Influence of Digitalization on Agricultural Credit for Green Economy and Sustainable Development

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Abstract

The prime objective of this paper is to analyze the impact of the level of digitalization on the volume of agricultural credit, viewed as a vital economic instrument contributing to the green economy and sustainable development, over the period from 2010 to 2020 in India. A broad review of past literature identifies the determinants of digitalization and agricultural credit. A sample survey is directed to examine the use of smartphones/internet by farmers for agricultural activities. The secondary data published by RBI for agricultural credit and TRAI for the number of mobile phones, smartphones and internet users is converted into an annual time series. The Augmented-Dickey-Fuller test is applied to confirm the stationarity behaviour of the time series. The results of the bivariate regression specify a significant positive correlation between digitalization and agricultural credit in India. The R2 value confirms that mobile phones, smartphones and internet users explain 80, 85 and 90 percent variation in the volume of agricultural credit. The use of smartphones/internet has emerged as a crucial factor in facilitating agricultural credit, thus promoting the green economy and augmenting the economic welfare of farmers, contributing to sustainable development.

Keywords: Agricultural Credit, Digitalization, Economic Instrument, Green Economy and Sustainable Development.

JEL Classification: Q14, O13

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INTRODUCTION

Sustainable development has become a buzzword today, with many highlighting the importance of crafting sustainable action plans for policymakers for economic development. It seems quite justified as global warming is taking a toll on the climate of Earth. The seventeen Sustainable Development Goals established by UNO, set up the target for different countries to be achieved by 2030. According to UNFCCC, eleven countries submitted national adaptation plans, clearly a positive development in the fight against climate change. With this, a total of 83 projects from 44 developing countries have received a nod from the Green Climate Fund. Not merely planning, immediate transformative action is crucial to mitigate the impact of climate change. Digitalization, transitioning towards renewable energy, strengthening public transport systems, and switching to electric vehicle transport systems, are some of the action plans needed to reduce the level of global warming. As more and more individuals are prioritizing sustainability, digitalization seems an inevitable strategy for all sectors of the economy (Schallmo & Williams, 2018).

Digitalization and easy access to agricultural credit are essential for promoting a green economy and sustainable development. Digitalization in agriculture is altering the industry through numerous innovative methods. Digital financial services are constructing a bridge that helps to improve access to financial services. Ultimately it leads to poverty reduction, the second goal of sustainable development. Precision in agriculture, inspired by digital tools like the Internet of Things and drones, helps farmers monitor soil and crop health, improving the usage of resources such as fertilizers and water while diminishing waste. Access to credit and smartphone/Internet usage assist the farmers in data-driven decision-making. The real-time information enables them to make informed choices about harvesting, planting and pest control producing higher yields. Digital resources and e-learning improve the awareness of sustainable and eco-friendly techniques like solar irrigation leading to higher income potential with a lower environmental footprint. Hence digitalization helps to mitigate the challenge of climate change (Agarwal, 2020).

The relevance of rural India in economic growth cannot be overlooked by any means. The sector-wise analysis shows that 95 percent of value added in agriculture and allied sectors comes from rural areas, but rural India contributes less than a fifth of the total net value added (NVA) in the financial services sector. Digital transformation is enhancing the aspiration of rural people for more stable income and improved infrastructure. The hassle-free access to credit induces higher investment and technological shifts in the economy. Understanding credit anatomy or infrastructure is the first step towards unlocking the potential of the rural economy. Traditionally the institutional credit delivery system in rural areas has been dependent on public sector banks, cooperative banks, and regional rural banks. The arrangement has significantly lessened the dependence of farmers on non-institutional and informal sources of credit such as Mahajans and landlords. As per the latest NSSO survey (All India Debt and Investment Survey 2019), institutional share in farmers' debt has considerably increased from 32 percent in 1971 to 66.1 percent in 2019 (Gulati & Juneja, 2019).

Generally, it is believed that land ownership rights will open the door of credit delivery to farmers for agricultural development. However, banks are still hesitant to provide credit to small and marginal farmers on one or another pretext such as creditworthiness or repaying abilities (Golait, 2007). The factors like long distance to bank branches, and uncertainty in agriculture productivity make the rural credit system unreliable and costly. The institutional lenders face difficulty in determining credit worthiness of small and marginal farmers. Hence farmers are forced to provide agricultural land as collateral. Land is the most valuable asset for farmers and a source of respect in society. At times, banks have to sell mortgaged land acquired through default at below the par cost and face losses. According to (Boulahya & Smith, 2020)

digitalization is being considered as a potential tool to improve the credit facility for the agricultural sector.

RBI policy of 2004 opened up multiple channels of credit delivery for small and marginal farmers (Ramakrishna, 2017). Digitalization could augment this trend. Digitalization would help in the monetization of the rural economy and improve credit facilities for farmers (Sidhu & Gill, 2006). The banking sector in India has developed a vibrant digital infrastructure. It is transforming towards contextual banking and Open Application Programming Interface (Singh & Malik, 2019). This study examines the relationship between the determinants of digitalization and the magnitude of agricultural credit for farmers. The study tries to find out if the use of smartphones/internet leads to improvement in agriculture credit or income of farmers. The study uses a sample survey for the use of smartphones/internet by farmers. The secondary data is analyzed for identification of the correlation between the use of smartphones/internet and access to agricultural credit.

The following are the two main objectives of this study:

- To identify the determinants for the level of digitalization and the volume of agricultural credit to farmers.
- To analyze the impact of the level of Digitalization on the magnitude of Agricultural credit for the period of 2010-2020.

The term digitalization was first used by Robert Wachal in his essay published in the North American Review on the social consequences of digitalization for society in 1971 (Nelson & Ellis, 2019). The researchers have analyzed and concluded that social architecture is transforming under the influence of communication networks (Dastranj et al., 2018). Digitalization has completely transformed the classical way of seeing information as anonymous, isolated, and standardized to the modern way which sees information as limpid, repeated, exclusive, continuous, and distinct (Sørensen, 2018). Cloud computing has made the availability of information easy and economical (Bomsel & Blanc, 2004).

As digitalization is influencing every facet of human life, the financial sector is not an exception to it. Digital banking technology has completely transformed the financial sector (Schuetz, 2019). Remember the banking sector of the 1990s, there would be long lines of customers waiting for their turn outside banks. A single transaction would consume a lot of energy and time. In the time of digitalization, transactions are completed with one click of the mouse (Carbó-Valverde, 2017). “Digitalization and innovative technologies are creating unprecedented disruption in the banking sector and the rate of change is accelerating,” SBI chairman Dinesh Khara said at a Dun & Bradstreet event (2022). Digital initiatives give a competitive advantage to all sizes of financial institutions (Umans et al., 2018).

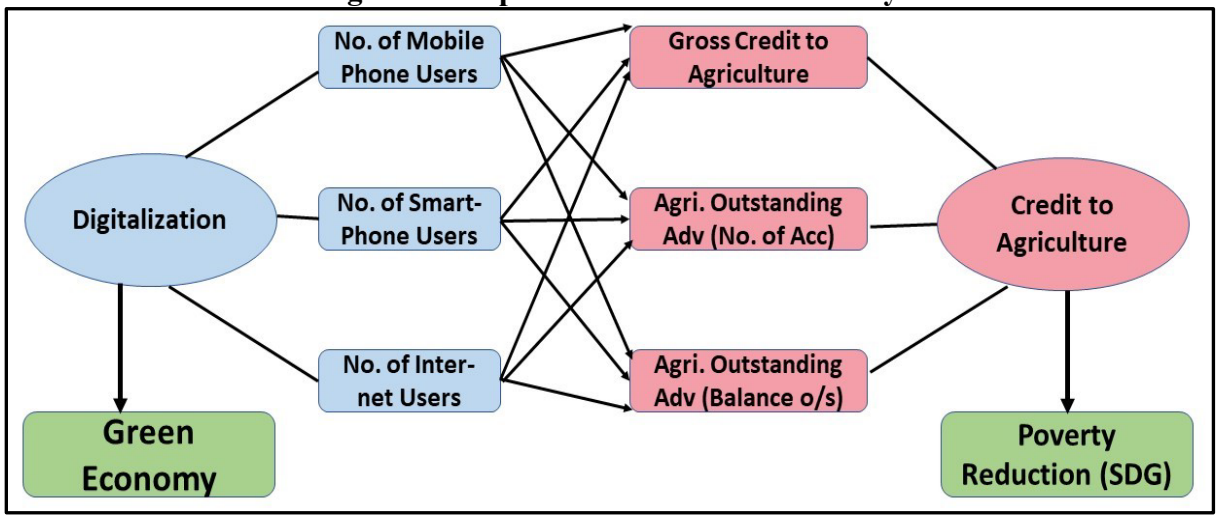
The investigation of (Matkar, 2015) concludes that banks in rural areas provide short-term credit to farmers for different stages of crop production activities. The government has been promoting Self-Help Groups, farmer clubs, Joint Liability Groups and interest subsidy schemes to improve the credit delivery services for farmers in rural areas (Thejeswini et al., 2014). The study (Sarfo et al., 2021) found that digital banking has great potential to provide agricultural finance in rural areas. The study of (Deichmann et al., 2016) found that digital techniques remove the information asymmetry in the agricultural credit market which blocks the development of a proper credit market for small and marginal farmers in developing countries. The study of (Yu & Xiang, 2021) confirms that the participation of farmers in e-commerce activities has a positive impact on the amount of digital credit available to farmers. Available literature justifies the effort to study the influence of digitalization on agricultural credit. There

is a lack of studies with empirical shreds of evidence for relation between digitalization and agricultural credit. Hence this study helps to fill this research gap in literature.

CONCEPTUAL FRAMEWORK

The digitalization of financial services results in cost-effective and efficient products (Fahmi & Sari, 2020). The digital transformation and the Fintech revolution are changing the landscape of collateral-based agriculture lending systems. Advancements in technology and rapid increase in the number of smartphone and internet connections could be used to make over agriculture credit system. The digital finance contributes towards development of green economy by reducing carbon footprints of financial transactions (Agarwal, 2020). The quick and easy access to agricultural credit is one of the goals of sustainable development of the United Nations. Hence this study explores the novel field of contribution of digitalization to the green economy on one hand and influence on sustainable development on the other. The figure 1. demonstrates a conceptual framework of study.

Fig. 1: Conceptual framework of the study



(Source: compiled by Author)

Level of Digitalization

The various parameters are being used for measuring the level of digitalization in the economics literature. Keeping the scope of the study in view, the use of a large number of parameters is neither feasible nor advisable. After a detailed and systematic literature review following three determinants of digitalization (Table 1) is selected for analysis.

Table 1: Determinants of Digitalization

Name of determinants	Notation in data analysis
• Mobile phone users (No.)	• (Digit_1)
• Smartphone users (No.)	• (Digit_2)
• Internet users (No.)	• (Digit_3)

(Source: compiled by Author)

In rural areas Mobile phone is the cheapest and easiest way to access information related to agriculture and weather forecast. Access to the Internet allows people in rural areas to grow economically as well (Bhanot et al., 2012). The total number of mobile phone users is one of the important benchmarks for the level of digitalization in the economy. A smartphone is like a mini-computer in a time of technology and innovation. Almost all the work of a computer can

be completed with a smartphone. Smartphones help people in rural areas improve their skills and chances to get a job (Donovan, 2012). The availability of smartphones can be used as an indicator of the digitalization of the economy. The number of internet users is an indication of the degree of connectivity of the economy within and to the outside world.

Credit to Agriculture

There are different indicators to measure the volume of credit to agriculture such as gross credit to agriculture, the number of agri. outstanding advance accounts, amount in agri. outstanding advances accounts, the number of accounts having Kisan Credit Card (KCC) facilities, and the amount in accounts having Kisan Credit Cards (KCC) facilities, etc. The following three determinants of credit to agriculture are selected for analysis.

Table 2: Determinants of usage of agricultural credit services

Name of Determinants	Notation
• Gross Credit to Agriculture	• (Usage_1)
• Agri. Outstanding Advances (No of A/c)	• (Usage_2)
• Agri. Outstanding Advances (Balance O/s)	• (Usage_3)

(Source: compiled by Author)

RESEARCH METHODOLOGY AND DATA COLLECTION

Hypotheses

As per the objectives of the study following hypothesis is proposed for testing:

"*There exists a significant relationship between digitalization and credit to agriculture*"

The above hypothesis is subdivided into three alternate sub-hypotheses based on determinants of digitalization.

- H_{a1}- "*Number of mobile phone users has direct and positive linkage with agricultural credit"*.
- H_{a2}- "*Number of internet users has a direct and positive relationship with agricultural credit"*.
- H_{a3}- "*Number of smartphone users has a direct and positive association with agricultural credit*".

This empirical study is a quantitative one and uses annual time series data related to digitalization and agricultural credit for 2010-20 published by TRAI, and RBI. The time series data is suitable to identify trends and growth in a variable. The Augmented-Dickey-Fuller test is used to check unit roots and stationarity behaviour. The use of non-stationary time series for analysis may lead to spurious results. The non-stationary time series are converted to stationary by taking differences. The bivariate regression model used is as follows

$$(\text{Determinant of Agricultural credit})_t = \alpha + \beta * \text{Determinant of Digitalization} + \varepsilon_t$$

Here determinants of Digitalization are the independent variable, α is the intercept, β is the coefficient, determinants of agricultural credit are the dependent variable and ε is the error term. A sample survey with the help of a questionnaire is conducted to analyze the use of smartphones/internet by farmers for agricultural purposes. Questions are designed to establish the fact that farmers are using mobile phones for their benefit.

RESULT OF DATA ANALYSIS

Unit Root Analysis

The unit roots are analyzed by applying the Augmented-Dickey-Fuller test on time series. The results are demonstrated in Table 3. The time series of three determinants of agricultural credit are non-stationary at the level. They follow a random walk. The series is transformed by taking the first difference. The time series of the number of mobile phone users becomes stationary at first difference. The time series of the number of Internet users and the number of smartphone users become stationary at a second difference.

Table 3: Unit Root analysis of determinants of digitalization.

	At Level		At First Difference		At Second Difference	
Time Series Variable	t-Statistic	p-value	t-Statistic	p-value	t-Statistic	p-value
(No. of Mobile phone user in Million)	-2.8134	0.0907	-3.3989	0.0451		
(No. of Internet users) in Million	1.0176	0.9922	-2.4737	0.1510	-3.535094	0.0378
(No. of smartphone users in Millions)	4.9444	1.0000	1.3429	0.9951	-6.488081	0.0013

(Source: - Compiled by author)

Table 4: Unit root analysis of determinants of agricultural credit

	At Level		At First Difference	
Time Series Variable	t-Statistic	p-value	t-Statistic	p-value
Gross Credit to Agriculture	-3.6427	0.0292		
Agri. Outstanding Advances (No of A/c)	-0.6584	0.8138	-3.9660	0.0186
Agri. Outstanding Advances (Balance O/s)	0.1280	0.9501	-3.2674	0.0495

(Source: - Compiled by author)

The result of the Augmented-Dickey-Fuller test (Table 4.) shows that the time series of gross credit to agriculture is stationary at the level. The time series of agriculture outstanding advances (No. of A/c in million), and agriculture outstanding advances (Balance O/s Rs. million) are non-stationary at the level. The time series of agriculture outstanding advances (No. of A/c in million), and agriculture outstanding advances (Balance O/s Rs. million) become stationary at the first difference.

Impact of No. of Mobile phone users on Credit to Agriculture

Table 5: Regression analysis for mobile phone users and credit to agriculture

Dependent Variable	Independe-nt Variable	Coeffi-cient	S. Error	t-Statistic	p-value	R-square	F-Statistic
Gross Credit to Agriculture	Mobile phone users (No.)	1.0646	0.1413	7.5349	0.0000	0.8632	56.7748
	c	-0.1699	0.1021	-1.6637	0.1305		
Agri. Outstanding Advances (No of A/c)	Mobile phone users (No.)	0.9024	0.1342	6.7248	0.0001	0.8340	45.2232
	c	0.0778	0.0970	-0.8027	0.4428		
Agri. Outstanding Advances (Balance O/s)	Mobile phone users (No.)	1.0378	0.1589	6.5301	0.0001	0.8257	42.6422
	c	-0.1998	0.1148	-1.7398	0.1159		

(Source: - Compiled by author)

The result of the regression analysis of the number of mobile phone users and determinants of credit to agriculture is shown in Table 5 indicating that the p-value for t-statistics of the slope coefficient for all three dependent determinants of credit to agriculture is less than a 5 percent level of significance. Hence with a 95 percent level of confidence, it can be asserted that all determinants of credit to agriculture are dictated by the number of mobile phone users. The r-square value of all determinants of credit to agriculture is more than 80 percent which signifies that a considerable proportion of variance in credit to agriculture can be explained by the number of mobile phone users from 2010 to 2020. Hence first sub-hypothesis that "*Number of mobile phone users has direct and positive linkage with agricultural credit*" is accepted.

Table 6: Wald Test for the mobile phone users and credit to agriculture

Dependent Variable	Independent Variable	Chi-square	p-value	Remarks
Gross Credit to Agriculture	Mobile phone users (No.)	56.7748	0.0000	Mobile phone users (No.) significantly impact Gross Credit to Agriculture
Agri. Outstanding Advances (No of A/c)	Mobile phone users (No.)	45.2232	0.0000	Mobile phone users (No.) significantly impact Agri. Outstanding Advances (No of A/c)
Agri. Outstanding Advances (Balance O/s)	Mobile phone users (No.)	42.6422	0.0000	Mobile phone users (No.) significantly impact Agri. Outstanding Advances (Balance O/s)

(Source: - Compiled by author)

The result of the Wald test for determinants of credit to agriculture and number of mobile phone users is demonstrated in Table 6. The p-value of chi-square for all three determinants of credit to agriculture is near zero which confirms the outcome of regression analysis i.e., number of mobile phone users has a positive influence on determinants of credit to agriculture.

Impact of No. of Smartphone users on Credit to Agriculture

Table 7: Regression analysis for Smartphone users and credit to agriculture

Dependent Variable	Independent Variable	Coefficient	S. Error	t-Statistic	p-value	R square	F-Statistic
Gross Credit to Agriculture	Smartphone (No.)	1.0110	0.1200	8.4250	0.0000	0.8875	70.9799
	c	0.1524	0.0590	2.5823	0.0296		
Agri. Outstanding Advances (No of A/c)	Smartphone (No.)	0.8877	0.0871	10.1864	0.0000	0.9202	103.7624
	c	0.1838	0.0428	4.2891	0.0020		
Agri. Outstanding Advances (Balance O/s)	Smartphone (No.)	1.0326	0.0930	11.1090	0.0000	0.9320	123.4098
	c	0.0967	0.0457	2.1153	0.0635		

(Source: - Compiled by author)

The result of the regression analysis of the number of Smartphone users and the determinants of credit to agriculture are displayed in Table 7. The p-value for t-statistics of the slope coefficient for all three dependent determinants of credit to agriculture is less than a 5 percent level of significance. Hence with a 95 percent level of confidence, it can be concluded that all determinants of credit to agriculture are affected by the number of smartphone users. The r-square value of all determinants is more than 85 percent which indicates that a substantial proportion of variance in the determinants of credit to agriculture can be expounded by the "*Number of smartphone users has a direct and positive association with agricultural credit*" is accepted.

Table 8: Wald Test for Smartphone users and Credit to agriculture

Dependent Variable	Independent Variable	Chi square	p-value	Remarks
Gross Credit to Agriculture	Smartphone (No.)	70.9799	0.0000	Smartphones (No.) significantly impact Gross Credit to Agriculture
Agri. Outstanding Advances (No of A/c)	Smartphone (No.)	103.7624	0.0000	Smartphones (No.) significantly impact Agri. Outstanding Advances (No of A/c)
Agri. Outstanding Advances (Balance O/s)	Smartphone (No.)	123.4098	0.0000	Smartphones (No.) significantly impact Agri. Outstanding Advances (Balance O/s)

(Source: - Compiled by author)

The result of the Wald test for the determinants of credit to agriculture and the number of smartphone users is shown in Table 8. The p-value of chi-square for all determinants of credit to agriculture is near zero which verifies the outcome of regression analysis i.e., the number of Smartphone users has a positive impact on determinants of credit to agriculture.

Impact of No. of Internet Users on Credit to Agriculture

Table 9: Regression analysis for internet users and credit to agriculture

Dependent Variable	Independent Variable	Coefficient	S. Error	t-Statistic	p-value	R square	F-Statistic
Gross Credit to Agriculture	Internet users (No.)	1.0133	0.0895	11.3242	0.0000	0.9344	128.2376
	c	0.1204	0.0465	2.5867	0.0294		
Agri. Outstanding Advances (No of A/c)	Internet users (No.)	0.8847	0.0619	14.3027	0.0000	0.9579	204.5666
	c	0.1578	0.0322	4.9037	0.0008		
Agri. Outstanding Advances (Balance O/s)	Internet users (No.)	1.0279	0.0623	16.4924	0.0000	0.9680	271.9995
	c	0.0669	0.0324	2.0633	0.0691		

(Source: - Compiled by author)

The result of the regression analysis of the number of internet users and the determinants of credit to agriculture are exhibited in Table 9. The p-value for t-statistics of the slope coefficient for all three dependent determinants of credit to agriculture is less than a 5 percent level of significance. Hence with a 95 percent level of confidence, it can be concluded that the determinants of credit to agriculture are influenced by the number of internet users. The r-square value of all determinants of credit to agriculture is more than 90 percent which shows that a considerable proportion of variance in the determinants of credit to agriculture can be described by the number of internet users from 2010 to 2020. Hence third sub-hypothesis that the "*Number of internet users has direct and positive relationship with agricultural credit*" is accepted.

Table 10: Wald Test for internet users and credit to agriculture

Dependent Variable	Independent Variable	Chi square	p-value	Remarks
Gross Credit to Agriculture	Internet users (No.)	128.2376	0.0000	Internet users (No.) significantly impact Gross Credit to Agriculture
Agri. Outstanding Advances (No of A/c)	Internet users (No.)	204.5666	0.0000	Internet users (No.) significantly impact Agri. Outstanding (No of A/c)
Agri. Outstanding Advances (Balance O/s)	Internet users (No.)	271.9995	0.0000	Internet users (No.) significantly impact Agri. Outstanding Advances (Balance O/s)

(Source: - Compiled by author)

The result of the Wald test for the determinants of credit to agriculture and the number of internet users is shown in Table 10. The p-value of chi-square for all determinants of credit to agriculture is near zero which confirms the outcome of regression analysis i.e., the number of internet users has a positive effect on the determinants of credit to agriculture. Based on the results of three sub-hypotheses the main hypothesis that "***There exists a significant relationship between digitalization and credit to agriculture***" is accepted.

Smartphone/Internet Usage by Farmers

Table 11: Smartphone usage and qualifications of farmers

	Smartphone users	**Non-users**
Upto 10^{th}	15	5
12^{th}	15	0
Graduate	9	0
Postgraduate	6	0

(Source: - Compiled by author)

The educational profile of farmers included in the sample survey is shown in Table 11. Out of 50 farmers included in the survey, 45 farmers use smartphones/internet and five do not use them. The smartphone users were further questioned about the use of smartphone/internet for agricultural purposes.

Table 12: Agricultural income and Smartphone/internet usage

Questions	**Yes (No)**	**Up to 10^{th}**	**12^{th}**	**Graduate**	**Post-graduate**
Do you think Smartphones/Internet help to improve the income of farmers from agriculture?	24(21)	5(10)	6(9)	7(2)	6(0)
Have you taken an agricultural loan in the last three years?	32(13)	8(7)	11(4)	9(1)	5(0)
Do Smartphones/the Internet have made the Agricultural loan process simpler?	13(32)	1(14)	4(11)	4(4)	4(3)

(Source: - Compiled by author)

Table 12. shows the perception of farmers about the use of Smartphones/internet for improvement of access to agriculture loans or agricultural income. Out of a total of 45 farmers, 53.3 percent of farmers consider that smartphones/internet helps in the improvement of agricultural income. This percentage has a positive relationship with educational qualification. The higher the qualification, the higher the percentage of farmers who consider smartphones to help in the improvement of agricultural income. 71.1 percent of farmers have taken loans in the last 3 years. This percentage increases with the qualification of the farmer. Only 28.8 percent of farmers think that smartphones/internet makes the agriculture loan process simple.

Table 13: Sources of agriculture related information

	Yes (No)	Sources of Information							
		Google	NDRI GP[1]	HAU GP[2]	Whats-AppGP	HAD GP[3]	Bank App	MF MB[4]	Govt. Camp
Do Smartphone/ Internet helps you to access weather-related information.	40 (5)	38	17	14	3	0	0	0	0
Do Smartphone/ Internet helps you with agriculture-related information, for example, HYVs, Fertilizers, Pesticides, Sowing, and Horticulture.	37 (8)	24	0	12	9	12	0	0	0
Do Smartphone/ Internet helps you to access Banking Services for Agriculture.	34 (11)	5	0	0	5	0	26	3	0
Do Smartphone/ The Internet helps you to access Credit Services for Agriculture.	33 (12)	9	0	0	26	0	0	0	0
Do Smartphone/ The Internet help you to know information about Government Agriculture Credit Schemes.	33 (12)	11	0	0	27	0	0	0	14

(Source: - Compiled by author)

[1]**NDRIGP-**National Dairy Research Institute's WhatsApp Group

[2]**HAUGP-**Haryana Agriculture University's WhatsApp Group

[3]**HAD GP-**Haryana Agriculture Department's WhatsApp Group

[4]**MFMB-**Meri FasalMeraByora

Table 13. displays the sources of agriculture-related information for farmers. 88.8 percent of farmers use smartphones/the internet to access weather-related information. The percentage of farmers using the smartphone/ internet for searching information about HYVs, fertilizers pesticides, horticulture, sowing and harvest is 82.2 percent. The percentage of farmers thinking that smartphone internet helps to access financial services for agriculture is 75.5 percent. 73.3 percent of farmers consider smartphone/internet helps to find information about credit services and government agricultural credit schemes.

FINDINGS AND CONCLUSION

The number of mobile phones, smartphones and internet connections are the main determinants of the level of digitalization in the economy. The results of regression analysis and the Wald test confirm that digitalization has a positive and significant impact on the volume of credit to agriculture. These results are in line with several pieces of evidence that digital technology has improved the economic condition of farmers by supporting livelihood and service delivery. Robert Jenson's work on Kerala fishermen identified the significant impact of mobile phones on the income of fishermen (Jensen, 2007). The use of digital technology in extension services saves time and reduces costs significantly (Aker, 2011). The smartphone and internet enable farmers to instantly access critical weather and climate information (Oliver et al., 2010). Using smartphone data for past cultivation and reviewing the loan application significantly improves the number of loan applications from female farmers (Kramer et al., 2021).

The result confirms that digitalization plays an imperative and substantial role in the improvement of the usage of agricultural credit services, making it a vital economic instrument for raising a green economy and sustainable development. It not only reduces the operating costs of traditional sectors of the economy but also enhances the accessibility of agriculture credit services, which is essential for driving innovation in sustainable farming practices (Sheokand & Gupta, 2017). By attracting investment and improving employment opportunities, digitalization facilitates the growth of green sectors, contributing to a more sustainable economic model. The jobs are generated by creating newer areas of service, business, and trade (Badam & Gochhait, 2020). According to research by the Centre for International Development, Harvard University, 'India will be the world’s fastest-growing economy over the next ten years.' Digitalization will play a significant role in this growth, particularly in enhancing agricultural productivity through efficient credit distribution and eco-friendly technologies. Therefore, the government should focus on increasing the use of mobile and smartphones and frame integrated and investor-friendly policies for improving the level of digitalization in the country (Haldankar & Com, 2018). The Government of India has already initiated many projects of digitalization. Digital India is a flagship program of the Government of India, which consists of twelve sub-programs (Kumari, 2018). The vision of the Digital India program is to transform India into a digitally empowered society and knowledge economy (Vij, 2018) which will further support sustainable development and green initiatives.

In conclusion, by expanding technology, financial institutions can reach underserved rural areas, reorganize loan processes, and offer personalized financial solutions to farmers. Hence, this empowers farmers to implement modern and sustainable agricultural practices, endorsing a green economy. The amalgamation of digital tools in agricultural funding not only boosts efficiency and earnings but also contributes considerably to the bigger goals of sustainable development, environmental conservation and economic inclusion.

RECOMMENDATIONS

- **Promotion of Mobile Phones for Access to Digital Financial Services:** Considering the importance of mobile phones in accessing digital financial services, the government should intensify efforts to increase their usage among farmers. Mobile phones offer instant access to crucial agricultural information such as weather updates, soil testing, and crop management (Padachi et al., 2021).
- **Investment in Digital Infrastructure**: Ensuring affordable access to smartphones for farmers. Smartphones, through various fintech apps, provide a range of financial services. The government must focus on making smartphones available at an economically feasible cost for farmers to enhance their access to these services (Murria et al., 2018).
- **Enhancing Rural Internet Connectivity for Information Access:** The Internet plays a pivotal role in delivering crucial information to rural areas at a low cost. The government should take necessary steps to ensure rural areas have access to internet facilities (Priyadarsini & Vijayaratnam, 2016).
- **Digitalization of Credit Access and Asset Verification:** Digital techniques simplify access to credit by enabling online loan applications and digital identity verification. Technologies like satellite imagery and remote sensors can aid in assessing the value of farmers' assets and their loan eligibility.
- **Leveraging Digital Verification to Reduce Collateral Requirements:** Digital verification can reduce the need for traditional collateral. In advanced economies, crop yields are often accepted as collateral due to digital supply chain tracking, ensuring product security in the post-harvest process.
- **Collaboration with New Financial Entrants for Expanding Credit Access:** New players such as Small Finance Banks (SFBs), Payment Banks, Microfinance Institutions, and NBFCs can complement banks in improving access to financial services for farmers. Fintech firms can also partner with traditional banks to drive digital transformation in agricultural lending.
- **Monitoring Agricultural Credit Usage through Technology:** Simply digitizing agricultural credit services is not enough. Monitoring credit usage remains crucial. Technologies like drones can be employed to ensure that farmers use agricultural credit for the intended purposes, reducing misuse and ensuring repayment.
- **Transitioning to Value Chain-Based Agricultural Lending:** Agricultural lending should shift from individual food-grain production financing to value chain-based financing. India’s growing ecosystem of agricultural start-ups and investors provides an opportunity to introduce innovative Agri-Fintech products.
- **Sustainability-Oriented Credit Models**: Banks and Financial institutions must offer credit products that encourage the implementation of sustainable agricultural practices, confirming long-term environmental benefits alongside economic gains.

FURTHER SCOPE OF RESEARCH

- The present study is a quantitative and empirical one with secondary data. A qualitative study to examine the ground-level impact of digitalization on agricultural credit can be conducted.
- A comparative study of two digitally unequal areas can further help to examine the role of digital financial services on agricultural credit.
- A quantitative study using primary data collected through a questionnaire will further help to deduce the relationship between digitalization and agricultural credit.
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