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Socio-economic and behavioural factors associated with income diversification among coconut farmers in South Kerala

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ABSTRACT

Income diversification is increasingly important for strengthening the economic resilience of small-holder farming households, particularly in coconut-based farming systems where farmers remain substantially dependent on the sale of raw coconut and conventional coconut products. The present study examined the extent of income diversification and assessed the association of selected socio-economic and behavioural characteristics with income diversification among coconut farmers in South Kerala. The study was conducted in Thiruvananthapuram, Kollam and Alappuzha districts of Kerala. A total of 90 coconut farmers, 30 from each district, were selected for the farmer survey. Income diversification was measured using the Herfindahl–Hirschman Index (HHI), where lower values represented greater diversification and higher values represented greater concentration of income. Age, education, landholding, annual income, experience in coconut value addition, risk orientation, innovativeness, extension orientation, market orientation and attitude towards income diversification were considered as explanatory variables. The overall mean HHI was 0.865, indicating a high degree of income concentration. Ninety per cent of farmers belonged to the low-diversification category, while only 7.78 per cent had medium diversification and 1.11 per cent had high diversification. Multiple linear regression analysis revealed that none of the selected explanatory variables had a statistically significant relationship with HHI. The overall regression model was also statistically non-significant ($R^2 = 0.059$; adjusted $R^2 = -0.061$; $F = 0.492$; $p = 0.891$). Although annual income, age, coconut value-addition experience and innovativeness had negative coefficients, suggesting a directional tendency towards greater diversification, these associations were not statistically established. The findings suggest that income diversification among the sampled coconut farmers may be constrained less by individual farmer characteristics and more by common structural conditions such as limited processing infrastructure, labour scarcity, financial constraints and weak market linkages. Strengthening collective value addition, extension support, processing facilities, institutional credit and market connectivity may therefore be important for expanding farmers' income opportunities.

Keywords: Coconut farmers, Income diversification, Herfindahl–Hirschman Index, Socio-economic factors, Value addition, South Kerala, Agricultural extension

1. Introduction

Coconut is one of the most important perennial crops of Kerala and supports a large number of farm households directly and indirectly. The crop has considerable potential for generating income through multiple products because almost every component of the coconut palm has economic utility. Coconut can be processed into copra, coconut oil, virgin coconut oil, desiccated coconut, coconut milk, coconut-based foods and beverages, while shells, husks and other by-products can also be utilised for value-added products.

Despite this potential, coconut farming in Kerala continues to face problems related to price fluctuations, rising production costs, labour scarcity, fragmented holdings and limited access to organised processing and marketing systems. Fluctuations in coconut prices can expose farmers who depend predominantly on raw-nut sales to considerable income uncertainty. Value addition provides one possible pathway for reducing this dependence by allowing farmers to obtain income from a wider range of products and activities.

Income diversification refers to the distribution of household income across different sources rather than dependence on a single source. In agricultural households, diversification can contribute to livelihood security by spreading economic risk across different activities. The Herfindahl–Hirschman Index (HHI) is commonly used to measure income concentration. An HHI approaching one indicates concentration of income in a single or limited number of sources, whereas lower values indicate a more diversified income portfolio.

The importance of diversification is particularly relevant to coconut farmers because value addition can potentially increase the economic value obtained from coconut and reduce dependence on raw-coconut markets. Earlier studies have indicated that farm-level coconut processing can generate additional value and improve the economic returns from coconut. However, participation in value addition depends not only on the

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availability of technologies but also on farmers' economic resources, experience, attitudes, innovativeness, risk orientation, access to extension services and market information.

The present study was therefore undertaken to assess the extent of income diversification among coconut farmers and examine the relationship between selected socio-economic and behavioural characteristics and income diversification in South Kerala. The study formed part of a broader investigation entitled *Income Diversification through Value Addition in Coconut: A Critical Analysis*.

Objectives

To assess the extent of income diversification among coconut farmers in South Kerala.

To examine the association of selected socio-economic and behavioural characteristics with income diversification.

To identify implications for strengthening coconut-based income diversification through extension and value-addition interventions.

2. Materials and Methods

2.1 Study area

The study was conducted in three southern districts of Kerala, namely Thiruvananthapuram, Kollam and Alappuzha. These districts were purposively selected because of the importance of coconut cultivation and the presence of different production, marketing and value-addition environments.

2.2 Research design and sampling

An ex-post facto research design with a descriptive survey approach was adopted. The study involved 90 coconut farmers, with 30 farmers selected from each of the three districts. Farmers constituted the primary unit of analysis. The broader thesis also included 30 stakeholders, but only the farmer sample was considered for the present analysis.

The independent variables were selected through review of literature, consultation with subject-matter specialists and judge rating. The final set of explanatory variables included age, education, landholding, annual income, experience in coconut value addition, risk orientation, innovativeness, extension orientation, market orientation and attitude towards income diversification.

2.3 Measurement of income diversification

Income diversification was measured using the Herfindahl-Hirschman Index:

$$HHI = \sum P_i^2$$

where P_i represents the proportion of total household income obtained from the i th income source.

An HHI value approaching one indicates greater concentration of income, whereas lower values indicate greater diversification. Thus, a lower HHI represents higher diversification, while a higher HHI represents lower diversification.

For classification, HHI values below 0.30 were considered indicative of high diversification, values from 0.30 to 0.60 represented medium diversification, values above 0.60 represented low diversification, and a value of 1.00 represented complete income specialisation.

2.4 Measurement of explanatory variables

Age was recorded in completed years. Education was measured according to the highest level of formal education attained. Landholding was recorded in operational area. Annual income was recorded in Indian rupees. Experience in coconut value addition was measured as the number of completed years of involvement in value-addition activities.

Risk orientation, innovativeness, extension orientation, market orientation and attitude towards income diversification were measured using structured scales developed for the study. The scales included statements relating to willingness to undertake risk, adoption of new practices, participation in extension activities, use of market information and perceptions regarding diversification.

2.5 Statistical analysis

Frequency and percentage were used to describe the distribution of farmers. Mean and standard deviation were calculated for continuous and scale variables.

Multiple linear regression analysis was used to examine the relationship between the selected explanatory variables and HHI. HHI was retained as the dependent variable. Since higher HHI values represent greater income concentration, a negative regression coefficient indicates a directional association with greater diversification, while a positive coefficient indicates a directional association with greater income concentration.

A Tobit specification was initially considered because HHI is bounded between zero and one. However, only one respondent recorded an HHI of exactly 1.00, and the preliminary Tobit analysis did not produce a statistically meaningful model. Therefore, multiple linear regression was retained as the principal determinant analysis.

3. Results and Discussion

3.1 Extent of income diversification

The overall mean HHI among the 90 coconut farmers was 0.865, with a standard deviation of 0.156. District-wise mean HHI values were 0.832 for Thiruvananthapuram, 0.877 for Kollam and 0.885 for Alappuzha.

The distribution of farmers showed a pronounced concentration towards low diversification. Overall, 90.00 per cent of the respondents belonged to the low-diversification category. Another 7.78 per cent had medium diversification, while only 1.11 per cent had high diversification. One respondent (1.11%) recorded complete income specialisation.

The HHI values ranged from 0.27 to 1.00. The high mean HHI demonstrates that coconut farmers in the study area depended on a relatively limited number of income sources. The concentration was particularly pronounced in Kollam and Alappuzha, where 90 per cent of respondents belonged to the low-diversification category.

This finding indicates that the existence of several technically feasible coconut value-added products does not necessarily translate into diversified household income. In the surveyed population, value addition remained concentrated mainly around conventional or minimally processed coconut products. The thesis findings showed that 96.66 per cent of respondents reported primary coconut products such as dehusked nuts, copra and traditionally processed coconut oil, while only a very small proportion reported more specialised product groups.

The result is broadly consistent with earlier evidence cited in the study. Krishnakumar *et al.* reported a Herfindahl Index of 0.70 before diversification interventions among coconut-based farming households and observed a reduction to 0.57 following integration of inter-crops and subsidiary enterprises.⁵ This suggests that organised diversification interventions can potentially reduce income concentration.

3.2 Socio-economic and behavioural characteristics

The farmers were predominantly middle-aged, with an overall mean age of 48.09 years. The largest proportions belonged to the 37–48 and 49–59 year categories.

Educational attainment was comparatively favourable, with a majority of respondents having degree-level or postgraduate education. Landholdings, however, were generally small. About one-third of respondents possessed less than 0.33 acre, while another 36.67 per cent possessed 0.33–0.65 acre.

The behavioural characteristics indicated that farmers were not uniformly prepared for enterprise expansion. Risk orientation and innovativeness were mainly distributed across low-to-medium and medium categories, while extension orientation was comparatively better. Market orientation showed a relatively favourable pattern, with more than half of the respondents falling in the medium-high or high categories.

The overall attitude towards income diversification was neutral to moderately favourable, with a mean score of 2.97. About 62.22 per

cent of respondents were concentrated in the low-medium and medium-high categories. This indicates that farmers generally recognised the possible benefits of diversification but were not uniformly prepared to expand diversified activities.

3.3 Determinants of income diversification

Multiple regression analysis was conducted with HHI as the dependent variable and ten explanatory variables: annual income, education, age, landholding, coconut value-addition experience, risk orientation, innovativeness, extension orientation, market orientation and attitude towards income diversification.

The regression model produced an R^2 of 0.059 and an adjusted R^2 of -0.061. The overall F -test was statistically non-significant ($F = 0.492$; $p = 0.891$). Thus, the ten explanatory variables jointly explained only 5.90 per cent of the observed variation in HHI, and the

overall model did not provide statistically significant explanatory power.

None of the explanatory variables was statistically significant at the five per cent level. Annual income, age, coconut value-addition experience and innovativeness had negative coefficients. Because HHI is an inverse measure of diversification, these coefficients indicate a directional tendency towards lower income concentration with increasing values of these variables. However, the corresponding p -values were greater than 0.05 and their confidence intervals included zero. Hence, these relationships cannot be interpreted as statistically established effects.

Education, landholding, risk orientation, extension orientation, market orientation and attitude towards income diversification had positive coefficients. These signs indicate a directional tendency towards higher HHI values, or greater income concentration, but none of the associations was statistically significant.

Table 1. Regression estimates for income diversification among coconut farmers

Explanatory variable	B	SE	t	p
Annual income	0.000	0.000	-0.819	0.415
Education	0.001	0.018	0.029	0.977
Age	-0.001	0.019	-0.075	0.941
Landholding	0.000	0.000	0.936	0.352
Coconut value-addition experience	-0.002	0.002	-0.735	0.464
Risk orientation	0.004	0.028	0.152	0.879
Innovativeness	-0.014	0.029	-0.473	0.638
Extension orientation	0.009	0.032	0.275	0.784
Market orientation	0.028	0.034	0.817	0.416
Attitude towards income diversification	0.016	0.044	0.358	0.722

Note: Dependent variable = HHI; $n = 90$; $R^2 = 0.059$; adjusted $R^2 = -0.061$; $F(12, 77) = 0.492$; $p = 0.891$.

3.4 Interpretation of the non-significant determinants

The absence of statistically significant relationships should not be interpreted as evidence that farmer characteristics are inherently irrelevant to diversification. Rather, the result needs to be interpreted in relation to the distribution of the dependent variable.

The mean HHI was 0.865, and 91.11 per cent of respondents were concentrated in the no-diversification or low-diversification categories. Such limited variation in the dependent variable reduces the ability of regression analysis to distinguish characteristics associated with more and less diversified farmers.

The result therefore points towards the importance of examining common structural conditions surrounding farmers. The thesis identified constraints including shortage and high cost of labour, limited investment and credit, inadequate processing facilities, weak marketing arrangements, insufficient technical support and limited access to suitable markets. These constraints can affect farmers across socio-economic categories and may therefore restrict diversification even among farmers who possess favourable attitudes, education or market orientation.

This interpretation is particularly relevant because the surveyed farmers demonstrated a relatively favourable market orientation, while actual income diversification remained low. The gap between awareness and actual diversification suggests that knowledge and orientation alone may not be sufficient to initiate commercially viable value-addition enterprises.

4. Implications for agricultural extension

4.1 From information dissemination to enterprise facilitation

Extension interventions should move beyond awareness creation and provide practical support for establishing viable value-addition enterprises. Training should cover processing technology, quality control, packaging, branding, costing, business planning and marketing.

4.2 Collective approaches to value addition

Small and fragmented holdings can make individual investment in processing machinery and infrastructure difficult. Farmer Producer Organisations, Coconut Producer Societies and other farmer collectives can facilitate aggregation of raw material, shared processing facilities, collective branding and joint marketing.

4.3 Strengthening market-oriented extension

The favourable market orientation observed among farmers indicates that farmers recognise the importance of markets. However, access to reliable buyers, consumer information and organised markets needs to be strengthened. Extension agencies can facilitate market intelligence, buyer-seller interactions, digital marketing and exposure to successful value-addition enterprises.

4.4 Linking training with finance and infrastructure

Training programmes may have limited impact when farmers lack capital, machinery or infrastructure. Extension programmes should therefore establish convergence among agricultural departments, financial institutions, research organisations, farmer organisations and processing enterprises.

4.5 Demonstration-based extension

Farm-level and community-level demonstrations of commercially feasible products can help farmers evaluate the technical and economic feasibility of diversification. Demonstrations should include actual production cost, labour requirement, expected returns, packaging and market channels rather than focusing solely on processing techniques.

5. Conclusion

The study revealed a high degree of income concentration among coconut farmers in South Kerala. The overall mean HHI of 0.865 and the concentration of 90 per cent of respondents in the low-diversifica

tion category demonstrate that substantial income diversification was uncommon among the sampled farmers.

The selected socio-economic and behavioural variables—age, education, landholding, annual income, experience in coconut value addition, risk orientation, innovativeness, extension orientation, market orientation and attitude towards income diversification—did not show statistically significant relationships with HHI. The overall regression model was also statistically non-significant.

The findings therefore suggest that the limited diversification observed among coconut farmers cannot be adequately explained by individual farmer characteristics alone. The restricted variation in diversification and the widespread presence of common constraints indicate the importance of structural and institutional conditions surrounding value addition. Access to processing infrastructure, labour, finance, technology, organised markets and collective institutions may be particularly important areas for intervention.

Agricultural extension can play a coordinating role by connecting farmers with appropriate technologies, financial institutions, farmer organisations, processors and markets. A shift from conventional information-oriented extension towards enterprise-oriented, market-linked and collective value-addition extension may provide a stronger pathway for expanding income diversification among coconut farmers.

6. Limitations

The study was conducted in three districts of South Kerala and involved 90 coconut farmers. Therefore, the findings should not automatically be generalised to all coconut farmers in Kerala or other coconut-producing regions. The cross-sectional design also limits interpretation of temporal changes in diversification. Furthermore, the high concentration of HHI values near one reduced the variation available for determinant analysis. Future studies involving larger and more heterogeneous samples, longitudinal observations and additional institutional and market-level variables may provide deeper insights into the determinants of coconut-based income diversification.

7. Acknowledgement

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8. Ethical statement

The study involved primary data collection from coconut farmers. Informed consent was obtained from the respondents before data collection.

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