this campaign, to transform various government departments from man-managed to machine-managed, require proper training to do that effectively and efficiently. It's a tedious task to train so many people of different calibres and interests into one common discipline. Most of the population lack the basic technical qualification required for the job.

Conclusion
Therefore, it can be concluded that Indian farmers will face pressure to increase food and nutritional security in the next years while also keeping in mind all other factors. Social media, which is enabled by mobile technology, has a significant potential to revolutionize communication. This situation creates room for new inventions and opportunities as the nation is undoubtedly going to see the change in the upcoming years that will lead to transformation. Using panel data analysis, it examines how digitalization is spreading among Indian farmers. Agriculture sector development and economic advancement are both outcomes of farmers' digitization, which has raised their revenue tremendously and digitalization has resulted in agriculture sector development and contributed to economic progress. Inputs for better soil fertility and soil structure, accessibility of farm equipment and new technology, access to markets, access to information, small holdings utilization, and the ability to perform predictive analysis are all benefits of digital transformation. It will also increase exposure and awareness due to digitalization in the agricultural sector, which will enable decision-makers to make informed choices. Planning, capacity building, identifying the appropriate players, governance and monitoring procedures, and providing buyers and sellers with a single platform are all necessary. This technological foundation will lower expenses, boost output and quality, raise pricing, lower risks, and link a sustainable environment. Although these technologies have previously been developed by national, regional, and international research institutions, farmers in India still need encouragement and motivation to employ them. Digitization will have an impact on Indian agriculture in the future by ensuring farmers have a higher income. However, the success of digital agriculture in India will be largely determined by several aspects, including the availability of affordable technology, the convenience of using it, the maintenance of its systems, and favourable governmental regulations. Finally, digitalization and technology will alter the future landscape of Indian agriculture, guarantee higher farmer incomes, and the success of digital agriculture in India will, however, be determined by several important aspects, including supportive government policies, low-cost technology, simple operations and access, and simple system maintenance. Adopting a holistic ecosystem approach to address challenges faced by the Indian agriculture sector is of national interest, to achieve objectives, like doubling farmer incomes and sustainable development. Enhancing and promoting digitalization in the nation is one step toward that goal. Much effort needs to be done to move the Indian economy from emerging economies to developed economies. Diverse actions must be performed to remove barriers and impediments to the way of digitalization. Better agriculture return on investment per person improved cost-to-output ratios for industrial goods, and improved service quality will result from the proper execution of the digital India program. It makes all systems and procedures transparent, enhancing the standard of living and farm income. To make digitalization a reality in every area of agricultural extension and consulting services, a multi-level approach and initiatives at the institutional and personal levels are required. The widespread adoption of digital agriculture in India would therefore require a multi-stakeholder strategy, with the government playing a major enabler's role in the ecosystem.

Ethical approval
This article does not contain any studies with human participants or animals performed by any of the authors.

Conflict of interest
There is no conflict of interest

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