



## Family Resources and Agricultural Skills as determinants of Farmer's Motivation in Rubber Cultivation in Kerala

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### HIGHLIGHTS

- Family resources strongly impact the economic and risk–stability motivation in rubber farming.
- Risk-stability motivation is negatively influenced by the agricultural skill, indicating a low level of perceived risk.
- Except for gender, impact on adoption of rubber farming has minimal effect by socio-economic factors.
- Policy should target resource access and skill translation into adoption behaviour.

### ARTICLE INFO

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### ABSTRACT

The research analysed the factors affecting the motivation for rubber cultivation among 180 smallholder farmers in Kerala during 2025. The study was based on primary data collected from 180 farmers and data were analysed using Pearson correlation and hierarchical multiple regression. Results indicate that farmers demonstrated moderate-to-high motivation for rubber cultivation, with economic motivation averaging 3.73, whereas risk–stability motivation reflected a mean of 3.87 on a five-point scale. The resource ownership and control index appeared as the strongest indicator, having an appositive impact on both motivational dimensions, while the financial and institutional access index affected economic motivation only. Agricultural skills have a negative association with risk–stability motivation, suggesting skilled farmers are involved in rubber cultivation due to low perceived risk. Socio-demographic characteristics had limited impact, except gender, which affects economic motivation. The findings suggest that family resource access is the major driver of motivational outcome, whereas skill and demographic factors have limited roles. Policy interventions improving the resource access and converting skill into informed decision-making can strengthen sustainable and economically viable rubber cultivation.

### INTRODUCTION

Natural rubber is a commercial plantation crop in tropical agricultural economies due to its high industrial demand and export potential. In India, rubber cultivation forms an integral component of smallholder farming in regions having fragmented landholdings and labour-intensive production structures (Gordon, 2019).

Kerala remains as the major centre of rubber cultivation in India, accounting for the largest share of the country's area and production. The state has approximately 3.84 lakh hectares under rubber cultivation and contributes more than half of India's natural rubber

output (Rubber Board of India, 2024). Further, this sector is mainly dominated by smallholders, with holdings below two hectares. That is, rubber cultivation supports the livelihoods of a large number of rural households and create employment through production, processing, and marketing activities. However, the sector has undergone considerable changes in the recent times due to price volatility, rising labour costs, increasing production expenses, climate-related challenges, and changing market conditions (Sahadevan & Vaithiyanathan, 2025). These developments have influenced farmers' perceptions of profitability and changed their crop preference decisions making the understanding of determinants

of rubber cultivation preference increasingly important in Kerala’s smallholder-dominated plantation economy. Identifying the factors that influence farmers’ preference for rubber cultivation remains important for agricultural planning, resource allocation, and rural livelihood sustainability (Vishnuprathap et al., 2024).

Although previous studies have mainly focused on the profitability, production, and marketing factors of plantation crops, limited attention has been given to the role of household resources and agricultural skills in shaping farmers’ cultivation preferences. This gap is particularly relevant in the context of rubber cultivation, which requires substantial initial investment, specialised management capabilities, and the capacity to sustain production despite delayed returns. Consequently, both household resource endowments and human capital characteristics are likely to influence farmers’ cultivation decisions. Moreover, empirical studies that examine the dimensional structure of agricultural skills, resource access, and motivational factors, while simultaneously developing validated composite indices and assessing their effects on cultivation preference after controlling for socio-demographic characteristics, remain scarce. Therefore, this study hypothesises that family resource access and agricultural skills significantly influence farmers’ preference for rubber cultivation, while socio-demographic characteristics also contribute to preference formation. By integrating household capital theory and human capital perspectives and employing psychometric validation together with multivariate regression analysis, the study provides a comprehensive framework for understanding the determinants of farmers’ preference for rubber cultivation.

**METHODOLOGY**

The present study is conducted in the Palakkad district of Kerala, by considering two major panchayats where rubber farming is prevalent, Nenmara and Thiruvazhiyode. A field-based, cross-sectional research design was adopted. Data were collected from 180 rubber farmers mainly through personal interviews employing a structured interview schedule during 2024–2025. The interview schedule is divided into socio-demographic variables (gender, family type, marital status, landholding size, and farming experience); eight statements measuring agricultural skills; nine statements evaluating resource access and control; and ten statements examining reasons for rubber cultivation. All given items were measured on a five-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). Landholding size was recorded in cents (1 cent = 40.47 m<sup>2</sup>).

Reliability of the items was assessed using Cronbach’s alpha ( $\alpha$ ). It was revealed that agricultural skill scale has  $\alpha = 0.798$ , the resource access,  $\alpha = 0.791$ , and the reasons for rubber cultivation scale,  $\alpha = 0.819$ , reflecting an overall satisfactory reliability ( $\alpha \geq 0.70$ ) (Nunnally, 1978). Construct validity was evaluated by conducting exploratory factor analysis applying principal component analysis with Varimax rotation after checking the sample adequacy tests. The Kaiser–Meyer–Olkin statistic values for resource access (0.826), agricultural skill (0.826), and reasons for rubber cultivation (0.849) indicate sampling adequacy. Bartlett’s Test of Sphericity was statistically significant for all constructs ( $p < 0.001$ ), confirming that the correlation matrices were not identity matrices and were suitable for factor extraction (Kaiser, 1974). Based

on the extraction, two factors were formed under each resource access and for reasons for rubber cultivation were created.

Composite indices were constructed by calculating the average of items under each extracted factor, resulting in the Agricultural Skill Index, Resource Ownership and Control Index, Financial and Institutional Access Index, Economic Motivation Index, and Risk–Stability Motivation Index. Since the dependent variables, namely the Economic Motivation Index and Risk–Stability Motivation Index, are continuous composite measures derived from multiple Likert-scale items, multiple linear regression analysis was employed to examine the influence of agricultural skills, resource dimensions, and socio-demographic characteristics on farmers’ motivational outcomes. The model is expressed as follows.

$$Y_i = \beta_0 + \beta_1 Si + \beta_2 Ri + \beta_3 Gi + \beta_4 Fi + \beta_5 Li + \beta_6 Ei + \beta_7 Mi + \epsilon_i \dots(1)$$

$$Y_j = \beta_0 + \beta_1 Si + \beta_2 Ri + \beta_3 Gi + \beta_4 Fi + \beta_5 Li + \beta_6 Ei + \beta_7 Mi + \epsilon_i \dots(2)$$

where  $Y_i$  represented economic motivation;  $Y_j$  denoted risk stability motivation;  $S_i$  indicated the agricultural skill index;  $R_i$  denoted resource-related indices;  $G_i$  showed gender;  $F_i$  represented family type;  $L_i$  denoted landholding size (cents);  $E_i$  indicated farming experience (years);  $M_i$  represented marital status;  $\beta_0$  was the intercept;  $\beta_1$ – $\beta_7$  were regression coefficients; and  $\epsilon_i$  was the random error term.

**RESULTS**

**Descriptive statistics**

Farmers reported moderate to high levels of motivation, with economic motivation averaging 3.73 and risk–stability motivation 3.87, reflecting both profit-driven and risk-conscious behaviours. Resource access emerged as a significant factor, with households having substantial ownership and control over productive assets ( $M = 3.80$ ) and also financial and institutional access ( $M = 3.88$ ). Agricultural skills were moderate ( $M = 2.03$ ), indicating that though the farmers possess basic technical and managerial competencies, there is need for improvement in activities where they are involved, such as tapping advanced cultivation practices, risk management, and productivity enhancement.

**Table 1.** Descriptive Statistics of Indices

Indices	Mean	Std. Deviation	N
Economic and Institutional Motivation	3.7300	.70544	180
Risk and Stability Motivation	3.8741	.77288	180
Agricultural Skill Index	2.0319	.67232	180
Resource Ownership and Control	3.8019	.66638	180
Financial and Institutional Access	3.8778	.66564	180

**Determinants of economic motivation**

Hierarchical multiple regression analysis was applied for identifying the key factor affecting the economic motivation. Table 2 give the model summary. Agricultural Skill Index, Resource Ownership and Control, and Financial and Institutional Access were incorporated in the first model, and the model explained 43.5% of the variance ( $R^2 = 0.435$ ) and was statistically significant. The

ANOVA results in Table 3 further confirm the overall significance of the model. As Table 4 states that resource Ownership and Control has the strongest impact ( $\beta = 0.528, p < 0.001$ ), followed by Financial and Institutional Access ( $\beta = 0.186, p = 0.010$ ), indicating the significance of resource access in motivating to adopt the plantation crop, like rubber. The agricultural skill index did not significantly affect the economic motivation ( $\beta = -0.009, p = 0.898$ ).

With the inclusion of socio-demographic variables in Model 2 (Table 2), the explanatory power of the model increased marginally from 43.5 per cent to 46.6 per cent ( $R^2 = 0.466$ ). However, the  $R^2$

change of 0.031 was not statistically significant ( $F \text{ change} = 1.999, p = 0.081$ ), indicating that demographic variables contributed little additional explanatory value beyond resource-based factors. As observed in Table 4, Resource Ownership and Control ( $\beta = 0.519, p < 0.001$ ) and Financial and Institutional Access ( $\beta = 0.205, p = 0.006$ ) remained significant predictors even after controlling for demographic characteristics. Among the newly added variables, only Gender showed a significant positive effect ( $\beta = 0.120, p = 0.038$ ), whereas Experience, Marital Status, Type of Family, and Area under Cultivation were statistically non-significant. The collinearity

**Table 2.** Model Summary<sup>c</sup>

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.659 <sup>a</sup>	.435	.425	.53496	.435	45.089	3	176	.000
2	.682 <sup>b</sup>	.466	.441	.52752	.031	1.999	5	171	.081

a. Predictors: (Constant), Financial and Institutional Access, Agricultural Skill Index, Resource Ownership and Control, b. Predictors: (Constant), Financial and Institutional Access, Agricultural Skill Index, Resource Ownership and Control, Experience in Rubber Farming, Type of family, Marital Status of the respondent, Gender, Area under cultivation, c. Dependent Variable: Economic and Institutional Motivation, R = Multiple Correlation Coefficient;  $R^2$  (R Square) = Coefficient of Determination; Adjusted  $R^2$  = Adjusted Coefficient of Determination; df = Degrees of Freedom; Sig. = Significance Level.

**Table 3.** ANOVA<sup>a</sup> Results

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	38.710	3	12.903	45.089	.000 <sup>b</sup>
	Residual	50.368	176	.286		
	Total	89.078	179			
2	Regression	41.492	8	5.187	18.638	.000 <sup>c</sup>
	Residual	47.586	171	.278		
	Total	89.078	179			

a. Dependent Variable: Economic and Institutional Motivation, b. Predictors: (Constant), Financial and Institutional Access, Agricultural Skill Index, Resource Ownership and Control, c. Predictors: (Constant), Financial and Institutional Access, Agricultural Skill Index, Resource Ownership and Control, Experience in Rubber Farming, Type of family, Marital Status of the respondent, Gender, Area under cultivation, ANOVA = Analysis of Variance; df = Degrees of Freedom; Sig. = Significance Level.

**Table 4.** Hierarchical Multiple Regression analysis for Economic Motivation

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Correlations			Collinearity Statistics	
		B	Std. Error	Beta			Zero-order	Partial	Part	Tolerance	VIF
1	(Constant)	.859	.406		2.116	.036					
	Agricultural Skill Index	-.009	.071	-.009	-.129	.898	-.366	-.010	-.007	.701	1.427
	Resource Ownership and Control	.559	.080	.528	7.019	.000	.641	.468	.398	.567	1.764
	Financial and Institutional Access	.197	.075	.186	2.617	.010	.498	.194	.148	.638	1.568
2	(Constant)	.057	.480		.119	.906					
	Agricultural Skill Index	-.004	.072	-.003	-.050	.960	-.366	-.004	-.003	.669	1.495
	Resource Ownership and Control	.550	.080	.519	6.905	.000	.641	.467	.386	.553	1.809
	Financial and Institutional Access	.218	.078	.205	2.807	.006	.498	.210	.157	.583	1.715
	Gender	.185	.089	.120	2.086	.038	.052	.158	.117	.938	1.066
	Experience in Rubber Farming	.047	.031	.086	1.505	.134	.116	.114	.084	.966	1.035
	Marital Status of the respondent	.104	.103	.058	1.012	.313	.116	.077	.057	.957	1.045
	Type of family	.032	.090	.020	.357	.721	.083	.027	.020	.954	1.048
Area under cultivation	.093	.062	.088	1.501	.135	.053	.114	.084	.901	1.110	

a. Dependent Variable: Economic and Institutional Motivation, B = Unstandardized Regression Coefficient; Beta ( $\beta$ ) = Standardized Regression Coefficient; Sig. = Significance Probability (p-value); VIF = Variance Inflation Factor.

statistics (VIF values below 2) indicate absence of multicollinearity issues.

**Determinants of risk–stability motivation**

The hierarchical multiple regression results presented in Table 5, 6 and 7 explain the determinants of Risk and Stability Motivation among rubber farmers. As shown in 5, Model 1, including the Resource Ownership and Control, Financial and Institutional Access, and Agricultural Skill Index, was statistically significant ( $F = 31.700, p < 0.001$ ) and 35.1 per cent of the variation in risk–stability motivation ( $R^2 = 0.351$ ; Adjusted  $R^2 = 0.340$ ) were explained. The ANOVA results in Table 6 further confirm the overall model significance. The regression coefficients in Table 6 indicate that Agricultural Skill Index had a significant negative effect ( $\beta = -0.318, p < 0.001$ ), suggesting that higher skill levels are associated with lower dependence on risk–stability motivation, possibly due to greater confidence and diversification capacity. Resource Ownership and Control exerted a positive and significant influence ( $\beta = 0.304, p < 0.001$ ), indicating that farmers with stronger asset control perceive rubber cultivation as a relatively stable livelihood option. However, Financial and Institutional Access was not statistically significant in Model 1 ( $\beta = 0.079, p = 0.300$ ).

With the inclusion of socio-demographic variables in Model 2 (Table 5), the explanatory power increased marginally from 35.1 per cent to 37.1 per cent ( $R^2 = 0.371$ ). Nevertheless, the  $R^2$  change of 0.020 was statistically non-significant ( $F$  change = 1.114,  $p = 0.355$ ), implying that demographic factors added limited explanatory value beyond resource-based variables. As observed in Table 7, Agricultural Skill Index ( $\beta = -0.344, p < 0.001$ ) and Resource Ownership and Control ( $\beta = 0.329, p < 0.001$ ) remained robust

predictors even after controlling for demographic characteristics. Among the newly introduced variables, only Area under Cultivation showed a significant negative association ( $\beta = -0.138, p = 0.033$ ), indicating that farmers with larger cultivated areas may exhibit relatively lower risk–stability motivation, possibly due to scale advantages or diversified risk management strategies. Gender, Experience, Marital Status, and Type of Family were statistically non-significant.

**Multicollinearity and model diagnostics**

Variance inflation factors (Table 7) for all predictors were below 5, suggesting that multicollinearity was not a concern. Residuals were normally distributed, and observed versus predicted values fell within acceptable ranges, further confirming the adequacy of the regression models.

**DISCUSSION**

The findings of the present study establish that household resource endowments—particularly ownership and control over resources and access to financial and institutional support—are the principal determinants of both economic motivation and risk–stability motivation among smallholder rubber farmers in Palakkad district. This aligns strongly with the Sustainable Livelihoods Framework, which posits that livelihood strategies are fundamentally shaped by access to capital assets—natural, financial, physical, human, and social—rather than by demographic attributes alone (Wang et al., 2023; Feder et al., 1985). In the context of plantation crops such as rubber, which require long gestation periods, sustained capital investment, and tolerance for delayed returns, resource access becomes not merely supportive but structurally decisive.

**Table 5.** Model Summary<sup>c</sup>

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.592 <sup>a</sup>	.351	.340	.62802	.351	31.700	3	176	.000
2	.609 <sup>b</sup>	.371	.342	.62701	.020	1.114	5	171	.355

a. Predictors: (Constant), Financial and Institutional Access, Agricultural Skill Index, Resource Ownership and Control, b. Predictors: (Constant), Financial and Institutional Access, Agricultural Skill Index, Resource Ownership and Control, Experience in Rubber Farming, Type of family, Marital Status of the respondent, Gender, Area under cultivation, c. Dependent Variable: Risk and Stability Motivation, R = Multiple Correlation Coefficient;  $R^2$  (R Square) = Coefficient of Determination; Adjusted  $R^2$  = Adjusted Coefficient of Determination; df = Degrees of Freedom; Sig. = Significance Level.

**Table 6.** ANOVA<sup>a</sup> Results

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	37.508	3	12.503	31.700	.000 <sup>b</sup>
	Residual	69.415	176	.394		
	Total	106.923	179			
2	Regression	39.697	8	4.962	12.622	.000 <sup>c</sup>
	Residual	67.226	171	.393		
	Total	106.923	179			

a. Dependent Variable: Risk and Stability Motivation, b. Predictors: (Constant), Financial and Institutional Access, Agricultural Skill Index, Resource Ownership and Control, c. Predictors: (Constant), Financial and Institutional Access, Agricultural Skill Index, Resource Ownership and Control, Experience in Rubber Farming, Type of family, Marital Status of the respondent, Gender, Area under cultivation, ANOVA = Analysis of Variance; df = Degrees of Freedom; Sig. = Significance Level.

**Table 7.** Hierarchical Multiple Regression analysis for Risk and Stability Motivation

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Correlations			Collinearity Statistics	
		B	Std. Error	Beta			Zero-order	Partial	Part	Tolerance	VIF
1	(Constant)	2.919	.477		6.125	.000					
	Agricultural Skill Index	-.365	.083	-.318	-4.377	.000	-.511	-.313	-.266	.701	1.427
	Resource Ownership and Control	.353	.094	.304	3.771	.000	.517	.273	.229	.567	1.764
	Financial and Institutional Access	.092	.088	.079	1.039	.300	.393	.078	.063	.638	1.568
2	(Constant)	3.332	.570		5.841	.000					
	Agricultural Skill Index	-.396	.085	-.344	-4.643	.000	-.511	-.335	-.282	.669	1.495
	Resource Ownership and Control	.382	.095	.329	4.038	.000	.517	.295	.245	.553	1.809
	Financial and Institutional Access	.037	.092	.032	.401	.689	.393	.031	.024	.583	1.715
	Gender	.040	.105	.024	.378	.706	-.060	.029	.023	.938	1.066
	Experience in Rubber Farming	.015	.037	.026	.416	.678	.069	.032	.025	.966	1.035
	Marital Status of the respondent	-.075	.122	-.038	-.613	.540	.022	-.047	-.037	.957	1.045
	Type of family	-.061	.107	-.035	-.570	.570	-.006	-.044	-.035	.954	1.048
	Area under cultivation	-.159	.074	-.138	-2.153	.033	-.092	-.162	-.131	.901	1.110

Dependent Variable: Risk and Stability Motivation

The positive association between resource access and economic motivation confirms that smallholders with stronger asset bases are more inclined to engage in commercially oriented crops that yield returns over extended periods (Suriansyah et al., 2024; Ravi et al., 2026). Resource ownership functions as a stabilizing mechanism, enabling farmers to allocate land, mobilize labour, and absorb initial establishment costs despite uncertainty. Similarly, financial and institutional access enhances economic motivation by lowering credit constraints and facilitating integration with formal markets, consistent with evidence that innovation and adoption behaviour are strongly conditioned by economic capacity and institutional backing (Kassie et al., 2013; Nain et al., 2019; Gowda et al., 2022; Nain et al., 2024). These findings reinforce livelihood scholarship emphasizing that production decisions are embedded in material capability structures rather than purely attitudinal preferences (Wang et al., 2023).

A notable contribution of this study lies in the differentiated role of financial and institutional access across motivational dimensions. While such access significantly predicts economic motivation, it does not significantly explain risk–stability motivation. This suggests that formal institutional mechanisms may stimulate profit orientation without sufficiently altering subjective perceptions of long-term security. As observed in related studies, institutional support systems often address liquidity and market barriers but may inadequately engage with farmers’ deeper perceptions of production risk and livelihood stability (Suriansyah et al., 2024). This distinction indicates that enhancing resilience requires not only financial inclusion but also risk mitigation instruments such as crop insurance, extension advisory systems, and long-term price stabilization measures.

The negative relationship between agricultural skill and risk–stability motivation presents an important theoretical nuance. Conventional human capital theory predicts that higher technical skill enhances motivation toward adoption and commercial agriculture. However, the present findings diverge from this expectation. Higher agricultural skill is associated with lower

stability-oriented motivation, suggesting that skilled farmers may perceive themselves as more capable of managing uncertainty and therefore less dependent on stability-seeking motives. This interpretation resonates with psychological frameworks indicating that confidence can reduce perceived vulnerability and alter risk appraisal (Pathak, 1992; Suriansyah et al., 2024). Rather than uniformly increasing motivation, human capital appears to reshape motivational orientation by influencing subjective risk perception. This finding refines human capital assumptions by demonstrating that skill interacts with confidence and perceived control rather than directly amplifying risk-averse behaviour.

Socio-demographic characteristics exerted limited influence once structural variables were introduced. With the exception of gender in explaining economic motivation, variables such as marital status, family type, experience, and area under cultivation did not significantly shape motivational outcomes. The positive gender coefficient is consistent with literature documenting gender-based disparities in asset ownership, financial access, and decision-making authority (Wang et al., 2023). Male farmers’ higher economic motivation likely reflects structural control over productive resources rather than inherent behavioural differences. The weak explanatory power of other demographic variables corroborates findings in plantation crop studies where demographic proxies lose significance when resource endowments are explicitly modeled (Mutyasira et al., 2018). This contrasts with consumer behaviour research, where socio-demographic factors strongly predict preference patterns (Vattekkad et al., 2025), thereby underscoring that production decisions in agriculture are materially constrained rather than socially stylized.

The overall pattern—strong resource effects, modest demographic effects, and an inverse association between skill and risk–stability motivation—reveals a complex motivational architecture among rubber smallholders. Farmers’ motivational orientations are shaped by the interaction between objective resource portfolios and subjective perceptions of control. Where resources are abundant, both economic and stability motives are

reinforced. Where skill levels are high but resource endowments are limited, confidence may reduce stability-seeking orientation without necessarily enhancing structural security. This supports broader evidence that access to assets fundamentally alters how rational farmers perceive and respond to risk–return trade-offs in plantation agriculture (Wang et al., 2023).

In conclusion, the study confirms prior research highlighting the centrality of resource assets in shaping crop choice and motivational behaviour (Wang et al., 2023; Nain et al., 2024), while extending the literature by demonstrating that human capital, in the form of agricultural skill, and exerts a psychologically mediated influence rather than a uniformly positive effect. The findings call for future research examining the intersection of resource access, risk perception, institutional trust, and confidence in determining smallholder crop decisions. Policy interventions aiming to strengthen rubber cultivation should therefore prioritize asset enhancement and institutional depth alongside behavioural risk-management support to sustainably influence motivational orientation.

### CONCLUSION

This study indicates that the main factors influencing farmers' motivation to cultivate rubber are household resource endowments. Both economic and risk-stability incentives are frequently driven by ownership and control over productive assets, and institutional and financial access further increases economic-oriented decisions. Agricultural skill shapes risk perception, with more skilled farmers having lower reliance on stability-driven strategies, indicating a shift to opportunity-focused and better-return behaviour. The findings further suggest that enhancing farmers' resource availability, strengthening institutional support mechanisms, and improving technical knowledge can play a crucial role in sustaining farmer motivation and promoting the long-term viability of rubber cultivation in Kerala.

### DECLARATIONS

**Ethics approval and informed consent:** Informed consent was sought from the respondents of the study and their organizations during the course of the research.

**Conflict of interest:** The author declares that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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