



IMPACT OF TECHNOLOGY ADOPTION ON AGRICULTURAL PRODUCTIVITY AND PROFITABILITY

Palakomma Tharun kumar, Dr.RB.Shridhar
Student,
ITM University

ABSTRACT

This study investigates the adoption of agricultural technology among farmers through an exploratory survey-based approach involving 250 respondents. The research employed a combination of probability and non-probability sampling techniques to gather data using standardized questionnaires with Likert scales. Analysis was conducted using SPSS 22.0, incorporating regression, correlation, and ANOVA tests to examine relationships between technology adoption, productivity, profitability, and influencing factors such as government support and farmer education. Key findings indicate a significant positive correlation between technology adoption and both productivity and profitability. Government subsidies and supportive policies were identified as critical drivers of technology adoption, alongside the impact of educational and awareness initiatives in enhancing farmer knowledge and confidence in technology adoption. The study underscores the importance of policy alignment and educational support in fostering a conducive environment for agricultural technology adoption, with implications for enhancing agricultural sustainability and economic outcomes in the sector.

Keyword: Agricultural Technology Adoption, Farmers, Productivity, Profitability.

INTRODUCTION

There are 1.3 billion people living in India, and the country ranks second globally for agricultural output. In 2021, 16.4% of the GVA came from the agricultural, forestry, and fishing industries. Contrarily, almost half of the country's population relies on the sector as their main source of income. In India, policymakers continue to discuss how to address the persistently low and stagnant income in various areas. People in these areas make up the bulk of the country's impoverished. A recent estimate puts the number of impoverished in India at around 220 million. Adopting better agricultural technology is one of the most noticeable methods to increase farmers' revenue[1]. Improved adoption of technology is the key to increasing agricultural output and farmers' revenue, according to the report. Adoption of improved technology is limited in developing nations and areas, despite the fact that they greatly affect farmers' livelihoods. There are a lot of supply-and-demand elements that determine how widely used and improved agricultural technology is. On the demand side, you'll find considerations like technological literacy, accessibility to capital and relevant inputs, risk tolerance, and marginal returns. The supply side consists of things like institutional frameworks for the dissemination and sharing of technologies, money for agricultural research and extension, infrastructure that is readily available, and support from lawmakers. Efficiently combining demand and supply side components is key to achieving targeted outcomes faster through the adoption rate of improved technology. Indian government agencies primarily work through the public sector agriculture research system to develop and disseminate innovative agricultural technologies. There has been a slow but steady increase in private sector involvement in the development and marketing of superior technology. The dissemination of innovations through agricultural extension channels is crucial to their up-scaling and out-scaling. The goals of the demand-side components of the -agricultural extension system are raising knowledge, decreasing hazards, and enhancing competence[2].

LITERATURE OF REVIEW

(Li & Zhang, 2023)[3]The standardized technical system is often used in China's tobacco industry in conjunction with other multiple agricultural technologies (AMATs). This study looks at the variables that affect the uptake of AMATs and how they affect earnings. Using a multinomial endogenous treatment effects model, this model takes selection bias and visible and unobserved variability into consideration. It is based on cross-sectional micro data from 346 households in Chongqing, China. First, the educational level of the household head; second, their experience growing tobacco; third, the ratio of available

mechanical cultivation land to tobacco land; fourth, the distance to an extension station; and fifth, the ratio of leased land are the factors showed to influence the adoption of combinations of AMATs. Utilizing a mix of AMATs helps farmers increase both output and quality, which impacts their revenue differently. (3) The broadest range of AMATs may not always be advantageous to farmers. Because of the interaction of technologies such as supplemental, replacement, or complementing impacts, a moderate application is the best combination of fertilizers and soil development. The hypothesis that AMATs can be utilized more efficiently in China is supported by the study's findings.

(Benoit, 2022)[4]Agricultural productivity is positively correlated with technological adoption, as has been demonstrated in earlier research. In turn, people's level of education affects the rate of technology adoption. Therefore, the purpose of this essay is to examine how education influences the uptake of modern farming techniques in rural India. Using information gathered from the 42,152 households that made up the India Human Development Survey (IHDS) 2011–2012 (Desai and Vanneman, 2015), which covered the whole country, we use a binary logistic model and a chi-square test to assess these effects. An educated farmer is 3.37 percent more likely to use modern farm technology, according to the estimations. However, education's impact remains diverse. Adopting new technology is 3.30% more likely for farmers residing in rural areas. Additionally, the results indicate that there is a 6.12% probability of technology adoption among farmers residing in urban areas. Lastly, additional elements have a significant role in facilitating the adoption of new technology by farmers. When farmers have access to farm loans and insurance, they are 8% more likely to use modern agricultural technology, and when farmers have insurance, they are 10% more likely to do so.

(Hoque, 2022)[5]The purpose of this research is to identify the factors that influence the profitability of growing Boro rice in the districts of Dhaka and Manikganj in Bangladesh. Technology adoption and its impact on the profitability of Boro rice farming in Bangladesh are also major topics. Three hundred homes that cultivated Boro rice were surveyed using in-person interviews using a single set of structured questions. The results demonstrated that farmers' profit efficiency ranged from 23% to 97%, with an average of 76%. This suggests that a mix of technical and allocative inefficiencies in Boro rice farming in the research region results in the loss of 24% of the profit. According to the inefficiency model, there is a strong relationship between the profit inefficiency and factors including farmer education level, farm size, seed variety, and training and extension services. According to the research, profit efficiency is influenced by the degree of the technology adoption index. Farmer education, farm size, and farm money all have a role in how technology is used in Boro rice farming.

(Zegeye, 2021)[6]This study examines poverty in Ethiopia's rural Amhara region by examining the impacts of different agricultural technology adoptions. This study used data collected from the 2015–2016 Ethiopian Socioeconomic Survey. A grand total of 656 rural homes were considered. A Multinomial Endogenous Switching model was used to evaluate the impact of adoption on poverty levels, while a Multinomial Logit model was used to determine the variables that contributed to adoption. Important factors that influence the decision to adopt agricultural technology include the head of the household's degree of education, family size, livestock, involvement off the farm, the availability of credit, advisory services, plot distance, market distance, zonal town distance, and remittances. Adoption of several technologies results in a significant increase in consumption spending, which lowers poverty. Adoption as part of a package also leads to higher consumption than when used alone. As a result, the study comes to the conclusion that the broad use of alternative agriculture technologies on a national and regional level ought to be given top priority in policies intended to combat poverty.

(Kotamraju et al., 2021)[7]The growth of agribusiness is impacted by market reforms, which continue to be a divisive issue in numerous emerging nations. Given the ongoing discussion and dearth of data regarding how marketing reforms have affected farmers' well-being, this study adds to the growing body of evidence. It zeroed particularly on how direct marketing with Super Markets (SMs) affected the uptake of contemporary production technology and the attainment of net returns among tomato-growing farmers in India. Applying the Seemingly Unrelated Regression (SUR) model to primary data collected from 500 farmers served as the basis for this investigation on the impact of SMs on the uptake of modern agricultural equipment and the attainment of net income. According to the research, SMs' participation decisions, interactions with SMs personnel, land holding size, and the attractive prices offered by SMs influence the utilization of modern inputs like organic manures, drip irrigation, micronutrients, and the realization of higher net income from tomato cultivation. Market linkages between tomato farmers and corporate enterprises have several benefits, such as reduced transaction costs, assured marketing, increased commercial perspective for farmers, and mitigation of production and marketing hazards.

(Mensah et al., 2021)[8]We want to find out how much of an effect the new maize seed technology has on farmers' bottom lines in this article. It calculates how much money farmers will make and how much money they will lose as a result of the new technology. By looking at more measures of production outcomes than are often seen in the literature on the adoption's effect on farms' profitability, this study hopes to broaden the scope of farm investment appraisal analysis. Field survey data was used as an empirical research in the publication. Researchers in Ghana interviewed 400 maize farmers from four different locations using a standardized questionnaire. Male and female farmers involved in commercial maize cultivation participated in focus groups in each region to supplement the study. Both demographic and socioeconomic information at the home level and data on maize production at the farm level (including input consumption and farm output) were recorded. Using data collected from actual farmers, this article delves into how maize seed technology is perceived and what variables contribute to its widespread acceptance. It also revealed that farmers make judgments about which maize seed technology to adopt based on factors other than farm revenue and productivity, such as the return on investment and the cost of the technology. It is possible that the research may oversimplify a very complicated situation in the maize sector due to data limitations that prevented the direct capture of the effect of some major actors (market power). This highlights the need for more study into the impact of this phenomena on agricultural profitability. A rise in farmer income is possible through sector-wide improvements to maize production and farm profitability. In conclusion, the study shows how the accepted seed technology affects farm profitability.

(Bucci et al., 2020)[9]Through improved resource management and input optimization, precision agriculture (PA) offers farmers the chance to increase their farm's bottom line. Despite these clear benefits, PA technologies (PATs) still have a long way to go before they are used extensively due to socioeconomic variables and farm-specific considerations including cropping practices, technical improvements, field sizes, and farm scale. The financial ramifications must be carefully considered before PATs are implemented. The majority of the time, farmers are wary of using precision farming systems because they don't fully understand the benefits, profitability, and costs involved. The objective of this case study is to analyze how PATs may affect the bottom line of a typical Italian grain farm. The farm's profitability was determined by a thorough economic examination. Evidence suggests that PATs may boost durum and soft wheat yields while cutting down on expenses associated with mechanical operations and technology. The possible advantages of PATs make policymakers want to develop targeted policies that could encourage their use.

(Dekaet al., 2019)(Dekaet al., 2019) In the Udalguri area, new high-yielding varieties of Toria, an oilseed crop, have been introduced via Front Line Demonstrations. This is to demonstrate improved production technologies and raise the low productivity of oilseed crops in the district, which is 3.80 q/ha, because farmers in this area are growing Toria in marginal areas and have not adopted an improved package of practices. Primary data formed the mainstay of the research. Two of the twelve development blocks in the district—the Udalguri and Rowta blocks—were chosen with purpose; three villages were chosen from each block based on the results of several front line demonstrations. The six settlements yielded a total of 120 responses. The purpose of this research is to examine the district's socioeconomic status and adoption pattern as a result of the Krishi Vigyan Kendra, Udalguri Front Line Demonstration. The research shows that stakeholders' income levels may be significantly raised by the execution of front-line demonstrations of proven technologies, which in turn increases the oilseed cultivation's yield potential and net revenue. Since crop output is dependent on seed quality and pest and disease control, the areas of variety selection and disease management had the greatest adoption rate following the Front Line Demonstration.

(Ogundipe, 2019)[11]This research looks at how different types of technology have affected the output of Nigerian small-scale farmers. This study's data came from the International Institute of Tropical Agriculture's (IITA) survey database. Improved cassava varieties boost farmer output and help alleviate poverty. Out of all the farmers who used ICVs, the ATT for productivity went up by 70%. Moreover, the adopters' income was ₦43463.77 more than the non-adopters'. A similar trend occurred with the adopters' income, which rose by 17%. Those that use ICVs also have a good chance of lowering the poverty rate by 20%. The findings point to the potential importance of innovative agricultural practices in boosting smallholder farmers' agricultural output, which in turn can enhance their revenue generation and food security.

RESEARCH METHODOLOGY

The Study: The study was exploratory in nature. Survey method was used to collect the data.

The Sample Design

Population: The population for this study Are farmer.

Sample Frame: Sample frame of this study Are farmer.

Sampling Technique: probability and non-probability sampling technique was used in this study.

Sampling Size: The sample sizes of this study are 250 farmer.

Tools used for Data Collection

Standardized questionnaires were used to collect data on advertisement. Likert type scale was used to collect data where 1 indicated strongly disagrees and 5 indicated strongly agree.

Tools used for Data Analysis

SPSS 22.0 Statistical software package

RESULTS & DISCUSSION

We used SPSS software to analyze data collected from 250 respondents, which is included in the study's results section. Several statistical tests were used in our analysis to examine different facets of the adoption of agricultural technology and its effects on the agricultural industry.

First, in order to give a broad picture of the respondents' demographic traits and overarching patterns, we used frequency and percentage tests. We were able to comprehend the participants' distribution of factors including age, education level, and farm size thanks to this preliminary analysis.

After that, we used regression analysis to look at the connection between the profitability of agricultural operations and the adoption of agricultural technology. This made it possible for us to evaluate how farms' financial results were affected by the use of new technologies.

Next, we looked into the connection between the uptake of agricultural technology and production using correlation analysis. With the use of this test, we were able to determine whether there was a meaningful correlation between the general production levels in farming operations and the deployment of technology.

In order to determine the variables that affect the adoption of new technologies in the agriculture sector, we lastly ran ANOVA (Analysis of Variance) tests, concentrating on the Government Support and Knowledge and Awareness variables. With the use of these tests, we were able to ascertain if the different levels of government support and farmer knowledge contributed to any discernible changes in the adoption levels of technology.

When taken as a whole, these analyses offered a thorough grasp of the relationships among productivity, profitability, adoption of agricultural technology, and the influencing factors in our sample. The main conclusions of the study are outlined in more detail in the parts that follow, together with their implications for agricultural policy and practice.

Table: 1 Frequency and percentage of Age of the Respondents.

Age		
	Frequency	Percent
25-30	74	29.6
31-35	57	22.8
36-40	40	16.0
41-45	54	21.6
Over 45	25	10.0
Total	250	100.0

The age distribution of 250 people is seen in the table. Among the responses, those in the 25–30 age bracket make up the biggest demographic, accounting for 29.6% of the total. The second largest demographic consists of individuals aged 31-35, accounting for 22.8% of the overall population. As individuals get older, the proportions gradually decrease: people between the ages of 36 and 40 represent 16.0%, those between 41 and 45 make up 21.6%, and individuals above the age of 45 constitute 10.0% of the sample.

Graph: 1 Graphical representation of Age of the Respondents.

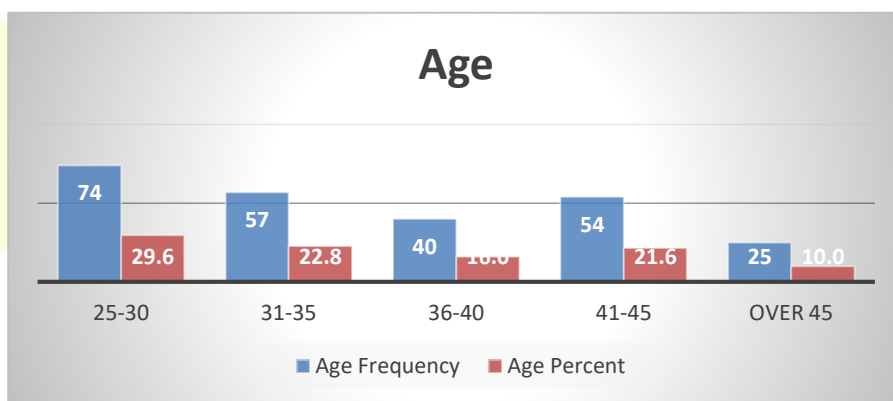


Table: 2 Frequency and percentage of Gender of the respondents.

Gender		
	Frequency	Percent
Male	196	78.4

Female	54	21.6
Total	250	100.0

The table presents the gender distribution of a sample size of 250 participants. Male respondents are the majority, accounting for 78.4% of the total. Conversely, the female population constitutes a lesser percentage, at 21.6%.

Graph: 2 Graphical representation of Gender of the respondents.

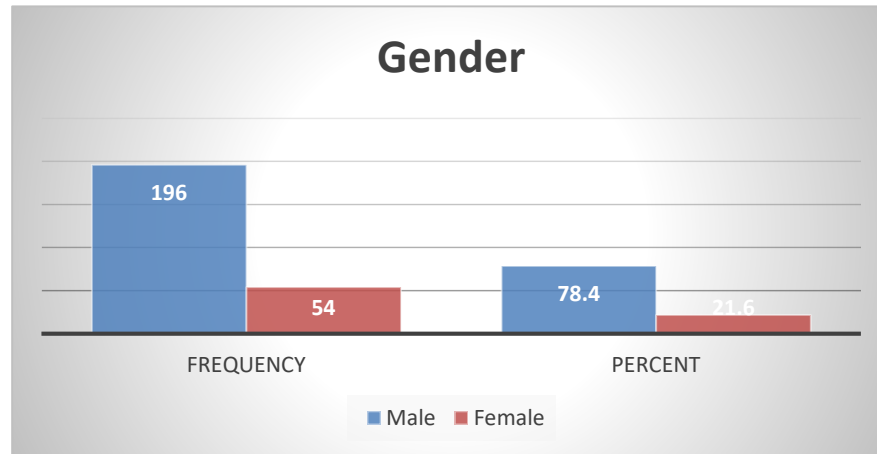


Table: 3 Frequency and percentage of Education of the respondents.

Education		
	Frequency	Percent
Higher Secondary	72	28.8
Diploma	62	24.8
Graduate	51	20.4
Post Graduate	65	26.0
Total	250	100.0

The table displays the educational achievement levels of 250 individuals that were surveyed, classified according to various educational stages. Among the sample, individuals with Higher Secondary education had the largest frequency, accounting for 28.8%. Next in line are individuals who possess Diploma qualifications, comprising 24.8% of the total. 20.4% of the respondents have completed graduate-level schooling, while 26.0% have postgraduate qualifications.

Graph: 3 Graphical representation of Education of the respondents.

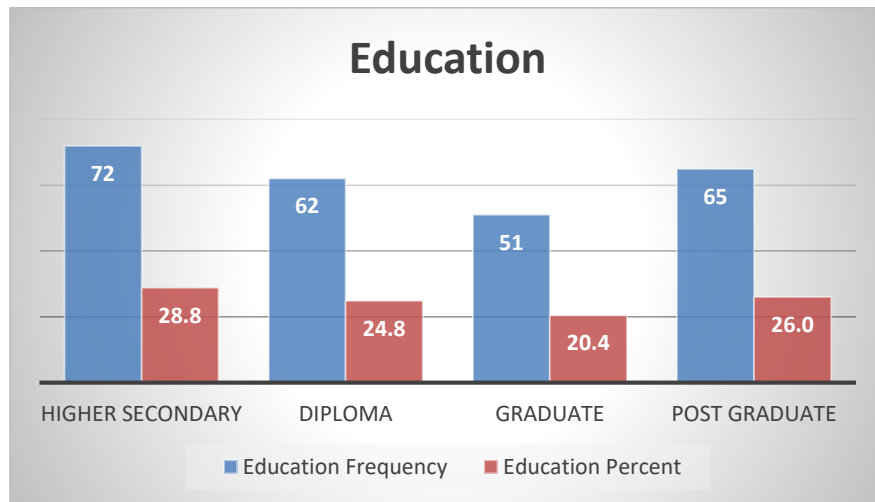


Table: 4 Frequency and percentage of marital status of the respondents.

Marital status		
	Frequency	Percent
Single	106	42.4
Married	144	57.6
Total	250	100.0

The table depicts the marital status of 250 individuals who were polled, clearly demonstrating a notable contrast between those who are single and those who are married. Out of the entire sample, the largest portion consists of married individuals, making up 57.6%. Conversely, 42.4% of the group consists of single persons.

Graph: 4 Graphical representation of marital status of the respondents.

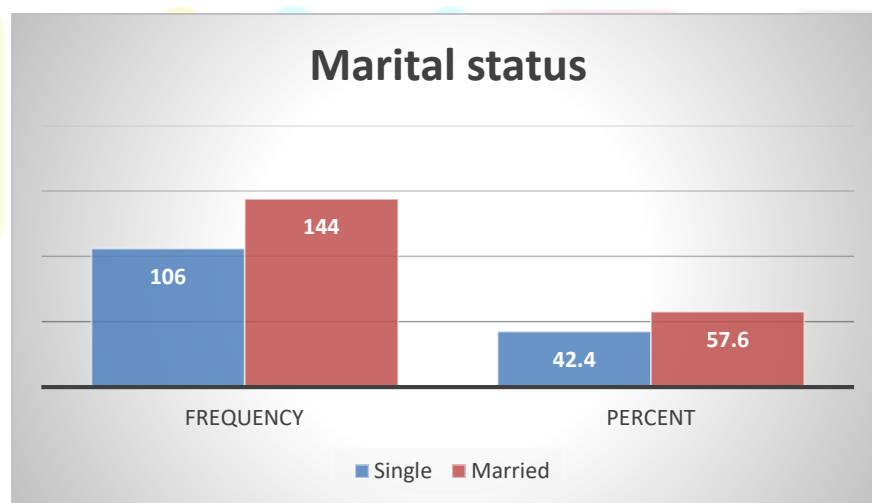


Table: 5 Frequency and percentage of Years of farming experience.

Years of farming experience

	Frequency	Percent
2-4 Years	74	29.6
5-6 Years	62	24.8
7-9 Years	57	22.8
Over 10 years	57	22.8
Total	250	100.0

The table presents a comprehensive analysis of the agricultural experience of 250 surveyed persons, classified into several intervals. The predominant group comprises individuals with a farming experience ranging from 2 to 4 years, making up 29.6% of the entire sample. Next in line are persons with a tenure of 5-6 years, constituting 24.8% of the total. Approximately the same percentage of participants possess farming experience of 7-9 years (22.8%) and more than 10 years (22.8%).

Graph: 5 Graphical representation of Years of farming experience.

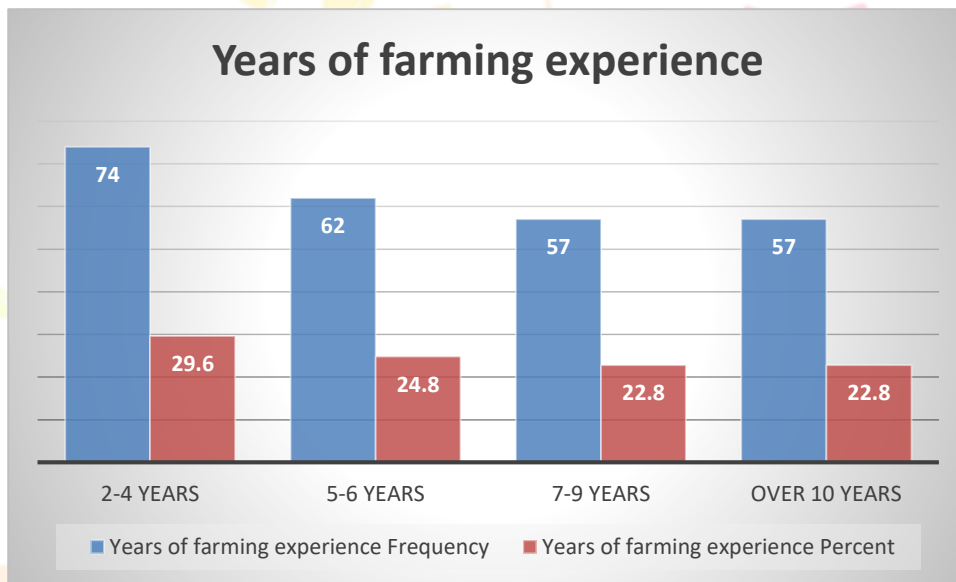


Table: 6 Regression Test.

Model Summary				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.477 ^a	.228	.224	5.64234

a. Predictors: (Constant), Agricultural technology adoption.

ANOVA ^a						
Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	2325.163	1	2325.163	73.036	.000 ^b

	Residual	7895.333	248	31.836		
	Total	10220.496	249			
a. Dependent Variable: profitability of agricultural operations.						
b. Predictors: (Constant), Agricultural technology adoption.						

Coefficients ^a						
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	5.356	1.579		3.391	.001
	Agricultural technology adoption	.580	.068	.477	8.546	.000
a. Dependent Variable: profitability of agricultural operations.						

The regression analysis shows that adopting agricultural technology has a significant impact on profitability ($F(1, 248) = 73.036$, $p < 0.001$). The model explains 22.8% of the variance in profitability, implying that, while agricultural technology adoption is an important predictor, other factors not included in the model also influence profitability. The positive coefficient (0.580) indicates that more adoption of agricultural technologies tends to result in higher profitability. The standardized coefficient (Beta) of 0.477 suggests that agricultural technology adoption has a moderate effect size on profitability.

As a result of this investigation, we can infer that agricultural technology adoption has a statistically significant impact on and may improve the profitability of agricultural enterprises. Further research and evaluation of additional variables may provide a more complete picture of the elements influencing agricultural profitability.

Table: 7 Correlation test.

Correlations			
		Agricultural technology adoption	Agricultural productivity.
Agricultural technology adoption.	Pearson Correlation	1	.578**
	Sig. (2-tailed)		.000
	N	250	250
Agricultural productivity.	Pearson Correlation	.578**	1
	Sig. (2-tailed)	.000	
	N	250	250

** . Correlation is significant at the 0.01 level (2-tailed).

The above table discusses the Correlation test on Agricultural technology adoption and Agricultural productivity, where the sig. value is 0.00, which means there is significant relation between Both Variable.

Table: 8 ANOVA test.

ANOVA			
	Mean Square	F	Sig.
Subsidies and incentives from the government significantly encourage the use of new technologies in agriculture.	22.961	22.696	.000
The current government policies are supportive of integrating new technologies into agriculture.	5.627	3.971	.004
Knowledge and awareness of new technologies among farmers are significantly influenced by the experiences of other farmers.	3.292	1.878	.115
Awareness campaigns about new agricultural technologies are widely accessible to farmers.	4.774	2.843	.025
There are sufficient educational resources available to help farmers understand new technologies.	6.566	3.836	.005
Farmers receive adequate technical support to implement new technologies.	9.562	5.485	.000

The above table discusses the Anova test on the factors influencing (Government Support and Knowledge and Awareness) the adoption of new technologies in the agricultural sector. In Subsidies and incentives from the government significantly encourage the use of new technologies in agriculture, F Value is 22.69 and Sig value is 0.00. In The current government policies are supportive of integrating new technologies into agriculture, f value is 3.97 and Sig. value is 0.00. In Knowledge and awareness of new technologies among farmers are significantly influenced by the experiences of other farmers, F value is 1.87 and Sig. value is 0.11. In Awareness campaigns about new agricultural technologies are widely accessible to farmers, f value is 2.84 and Sig. value is 0.02. In There are sufficient educational resources available to help farmers understand new technologies, F value is 3.83 and Sig. value is 0.00. In Farmers receive adequate technical support to implement new technologies, f value is 5.48 and Sig. value is 0.00.

CONCLUSION

The adoption of agricultural technology among a sample of 250 farmers was examined in this research using a rigorous exploratory technique, to conclude. Regression analysis, correlation analysis, and ANOVA were used to examine different aspects of technology adoption and how they affect agricultural practices using survey data. Significant benefits on farming operations' productivity and profitability are seen as agricultural technology usage increases. It seems that farms that implement new technologies often have larger financial returns since regression research showed a favorable association between technology adoption and profitability. Agriculture production and technological adoption are positively correlated, as further shown by correlation analysis. In encouraging farmers to utilize technology, the research emphasized the important role that the government, awareness campaigns, and instructional materials play. ANOVA experiments verified that key factors in promoting the adoption of new technology in agriculture are government subsidies and policy. For agricultural policy and practice, these results have significant ramifications. With this information, policymakers may better design initiatives that encourage farmers to embrace new technologies, increasing agricultural output and sustainability in the process. Farmers may make more educated choices about investment and implementation if they are aware of the particular elements that impact technology adoption. While the present study offers insightful information, future investigations should explore more factors and longitudinal studies to further our comprehension of the changing agricultural technology adoption landscape. We can create a future agricultural industry that is more robust and successful by keeping an eye on and encouraging technology developments in the field.

REFERENCES

- [1] Drishtiiias, "Adoption of Modern Technology in Agriculture," *drishtiiias*, 2022.
- [2] P. K. J. and D. Varshney, "Agricultural Technologies in India: A Review," *NABARD Res. Policy Ser.*, pp. 1–53, 2022.
- [3] Y. Li and Z. Zhang, "Research on farmers' adoption of additional technology combinations: Practice from Chongqing, China," *PLoS One*, vol. 18, no. 11, p. e0294862, Nov. 2023, doi: 10.1371/journal.pone.0294862.
- [4] K. Benoit, "Education and agricultural technology adoption: Evidence from rural India," *Int. J. Res. Bus. Manag. Econ.*, vol. 1, pp. 53–74, 2022, doi: 10.5281/zenodo.7295515.
- [5] F. Hoque, "Profit Efficiency and Technology Adoption of Boro Rice Production in Bangladesh," *Iran. Econ. Rev.*, vol. 26, no. 03, pp. 511–524, 2022, doi: 10.22059/ier.2021.79456.
- [6] M. B. Zegeye, "Adoption and Ex-post Impact of Agricultural Technologies on Rural Poverty: Evidence from Amhara Region, Ethiopia," *Cogent Econ. Financ.*, vol. 9, no. 1, Jan. 2021, doi: 10.1080/23322039.2021.1969759.
- [7] N. R. K. Kotamraju, S. C. Babu, and J. M. R. Maligireddy, "Impact of Market Reforms on Technology Adoption and Profitability: The Case of Tomato Farmers in India," *Res. Dev. Chang. Technol.*, vol. 28, no. 02, pp. 1–20, 2021, doi: 10.22004/ag.econ.334383.
- [8] A. Mensah *et al.*, "Adoption impact of maize seed technology on farm profitability: evidence from Ghana," *J. Agribus. Dev. Emerg. Econ.*, vol. 11, no. 5, pp. 578–598, Oct. 2021, doi: 10.1108/JADEE-06-2020-0120.
- [9] G. Bucci, D. Bentivoglio, M. Belletti, and A. Finco, "Measuring a farm's profitability after adopting precision agriculture technologies: A case study from Italy," *ACTA IMEKO*, vol. 9, no. 3, p. 65, Sep. 2020, doi: 10.21014/acta_imeko.v9i3.799.
- [10] P. Deka, Pallavi; Borah, Debasish; Barman, Sinki; Borah, "ANALYSING IMPACT OF IMPROVED TECHNOLOGIES ON TECHNOLOGY ADOPTION AND PROFITABILITY OF TORIA IN UDALGURI DISTRICT.," *Indian J. Soc. Res.*, vol. 60, no. 06, p. 749, 2019.
- [11] A. A. Ogundipe, "AGRICULTURAL TECHNOLOGY ADOPTION AND PRODUCTIVITY AMONG SMALL SCALE FARMERS," *Proc. SOCIOINT 2019- 6th Int. Conf. Educ. Soc. Sci. Humanit.*, pp. 1270–1274, 2019.
- [12] A.M Rufai, "AGRICULTURAL TECHNOLOGY ADOPTION AND PROFIT ABILITY AMONG SMALL HOLDER FARMERS IN NIGERIA," *Conf. Proc. 18'' Annu. Natl. Conf. Niger. Assoc. Agric. Econ. Held Fed. Univ. Agric.*, pp. 374–383, 2017.
- [13] M. G. Gebeyehu, "The Impact of Technology Adoption on Agricultural Productivity and Production Risk in Ethiopia: Evidence from Rural Amhara Household Survey," *OALib*, vol. 03, no. 02, pp. 1–14, 2016, doi: 10.4236/oalib.1102369.
- [14] S. K. S. and S. Das, "Impact of Agricultural Related Technology Adoption on Poverty: A Study of Select Households in Rural India," *MADRAS Sch. Econ.*, pp. 1–25, 2015.
- [15] P. Hellegers, D. Zeng, and D. Zilberman, "Technology adoption and the impact on average productivity," *Econ. Innov. New Technol.*, vol. 20, no. 7, pp. 659–680, Oct. 2011, doi: 10.1080/10438599.2010.523269.