








DETERMINANTS OF KNOWLEDGE, ADOPTION AND RESOURCE MANAGEMENT AMONG PULSE FARMERS IN ODISHA

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ABSTRACT

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Agriculture supports rural livelihoods and food security in developing regions, while pulse-based farming contributes substantially to household nutrition, income and soil fertility. However, the adoption of improved pulse production practices and effective resource management among smallholder farmers are often shaped by socio-economic and communication-related factors. This study examined the determinants of knowledge, adoption, and resource management behaviour among pulse farmers in Nayagarh district, Odisha. Primary data were collected from 256 pulse farmers selected through proportionate random sampling from eight villages across four blocks. Data were gathered using a structured interview schedule and analysed using Pearson's correlation, canonical correlation and multiple linear regression. The findings revealed that education, annual family income, savings, cosmopolitanism and sources of information were important factors associated with farmers' knowledge and adoption behaviour. Adoption was significantly influenced by education, annual family income, savings, housing pattern, landholding, source of income and sources of information. Resource management behaviour was influenced by age, education, housing pattern, social participation and cosmopolitanism. The study concludes that improving pulse-based farming systems requires more than technology dissemination; it demands farmer-oriented training, credible information delivery, financial support and institutional facilitation to strengthen adoption and resource management among smallholder pulse farmers.

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INTRODUCTION

Pulses are leguminous crops that are members of the leguminous family, which includes beans and lentils and chickpeas, which are seen as the key to global nutritional stability and food security (Limenie, 2025). For people who adhere to vegetarian diets and the developing world population, the food items contain vital nutrients, including protein, fibre, minerals, and vitamins (Gurusamy *et al.*, 2022). Since pulses have nitrogen-fixing properties, these crops enhance soil health, eliminate the need for chemical fertilisers, and support the development of sustainable agricultural systems (Kebede, 2021). The cultivation of pulses supports biodiversity and helps reduce climate change by absorbing carbon (Kumar *et al.*, 2023). Pulses serve as valuable food supplies in agricultural systems that support

millions of people with food and nutrients (Kumar *et al.*, 2023). Pulses play a crucial role as edible food crops in India because they fulfil both food and economic stability needs (Ahlawat *et al.*, 2016). Indian production is a significant part of global pulse production, with Odisha contributing significantly to national production. The Odisha state is a relatively diverse agricultural land located to the east of India, which is acknowledged to be a primary economic activity capable of supporting the local inhabitants of the area and increasing the level of food security (Rout and Sharma, 2024).

The literature on agricultural innovation has repeatedly demonstrated that socio-economic, informational, and institutional factors are at play in determining farmers' knowledge and adoption behaviour, rather than simply a matter of technology availability. Policy and program support have been demonstrated to be important in the pulse sector in India. In their article on the revival of pulse production in Bihar, Lybbert *et al.* (2024) showed that extension support, input subsidies, and output price supports can enhance farmers' incentives to participate in pulse cultivation, especially when learning and profitability constraints limit adoption. Similarly, Varma and Manda (2025), who examined black gram and green gram farmers in India, reported that availability of information, exposure to government extension services, and availability of off-farm activities are key predictors of adopting agronomic practices, and yield, crop revenue, and net income had a significant impact in this context. These results are very much applicable in research related to pulse farmers since they prove that adoption is crucially associated with the availability of knowledge systems and facilitating institutional situations as opposed to mere willingness of the farmers.

The role of the farmer knowledge as a precondition to better practice adoption has also been highlighted in research. Ashrit and Joshi (2024) investigated farmers in southern India and found that knowledge and adoption of agricultural practices were related to education, exposure to mass media, social participation, risk orientation, and innovativeness. Their result indicates that knowledge is not a result of formal education only but also a result of involvement in broader communication and social systems. This observation is especially relevant to smallholder systems, where awareness is translated into practice adoption by the extent to which small farmers are linked to extension services, peer networks, and information systems. Similarly, Oduniyi and Tekana (2021) demonstrated that information acquisition is highly related to the implementation of sustainable land management practices, and that the number of years of schooling, frequency of extension visits, and the number of extension visits affect information acquisition and adoption. Collectively, these studies support the view that knowledge and adoption are closely linked, and that investments in information delivery systems can enhance agricultural decision-making.

Socio-economic traits continue to come out as powerful predictors of adoption behaviour. In their case study, Sithole and Olorunfemi (2024) investigated the prevalence of smallholder crop farmers in the North-Eastern region of South Africa and concluded that education, annual income, source of income, and satisfaction with extension services are important for implementing sustainable farming practices. On the same note, Miheretu and Yimer (2017) found that

education, family size, tenure security, training, access to farm credit, and extension services positively affect the adoption of land management practices, whereas age negatively affects adoption. Their results also indicated that credit and extension contacts are likely to increase farmers' likelihood of investing in better land management. Using a massive Indian dataset of paddy farmers, Jha *et al.* (2024) also found that age, education, household size, farm organisation membership, awareness of the minimum support price, and access to technical advisory services play a pivotal role in the adoption and intensity of adoption of sustainable inputs. All these studies point to the fact that the implementation of better agricultural practices is embedded in the household's broader socio-economic capacity, including education, financial status, organisational membership, and institutional provision.

Research on pulse-based systems and legumes provides additional evidence on the importance of training, seed access systems, and resources. In their article on the presence of better varieties of haricot beans in southern Ethiopia, Cholo *et al.* (2023) found that socio-agronomic factors, including the availability of better seed, institutional facilitation, and farmers' individual capacities, affect their adoption and the intensity of adoption. Even though the crop and context are different, the study can be applied to pulse-based research, as it shows that legume production systems are highly responsive to information, training, and access to inputs. In India, Shivaswamy *et al.* (2022) found that access to irrigation and institutional credit enhances chickpea seed replacement and productivity, whereas policy support through pulse development programs increases the likelihood that farmers use enhanced seed. Mutyasira *et al.* (2018) contended that the application of sustainable farming methods by smallholders ought to be understood through an integrative lens that incorporates psychosocial and socio-economic factors, rather than focusing solely on structural farm attributes. In a more recent review, Thobane *et al.* (2025) examined Southern Africa and found that adoption of sustainable agricultural practices was limited due to financial constraints, limited access to information, and limited knowledge of the practices, despite identified positive ramifications. These studies indicate that, across various smallholder settings, adoption trends are influenced by a consistent set of drivers and hindrances, namely information, credit, education, and institutional access.

Pulse farmers face significant challenges in adopting new practices that would not only increase their productivity but also advance their sustainability goals. There are many challenges, influenced by social and economic factors that shape how individuals learn and embrace contemporary practices, as well as their capacity to manage resources effectively. According to Fuglie *et al.* (2019), the educational attainment of farmers, along with their economic status, accessibility to, and exposure to information, is shaped by their cosmopolitanism. Knowledge of these states enables the development of dedicated programs to enhance agricultural practices and the long-term sustainability of agriculture. The research by the Pace Institute will be carried out among pulse farm operators in the Nayagarh district of Odisha, which has maintained a good pulse-growing region. The research site is of significant importance because it encompasses a range of social and economic factors that depend on smallholder farmers to maintain food security and economic stability. The study was conducted to establish primary relationships among

educational background, economic status, cosmopolitan preferences, and access to information, as these factors shape pulse farmers' knowledge acquisition, practice adoption, and resource allocation.

The study was undertaken to examine adoption and resource management behaviour among pulse farmers in Nayagarh district of Odisha. The specific objectives were:

1. To examine the adoption of improved pulse production practices among pulse farmers in Nayagarh district of Odisha.
2. To analyse resource management behaviour among pulse farmers in relation to selected socio-economic characteristics.
3. To determine the major socio-economic predictors influencing adoption and resource management behaviour among pulse farmers.

MATERIALS AND METHODS

The study designed a survey-based research to understand the connections between social and economic factors that impact the acquisition of knowledge, the adoption of practices, and resource management decisions among Nayagarh district pulse growers in Odisha, India. The examination lasted from 2022 through 2024, with an emphasis on analysing the connections between socio-economic factors and dependent measures of knowledge, adoption practices, and resource management. The research site was strategically chosen because it is a key area for pulse cultivation, with numerous smallholders who safeguard the neighbourhood's food safety and financial stability. The research team picked four major blocks from among the six pulse-production blocks located in the district. The random selection process included blocking Gram panchayats and their corresponding villages within the selected blocks. A total of 256 participants from eight villages were selected using random proportionate sampling across the four blocks.

Data were collected using a structured interview schedule developed following a pilot visit to the selected villages. The schedule was prepared following discussions with pulse farmers, input dealers, government officials and other local stakeholders. It contained closed-ended questions related to farmers' socio-economic characteristics, the adoption of improved pulse production practices, and resource management behaviour. The schedule was pre-tested with 50 samples, and these respondents were excluded from the final survey. Based on pre-testing, minor modifications were made before final data collection. Personal interviews were conducted after rapport was established with the respondents.

The independent variables included age, education, family type, family size, housing pattern, landholding, source of income, annual family income, savings, debt, extension participation, social participation, cosmopolitaness and sources of information. These variables were measured using suitable categorical and ordinal scores. Adoption of pulse production practices was measured on a three-point scale: adopted = 3, discontinued = 2 and rejected = 1. Resource management behaviour was measured as full = 3, partial = 2 and no = 1. Higher scores indicated greater adoption or better resource management behaviour. SPSS, together with RStudio tools,

conducted statistical analysis of data gathered through tabulation. Several statistical procedures analysed the collected information through different methods.

Pearson's Correlation Coefficient

Pearson's correlation coefficient was used to measure the linear relationship between two continuous variables. The formula for Pearson's correlation coefficient (r) is:

$$r = \frac{\sum(xi - \bar{x})(yi - \bar{y})}{\sqrt{\sum(xi - \bar{x})^2 \sum(yi - \bar{y})^2}}$$

where xi and yi are individual sample points indexed with i , and \bar{x} and \bar{y} are the mean values of x and y , respectively.

Canonical Correlation Analysis

Canonical correlation analysis was employed to assess the relationships between two sets of variables. The canonical correlation coefficient (CC) is given by:

$$CC = \frac{\text{Covariance between the canonical variables}}{\text{Variance of the first canonical variable} \times \text{Variance of the second canonical variable}}$$

where the canonical variables are linear combinations of the original variables in each set.

Linear Multiple Regression

Linear multiple regression was used to model the relationship between the dependent variables and a set of independent variables. The model is represented by:

$$Y = \beta_0 + \beta_1X_1 + \beta_2X_2 + \dots + \beta_nX_n + \epsilon$$

where Y is the dependent variable,

X_1, X_2, \dots, X_n are the independent variables,

β_0 is the intercept,

$\beta_1, \beta_2, \dots, \beta_n$ are the regression coefficients, and

ϵ is the error term.

RESULTS AND DISCUSSION

The results are presented in the order of the analytical sequence used in the study. Correlation analysis was used to examine the association between selected socio-economic characteristics, adoption and resource management behaviour. Canonical correlation analysis was used to assess the combined relationship between predictor variables and the major dependent variables. Multiple regression analysis was then used to identify the major socio-economic predictors of adoption and resource management among pulse farmers.

Pearson's correlation coefficient

The correlation analysis of pulse farmers in Nayagarh reveals significant associations among the socio-economic variables and the dependent variables of Knowledge, Adoption, and Resource Management (Figure 1). Education proves to be an essential element, with moderate and strong positive correlation with Knowledge ($r = 0.43$) and Adoption ($r = 0.35$), and as such, it could be observed that the higher the education level the higher is the knowledge, and a better chance of

adopting new practices. Annual Family Income also shows significant positive relationships with Knowledge ($r = 0.49$) and Adoption ($r = 0.43$), indicating that economic status is critical to knowledge acquisition and the adoption of new agricultural practices. It has been clearly established that cosmopolitan exposure significantly influences knowledge acquisition ($r = 0.71$) and the adoption of new practices ($r = 0.30$), as it requires exposure to many different cultures and ideas to foster innovative thinking. The high positive correlation between Knowledge and Adoption ($r = 0.47$) supports the direct role of knowledge on the adoption of new practices. When the level of education of the farmer and the management strategies for the resources are related, the resulting relationship is a robust negative one ($r = -0.49$). The relationship between family size and resource management shows a moderate negative correlation of -0.24 , suggesting that larger families face challenges in resource management. The results show that the data have moderate positive relationships with Resource Management, with coefficients of $r = 0.49$ and 0.43 for Land Holding and Annual Family Income, respectively. The study shows that agricultural activities entail various aspects that require targeted intervention measures to enhance the management and transfer of knowledge and practice in the pulse production industry.

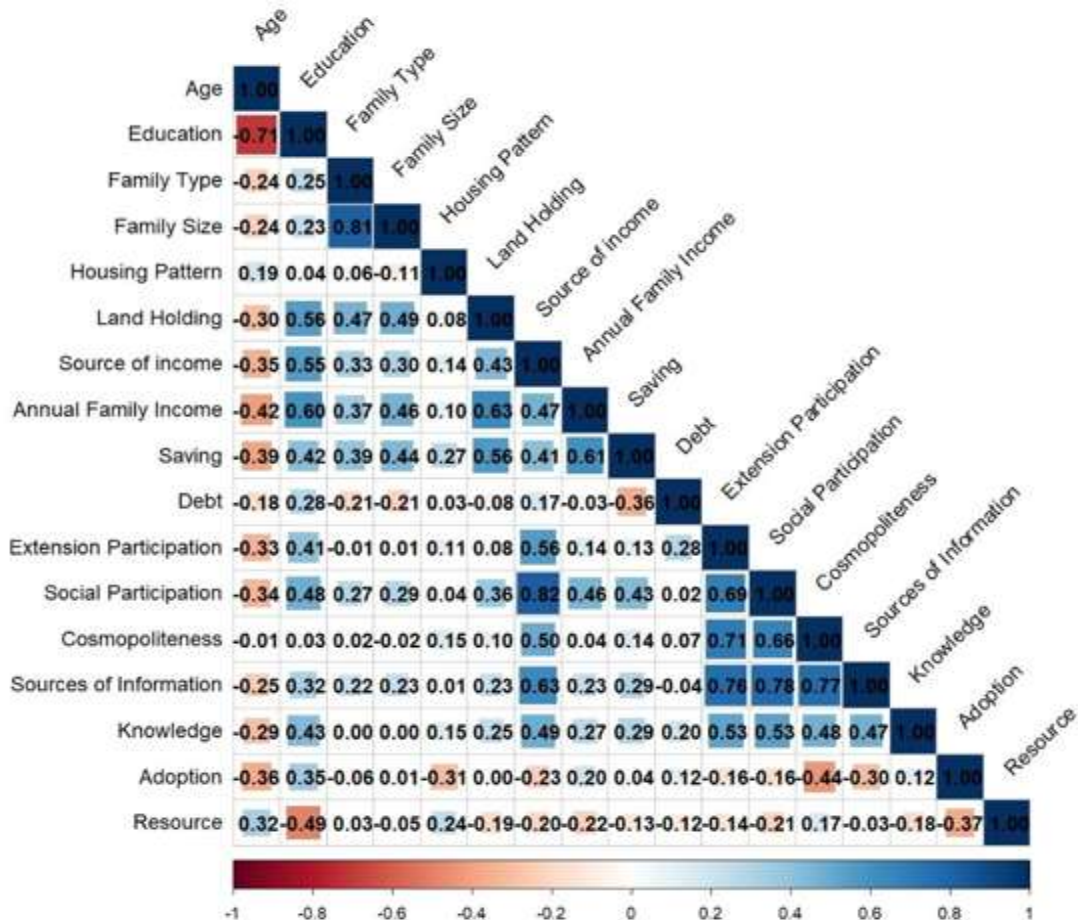


Figure (1). Correlation plot of variables of Pulse farmers (Pearson's correlation coefficient)

Canonical Correlation

Canonical correlation analysis in Table 1 showed significant differences in the strength of the linear correlation between Knowledge and Adoption between Sets 1

and 2. The canonical correlation of 0.809 indicates that the linear variables of Set 1 and the linear variable combinations of Set 2 have a strong linear relationship with the linear variable of Set 2, Knowledge. On the same note, the canonical correlation for "Adoption" was 0.700, indicating a strong relationship. Conversely, the canonical correlation for "Resource Management" was 0.344, indicating a lower association between the variables in Set 1 and those in Set 2.

Table (1). Canonical correlation analysis results for knowledge, adoption, and resource management among pulse farmers (n=256)

Canonical Correlations							
	Correlation	Eigenvalue	Wilks Statistic	F	Num D.F	Denom D.F.	Sig.
Knowledge	.809	1.897	.155	14.76	42.00	709.75	.000
Adoption	.700	.961	.450	9.06	26.00	480.00	.000
Resource Management	.344	.134	.882	2.69	12.00	241.00	.002

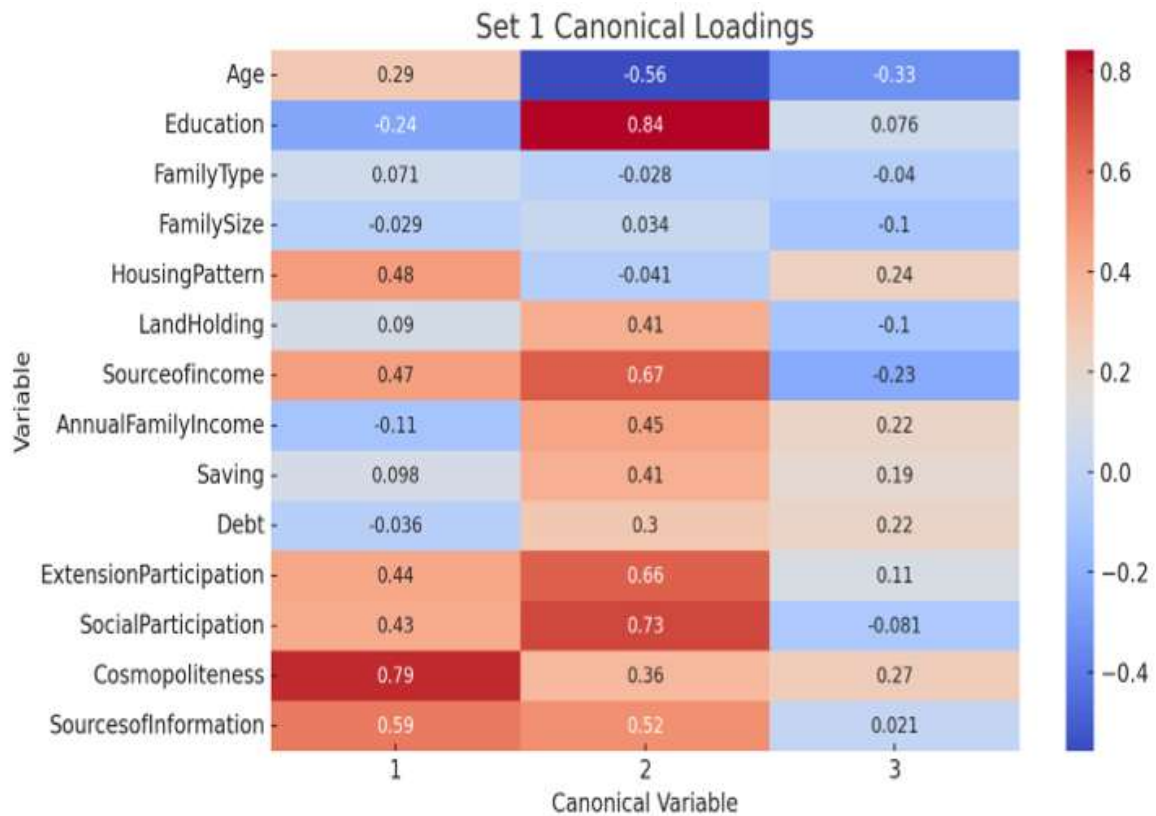


Figure (2). Canonical loadings for socio-economic factors affecting pulse farmers' knowledge, adoption, and resource management (n=256)

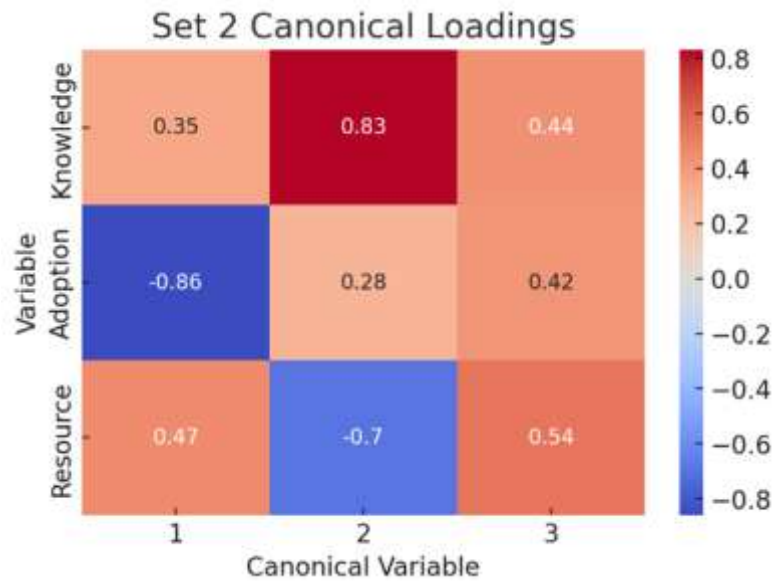


Figure (3). Canonical correlation loadings for knowledge, adoption, and resource management (n=256)

The eigenvalues of Knowledge (1.897), Adoption (0.961), and Resource Management (0.134) confirmed that the former two canonical variates accounted for a large portion of the variance, whereas the third accounted for a smaller portion (Table 1). The significance of these relationships was also supported by Wilks Lambda values and F-tests. For the Knowledge Wilks Lambda, the value was 0.155, with an F-value of 14.767 and a p-value of 0.001, which is significantly less than 0.001, indicating a very strong relationship. In the case of adoption, the Lambda of Wilks was 0.450, the F-value was 9.069, and the p-value was below 0.001, indicating a significant relationship. In the case of Resource Management, Wilks Lambda was 0.882 with a F value of 2.695 and p-value of 0.002, still significant but not so as compared to the other two. The results indicate that socio-economic and demographic variables are important determinants of knowledge and uptake of agricultural practices by pulse farmers in Nayagarh, Odisha. The combination of variables "Cosmopolitanism" and "Sources of Information" has a high predictive ability for knowledge acquisition and the intent to adopt new farming techniques among farmers, as shown by "Knowledge" and "Adoption." Social networks are also critical for disseminating agricultural knowledge and for providing access to information.

The canonical evaluation in Figures 1 and 2 showed how each set variable affected its respective construct. The first canonical variate in Set 1 presented a strong relationship between "Cosmopolitanism" (0.792 loading) and "Sources of Information" (0.590 loading), which explained the relations to "Knowledge" in Set 2. Among the variables that produced significant effects were "Extension Participation" and "Social Participation." In the second canonical variate for "Adoption", the variables "Education" (0.842) and "Sources of income" (0.674) played dominant roles. In "Resource Management", the second canonical variate showed a strong negative association (-0.701) between "Adoption" and the overall component. Education and Sources of Income demonstrate a strong influence on the adoption of new practices based on their high loading scores within the second canonical variate.

Farmers with advanced education and dependable income sources tend to adopt advanced agricultural methods because they have greater access to resources and enhanced risk management capabilities.

Multiple linear regression of Knowledge with independent variables

The ANOVA results from Table 2 for the regression model predicting knowledge among pulse farmers in Nayagarh, Odisha, indicated that the model was highly significant ($F = 13.492, p < .001$).

Table (2). ANOVA Results for the Regression Model Predicting Knowledge Among Pulse Farmers in Nayagarh, Odisha

ANOVA^a						
Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	134.494	14	9.607	13.492	.000 ^b
	Residual	171.597	241	0.712		
	Total	306.091	255			
a. Dependent Variable: Knowledge						
^b Predictors: (Constant), Sources of Information, Housing Pattern, Debt, Annual Family Income, Family Type, Age, Land Holding, Source of income, Saving, Cosmopolitaness, Family Size, Extension Participation, Education, Social Participation						

The regression model explained a substantial portion of the variability in knowledge levels, with a regression sum of squares of 134.494 and a mean square of 9.607. The residual sum of squares was 171.597, with a mean square of 0.712. The total sum of squares was 306.091. Sources of information, housing pattern, debt, annual family income, family type, age, land holding, source of income, savings, cosmopolitaness, family size, extension participation, education, and social participation were significant predictors. This means that the predictors identified as significantly affecting farmers' knowledge included education, annual family income, and cosmopolitanism.

Table 3's regression analysis indicated that education, cosmopolitanism, and saving had significant effects on knowledge levels among pulse farmers in Nayagarh, Odisha. In particular, education was found to have a strong positive influence, and a unit increase in education was associated with a unit increase in knowledge (Beta = 0.302, $t = 2.737, p = 0.007$). There was also a significant positive effect of cosmopolitaness with every unit of cosmopolitaness increasing knowledge by 0.704 units (Beta = 0.312, $t = 2.925, p = 0.004$). Also, saving positively affected knowledge, and each additional unit of saving had a positive effect of 0.405 on knowledge (Beta = 0.184, $t = 2.113, p = 0.036$). These results show the relevance of these socio-economic variables in determining farmers' knowledge acquisition.

Table (3). Regression Coefficients for Predictors of Knowledge Among Pulse Farmers in Nayagarh, Odisha

Coefficients ^a						
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	1.753	0.730		2.401	0.017
	Age	0.130	0.461	0.023	0.282	0.778
	Education	1.153	0.421	0.302	2.737	0.007
	Family Type	-0.532	0.413	-0.121	-1.287	0.199
	Family Size	-0.206	0.447	-0.046	-0.460	0.646
	Housing Pattern	0.159	0.539	0.019	0.294	0.769
	Land Holding	0.021	0.395	0.004	0.053	0.958
	Source of income	0.238	0.655	0.035	0.363	0.717
	Annual Family Income	-0.188	0.410	-0.036	-0.459	0.647
	Saving	0.405	0.192	0.184	2.113	0.036
	Debt	0.284	0.202	0.099	1.404	0.162
	Extension Participation	0.109	0.204	0.056	0.533	0.595
	Social Participation	0.587	0.638	0.111	0.921	0.358
	Cosmopolitaness	0.704	0.241	0.312	2.925	0.004
Sources of Information	-0.038	0.285	-0.015	-0.134	0.894	

a. Dependent Variable: Knowledge

Multiple linear regression of Adoption with independent variables

The ANOVA for the regression model in Table 4 predicting adoption among pulse farmers in Nayagarh, Odisha, indicated that the model was highly significant ($F = 20.595, p < .001$) and accounted for a substantial percentage of the variation in adoption levels.

Table (4). ANOVA Results for the Regression Model Predicting Adoption Among Pulse Farmers in Nayagarh, Odisha

ANOVA ^a						
Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	521.825	14	37.273	20.595	.000 ^b
	Residual	436.175	241	1.810		
	Total	958.000	255			

a. Dependent Variable: Adoption

^b Predictors: (Constant), Sources of Information, Housing Pattern, Debt, Annual Family Income, Family Type, Age, Land Holding, Source of income, Saving, Cosmopolitaness, Family Size, Extension Participation, Education, Social Participation

The regression sum of squares was 521.825, and the mean square of the regression was 37.273; the sum of squares of the residuals was 436.175, and the mean square of the residuals was 1.810. The important predictors were education, annual family income and cosmopolitaness, among others. These results emphasise the importance of educational programs, financial assistance, and exposure to new sources of information in improving farmers' ability to be innovative in their farming practices. Developed interventions that enhance these aspects may have a considerable impact on the implementation of new practices and overall productivity,

leading to agricultural innovation and sustainability amongst pulse farmers in Nayagarh, Odisha.

Table 5 employed regression analysis, showing that a number of predictors greatly predicted pulse farmers' adoption in Nayagarh, Odisha. Education ($B = 4.007$, $Beta = 0.593$, $t = 5.967$, $p = 0.000$) was a significant positive factor influencing adoption, indicating that the higher a farmer's education level, the greater the likelihood of adopting new practices. When it came to housing pattern ($B = -4.377$, $Beta = -0.299$, $t = -5.091$, $p = 0.000$) and land holding ($B = -2.435$, $Beta = -0.275$, $t = -3.868$, $p = 0.000$), the effect was negative, implying that some housing and land conditions are possible barriers to adoption.

Table (5). Regression Coefficients for Predictors of Adoption Among Pulse Farmers in Nayagarh, Odisha

Coefficients ^a					
Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	48.499	1.164		41.676	0.000
Age	0.066	0.735	0.007	0.089	0.929
Education	4.007	0.672	0.593	5.967	0.000
Family Type	-0.018	0.659	-0.002	-0.027	0.979
Family Size	0.010	0.713	0.001	0.014	0.989
Housing Pattern	-4.377	0.860	-0.299	-5.091	0.000
Land Holding	-2.435	0.629	-0.275	-3.868	0.000
Source of income	-5.695	1.044	-0.473	-5.455	0.000
Annual Family Income	1.362	0.654	0.146	2.083	0.038
Saving	0.712	0.306	0.183	2.332	0.021
Debt	0.370	0.323	0.073	1.146	0.253
Extension Participation	0.076	0.325	0.022	0.235	0.815
Social Participation	1.683	1.017	0.180	1.655	0.099
Cosmopolitaness	-0.405	0.383	-0.102	-1.055	0.292
Sources of Information	-1.321	0.454	-0.287	-2.910	0.004

a. Dependent Variable: Adoption

Source of income ($B = -5.695$, $Beta = -0.473$, $t = -5.455$, $p = 0.000$) also negatively influenced adoption, while annual family income ($B = 1.362$, $Beta = 0.146$, $t = 2.083$, $p = 0.038$) and saving ($B = 0.712$, $Beta = 0.183$, $t = 2.332$, $p = 0.021$) had positive effects. Information sources ($B = -1.321$, $Beta = -0.287$, $t = -2.910$, $p = 0.004$) negatively influenced adoption, indicating the importance of information source credibility.

Multiple linear regression of resource management with independent variables

Table 6 presents ANOVA results for the regression model predicting resource management among pulse farmers in Nayagarh, Odisha, which revealed that the model was highly significant ($F = 12.322$, $p < .001$). The regression model explains a large percentage of the variability in resource management, with a regression sum of squares of 1102.534 and a mean square of 78.752. The remaining amount squared was 1540.337, with a mean squared of 6.391. The total sum of squares was 2642.871. The major predictors were information sources, family pattern, debt, family annual income, type of family, age, landholding, source of income, savings, cosmopolitaness, family size, extension participation, education and social

participation. This was to show that the identified predictors were critical in determining the farmers' resource management strategies.

Table (6). ANOVA Results for the Regression Model Predicting Resource Management Among Pulse Farmers in Nayagarh, Odisha

ANOVA ^a						
Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	1102.534	14	78.752	12.322	.000 ^b
	Residual	1540.337	241	6.391		
	Total	2642.871	255			
a. Dependent Variable: Resource						
^b Predictors: (Constant), Sources of Information, Housing Pattern, Debt, Annual Family Income, Family Type, Age, Land Holding, Source of income, Saving, Cosmopolitaness, Family Size, Extension Participation, Education, Social Participation						

The analysis of ANOVA showed that the regression model is highly effective in the determination of the socio-economic and demographic factors on pulse farmers in Nayagarh, Odisha in their resource management activities ($F = 12.322, p < .001$). According to studies, family education, annual income, and cosmopolitanism were the main factors influencing how farmers utilised their resources. These reasons indicate why education program economies and various information systems are vital for enhancing farmers' ability to manage their resources efficiently.

Regression results identified three important variables that have a positive effect on resource management practices of pulse farmers in the Nayagarh region of Odisha, as shown in Table 7. Age ($B = -3.473, \text{Beta} = -0.210, t = -2.513, p = 0.013$) and education ($B = -6.503, \text{Beta} = -0.579, t = -5.153, p = 0.000$) were found to have significant negative effects on resource management because older and more educated farmers tend to manage their resources differently. The positive effects showed significant impacts with Housing pattern ($B = 7.224, \text{Beta} = 0.298, t = 4.472, p = 0.000$) and cosmopolitaness ($B = 2.202, \text{Beta} = 0.333, t = 3.055, p = 0.003$) and these two factors promote the resource management strategies. Social participation ($B = -5.306, \text{Beta} = -0.342, t = -2.777, p = 0.006$) was significant, indicating a negative effect: the more social participation, the more it can impede proper resource management.

Table (7). Regression Coefficients for Predictors of Resource Management Among Pulse Farmers in Nayagarh, Odisha

Coefficients ^a						
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	124.535	2.187		56.946	0.000
	Age	-3.473	1.382	-0.210	-2.513	0.013
	Education	-6.503	1.262	-0.579	-5.153	0.000
	Family Type	1.662	1.238	0.129	1.343	0.181
	Family Size	0.131	1.339	0.010	0.098	0.922
	Housing Pattern	7.224	1.615	0.298	4.472	0.000
	Land Holding	0.338	1.183	0.023	0.286	0.775
	Source of income	0.741	1.962	0.037	0.378	0.706
	Annual Family Income	2.039	1.229	0.132	1.660	0.098
	Saving	-0.916	0.574	-0.141	-1.595	0.112
	Debt	0.207	0.606	0.025	0.341	0.733
	Extension Participation	-1.110	0.611	-0.196	-1.816	0.071
	Social Participation	-5.306	1.911	-0.342	-2.777	0.006
	Cosmopolitaness	2.202	0.721	0.333	3.055	0.003
	Sources of Information	1.613	0.853	0.211	1.891	0.060

a. Dependent Variable: Resource

The strong positive correlations between education and both Knowledge and Adoption underscore the critical role of education in enhancing farmers' capacity to acquire new knowledge and adopt innovative practices. Multiple studies demonstrate that education is a key factor in agricultural innovation (Gerbi & Megerssa, 2020). The government should develop specialised educational programs to enhance farmers' technical education, thereby enabling the adoption of advanced, sustainable agricultural methods. A farmer's annual family income demonstrates positive relationships at moderate to strong levels with their ability to effectively control resources and acquire knowledge (Sharma *et al.*, 2020). Such findings support the implementation of income support programs and microfinance, as they create twofold benefits: boosting knowledge acquisition and enhancing resource management. Proof of the very strong positive correlations between the Cosmopolitaness measure and both the Knowledge measure and the Adoption measure demonstrates the pivotal role of cultural and intellectual encounters in stimulating innovation. Farmer field schools and exchange programs between farmers are effective methods for boosting both knowledge acquisition and practice adoption, according to Aniah *et al.* (2019). Farmers with larger landholdings tend to adopt new practices, as indicated by the moderate positive association. Greater landholdings, in combination with larger-scale operations or experimental capabilities, allow farmers to adopt new practices. The relationship between land size and adoption behaviour remains weaker than the influence of education and income levels, since land possession alone does not ensure adoption success. Research should investigate the unexpected negative relationship that exists between Education levels and Resource Management practices (Dlamini *et al.*, 2023). Higher education often leads farmers to better understand resource limitations, so they may show reduced intensive management, but this effect might

also be driven by reporting preferences. The complete connection between these variables requires further research. The study implies that systematic interventions must include diverse components, as education and economic independence must be coupled with cosmopolitanism and enhanced access to various sources of information (Grady *et al.*, 2020). The research strategies are advantageous for providing an in-depth understanding of factors that lead to mobilisation, as well as the complex relationships between educational attainment and resource management behaviours.

As established, canonical correlation techniques are effective for determining the factors of Knowledge and Adoption in Set 2, as Cosmopolitanism and Sources of Information showed strong correlations with the Set 1 variables. The low relationship between "Resource Management" suggests that it should be studied alongside other factors or in alternative ways to examine its relationship with Set 1 variables. The correlation between the Resource Management variables and the socio-economic demographics is weaker, suggesting that the Resource Management variables may be complex (Ongbali *et al.*, 2024). The discussion shows that other environmental factors, such as land quality and market conditions, should be examined to better understand resource management practices in the pulse farming sector.

Knowledge levels are highly dependent on education, suggesting that educational programs play a critical role in enhancing farmers' knowledge acquisition. Šūmane *et al.* (2018) found that education is one of the key drivers of agricultural innovation. The government should target educational programs for farmers who need to develop technical knowledge to adopt sustainable, high-productivity farming practices. Cosmopolitanism positively influences knowledge acquisition, as exposure to diverse cultural beliefs and intellectual perspectives fosters innovation. Exchange programs and Farmer Field Schools are the most effective ways to enhance knowledge transfer and practice adoption among farmers (Rose *et al.*, 2019). Saving has a significant influence on farmers, enabling them to access resources to acquire and apply new knowledge. These barriers should be overcome through targeted interventions to improve adoption rates. Savings, along with family income, are crucial in helping farmers adopt new practices, as they indicate that economic stability offers an opportunity to do so (Manda *et al.*, 2016). Economic initiatives that improve financial situations are crucial to advancing innovative agricultural practices and sustainable farming techniques. The negative impact that various information sources can have on adoption requirements underscores the need for appropriate information resources. The current methods of disseminating information seem insufficient to help farmers make important decisions. The systems of extension and other communication tools must be enhanced to ensure access to relevant, timely information, thereby increasing adoption rates (Zakaria *et al.*, 2020).

Older farmers face challenges in adopting new resource management practices, resulting in poor performance in resource management (Fisher *et al.*, 2017). It is true that the negative relationship between educational level and resource management is surprising and warrants further exploration to understand the various management decisions made by trained farmers (Bednář *et al.*, 2025). The results require further studies to identify the underlying causes of such findings. Both housing patterns and cosmopolitanism are highly advantageous for resource

management, which is based on appropriate living conditions and the exchange of diverse ideas. The study suggests that improving farm homes and promoting social exchange are evidence-based resource management practices that positively impact agricultural production (Mills *et al.*, 2017). Social participation appears to significantly reduce resource management, suggesting that various social events may diminish the number of resources that can be managed effectively (Soltis *et al.*, 2018). The evidence shows that there should be an endeavour to strike a balance between social interaction and natural resource management strategies.

The study was confined to selected pulse-growing areas in Odisha. The analysis was based on cross-sectional survey data and self-reported responses, which may be subject to recall or response bias. Further, resource management behaviour may also be influenced by factors such as soil quality, irrigation availability, access to inputs, market conditions and institutional support, which were not examined in detail in the present study. Future studies may include a wider geographical area and additional agro-economic variables to provide a more comprehensive understanding of adoption and resource management behaviour among pulse farmers.

CONCLUSIONS

The study concluded that adoption and resource management behaviour among pulse farmers in Nayagarh district of Odisha were influenced by selected socio-economic and communication-related factors. Education, annual family income, savings, cosmopolitanism, housing pattern and sources of information emerged as important variables affecting farmers' adoption of improved pulse production practices and resource management behaviour. The findings indicate that adoption cannot be improved only through technology availability; it also requires farmer-oriented training, credible information delivery, financial support and better exposure to improved agricultural practices. Resource management behaviour appeared to be more complex and may require additional support related to land use, input access, irrigation, market linkage and institutional services. Therefore, extension programmes for pulse farmers should integrate technical education, reliable advisory services and economic support mechanisms to improve adoption and resource management in pulse-based farming systems.

CONFLICT OF INTEREST

The authors state that there are no conflicts of interest with the publication of this work.

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