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Factors Affecting the Income of Tea Farming Households in Dong Hy District, Thai Nguyen Province

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Abstract

The study aims to analyze the factors influencing the income of tea-growing farmers in rural areas of Dong Hy district, Thai Nguyen province. Based on the framework of economic theory and the practical income situation of farming households, the author develops a multivariate linear regression model to quantify the factors affecting the income of tea-growing farmers. The research is conducted through direct surveys of 200 households in rural areas of

Dong Hy district. The analytical methods used in this study include descriptive statistics and multivariate linear regression. The regression model results show seven factors influencing the income of tea-growing farmers, including (1) agricultural land area, (2) loan scale from credit institutions, (3) labor participation in production, (4) educational level of household head, (5) biological costs, (6) mechanization costs, and (7) tea productivity.

Keywords: Income, Tea Farming, Agricultural, Vietnam

1. Introduction

Over more than 30 years of renovation since 1986, Vietnam has consistently maintained its position as one of the world's largest rice exporters. Tea has become one of Vietnam's key agricultural export commodities. Tea exports have generated significant foreign currency earnings for the country, amounting to 120.31 thousand tons valued at USD 211.93 million in 2024. This has made considerable contributions to the nation's economic development and international economic integration. Tea exports have expanded to many countries worldwide, penetrating and increasing export volumes to premium markets such as Hong Kong, Singapore, Australia, and Japan.

Despite these remarkable achievements, Vietnam's tea industry has revealed several limitations, such as low quality, efficiency, added value, and competitiveness. While rice is exported in large volumes, its value remains low. Tea production lacks sustainability and negatively impacts the environment and climate change. Farmers' livelihoods remain challenging, as income from tea production often fails to cover production costs. Many young laborers migrate to industrial areas and major urban centers for livelihood opportunities. Agricultural production costs are rising, mechanization remains underdeveloped, market access is limited, and farming households lack sufficient investment capital, necessitating bank loans, among other issues.

This reality highlights the need for scientifically grounded solutions to improve the income of tea-growing farmers. To achieve this, the author conducts a study on the factors influencing household income. This article focuses on two main issues: Identifying the factors affecting the income of tea-growing farmers and suggesting solutions to enhance the income of these households.

2. Theoretical Basis and Research Model

2.1 Theoretical Basis

2.1.1 Theoretical Basis of Agricultural Household Income

According to Ho Cao Viet (2009)^[10], tea farming households are defined as those dedicating part or all of their land to tea cultivation, utilizing tea for dual purposes: Self-consumption and commercialization, thereby contributing to household income.

The General Statistics Office (2014) defines household income as "the total monetary value and in-kind value converted into money, after deducting production costs, that the household and its members receive over a specified period, typically one year." "An agricultural household is one in which all or 50% of its regular labor force directly or indirectly engages in activities such as crop cultivation, animal husbandry, or agricultural services (land preparation, irrigation, crop varieties, pest control, etc.), with agriculture being the primary source of livelihood" (Pham Tan Hoa, 2014)^[23].

Park (1992)^[21] suggests that during the development stage, agricultural growth stems from enhanced agricultural labor productivity, which directly impacts farmers' income. Increasing capital leads to higher labor productivity, reducing the agricultural workforce while increasing income (Dinh Phi Ho, 2011)^[8]. Thus, farmers' income depends on labor productivity; factors influencing productivity inherently impact income. Park (1992)^[21] further notes that agricultural development occurs in three phases: Initial, developing, and developed, with labor scale, biotechnology application, and mechanization being decisive factors for each phase.

According to Lewis (1954)^[14] and Oshima (1993)^[20], household income is influenced by factors such as the size of agricultural land, mechanization level (mechanization costs), credit availability, the household head's agricultural knowledge, and biological inputs (costs for seeds, fertilizers, and chemicals).

Singh *et al.* (1986)^[24] categorize household income into agricultural and non-agricultural sources. Barker (2002) highlights that agricultural labor productivity depends on land productivity (gross product value per hectare of farmland) and land scale (farmland area per agricultural laborer).

Studies by Abdulai and CroleRees (2001)^[1], Demurger *et al.* (2010), Janvry and Sadoulet (2001)^[3], and Yang (2004) identify multiple factors influencing household income, including capital, land, education, production experience, labor size, income diversification ability, and market access opportunities.

2.1.2 Empirical Studies on Tea Farming Household Income

Huynh Truong Huy (2007)^[12] analyzed the impact of scientific techniques on tea production efficiency in Tuyen Quang. This study describes the current state of scientific technique adoption and factors influencing tea production efficiency among farming households, based on interviews with 261 households. Analytical methods include descriptive statistics and multiple regression analysis, complemented by semi-structured interviews to assess the feasibility of technical solutions. The results indicate that education level, labor force, seed costs, fertilizer costs, irrigation costs, and land preparation costs positively affect household income, while pesticide costs have a negative effect. Production experience showed no correlation with income among tea farming households.

Dinh Phi Ho and Chiv Vann Dy (2010)^[5] conducted research in Kampong Cham Province, Cambodia, using a logarithmic linear model to identify factors affecting tea farming household income. The study surveyed 150 households across three districts representing low, medium, and high-income groups, using random sampling. Results showed a positive linear relationship between household

income and factors like production land size (LS), mechanization service costs (MS), credit status (CS), agricultural knowledge level of the household head (AK), and biological costs per unit area (BC). Labor cost (LC) showed no effect on household income.

Dinh Phi Ho and Nguyen Huu Tri (2010)^[6] explored factors influencing agricultural labor productivity in Ben Tre Province using a multivariate linear regression model (logarithmic form). The study surveyed 210 households across three districts—Giong Trom, Chau Thanh, and Cho Lach—using random sampling. Findings revealed that factors such as household agricultural land size (DT), mechanization service costs (MC), loan scale (LS), agricultural knowledge level (KL), and diversification of production models (DM) impacted agricultural labor productivity and household income. The gender of the household head was not statistically significant in the model.

Nguyen Quoc Nghi *et al.* (2011)^[18] identified factors affecting rural household income using a logarithmic linear regression model. Primary data were collected through interviews with rural households in Tra On District, Vinh Long Province, using stratified random sampling based on criteria such as region, household size, and livelihood characteristics. A total of 182 households in Vinh Xuan, Thuan Thoi, Tich Thien, Tan My, and Thien My communes were surveyed. Results indicated that average household income was influenced by factors such as household size (X1), work experience of the household head (X2), education level of the household head (X3), number of income-generating activities (X4), and labor age (X5). Among these, four variables positively correlated with income, while household size negatively correlated.

2.2 Research Model and Hypotheses

Agricultural Land Area (AL): In rural areas, land is the primary and irreplaceable means of production in agriculture. Land is used for cultivation and animal husbandry; therefore, the larger the land area owned by a household, the more favorable production becomes. According to Manjunatha *et al.* (2013)^[15] and Nguyen Tien Dung & Le Khuong Ninh (2014)^[19], having little or no agricultural land limits the ability to improve income, as small land areas make it difficult to apply modern farming techniques.

Loan Scale (LS): Loan scale is an essential input for farming households, as farmers need capital to purchase materials, seeds, machinery, and hire labor, ensuring timely production. Nguyen Lan Duyen (2014)^[17] and Dinh Phi Ho & Chiv Vann Dy (2010)^[5] argue that loans enable households to invest in irrigation systems, adopt new techniques, and diversify production to avoid selling products at low prices. A lack of investment capital leads to low productivity and consequently lower income.

Number of Household Laborers (NH): This represents an important human resource in agricultural production. Abdulai & CroleRees (2001)^[1] and Yang (2004) state that "In less mechanized production conditions, the number of laborers is a fundamental factor in increasing household income." Nguyen Quoc Nghi *et al.* (2011)^[18] noted that the number of household laborers affects income. However, due to seasonal factors and labor skill limitations, underemployment remains common in rural areas. Thus, households may have many laborers but low income if some laborers do not directly contribute to generating income.

Education Level of Household Head (EL): The education level of the household head determines the quality of human resources in agricultural production. Education provides an advantage in income generation, as higher education levels facilitate the adoption of new techniques and the effective use of other resources. Foster & Rosenzweig (1996) and Pitt & Sumodiningrat (1991), as cited by Nguyen Lan Duyen (2014) ^[17], as well as Yang (2004), suggest that education enhances the ability to access and process market information, creating opportunities to participate in agricultural activities and thereby increasing income.

Biological Costs (BC): This includes expenses for seeds, fertilizers, pesticides, and irrigation water. According to Huynh Truong Huy (2007) ^[12], Dinh Phi Ho *et al.* (2010), and Pham Le Thong (2010) ^[22], these costs are effective only when meeting the physiological requirements of tea plants. Overuse not only increases production costs and reduces income but also negatively impacts soil and water environments.

Labor Costs (LC): Pham Le Thong (2010) ^[22] notes that "Labor costs account for approximately 33% of total expenses. Labor is typically hired for tasks such as land preparation, sowing, weeding, fertilizing, spraying pesticides, harvesting tea, threshing tea, loading, transporting, and drying." Farmers also utilize family labor to reduce hired labor costs.

Mechanization Costs (MC): These are expenses incurred by tea farming households for purchasing or renting mechanized equipment (plows, cultivators, tea threshers). Mechanization replaces manual labor, reduces production costs, enhances labor productivity, and thereby increases household income.

Tea Productivity (TP): According to economic theories on agricultural labor productivity, Park (1992) ^[21] suggests that increases in farmers' product output result from the application of scientific and technological achievements, enhancing land productivity, improving labor productivity, and raising household income. Research by Nguyen Tien Dung & Le Khuong Ninh (2014) ^[19] indicates a positive linear relationship between tea yield and the income of tea-farming households.

3. Research Methods

To apply the model in practice, the author conducted a household survey based on criteria such as location, family size, and livelihood characteristics, including the areas of Khe Mo, Hoa Trung, Nam Hoa, Minh Lap, Song Cau, Trai Cau, Hoa Thuong, Quang Son, Van Lang, Cay Thi, Van Han, Tan Long, Hop Tien, Hoa Binh, and Tan Loi, located in Dong Hy District, Thai Nguyen Province.

With a sample size of 200 households selected using a multi-stage, cluster sampling method, the survey management process was carried out through direct interviews with household heads using a questionnaire comprising 14 questions divided into three sections: Household and demographic information, content-related questions, and challenges and recommendations from the households. The questionnaire was refined to align with local conditions before conducting extensive surveys in the study areas.

The multivariate regression analysis method was employed to analyze the factors affecting the income of tea-farming households, using the SPSS 20.0 software for data processing and analysis.

4. Research Results

In order to evaluate the factors affecting the income of tea farming households in Dong Hy District, a regression analysis was conducted. The results are presented in Table 1.

Table 1: Regression Results

Variable	B	Standardized β	t-value	Significance	VIF
LnAL	0.131	0.286	3.789	0.000	1.666
LnLS	0.482	0.206	3.097	0.0003	1.387
LnNH	0.145	0.182	2.601	0.011	1.348
LnEL	0.110	0.184	2.987	0.004	1.102
LnBC	-0.178	-0.224	-3.443	0.001	1.340
LnLC	-0.114	-0.046	-0.795	0.429	1.243
LnMC	-0.411	-0.208	-3.142	0.002	1.183
LnTP	0.473	0.255	3.632	0.000	1.467

Source: Based on the author's calculations

From the results in Table 1, it is evident that there are six statistically significant variables, among which variables LnAL, LnLS, LnNH, LnEL, and LnTP have a positive effect on the income of tea-growing households. In contrast, variables LnBC and LnMC exhibit a negative effect on the income of tea-growing households. The variable LnLC (Labor Cost) is not statistically significant because its Sig. value = 0.429 is greater than 0.05. Testing the correlation coefficient r (Correlation) between the independent variables and the dependent variable using Pearson's test indicates that the correlation coefficient r of the variable LnLC (Labor Cost) is not statistically significant at the 95% confidence level because its Sig. value = 0.582 exceeds 0.05. To ensure the robustness of the results, the study conducted the following tests:

Testing the model's goodness of fit: The model's adjusted R^2 is $0.668 > 0.5$ (50%), which implies that 66.8% of the variation in income per 1,000 square meters of tea-growing land is explained by the independent variables in the model. The results of the ANOVA analysis show that the F-test value is 37.427 and is statistically significant since Sig. = $0.000 < 0.01$. Therefore, the regression model is appropriate for the research data.

Checking for multicollinearity among independent variables: The results in Table 1 reveal that the Variance Inflation Factor (VIF) values for the independent variables are very small (less than 10). Accordingly, the independent variables are not closely related to one another. Consequently, the relationship among the independent variables does not significantly affect the explanatory results of the regression model. It can be concluded that there is no multicollinearity among the statistically significant independent variables in the model.

From the regression model testing results, it was found that there is no multicollinearity, no violation of heteroscedasticity, and the model is statistically significant. Therefore, the formal research model on factors influencing the income of tea-farming households in Dong Hy District, Thai Nguyen Province, is established as follows:

The research model results can be explained as follows:

LnAL (Agricultural Land Area) has a coefficient $\beta = 0.131$. Assuming other factors remain constant, an increase in land area will result in increased income for tea-farming households. This finding aligns with the studies of Pham Tan Hoa (2014) ^[23], Dinh Phi Ho and associates (2010). Related to policy analysis at the household level in Vietnam,

several critical issues include the impact of land consolidation, input/output pricing policies, technological advancements, credit policies, and taxation.

LnLS (Loan Size) has a coefficient $\beta = 0.482$. Assuming other factors remain constant, a 1% increase in average loan size will increase income by 0.482%. This result is consistent with the reality of local loan conditions and studies by Nguyen Lan Duyen (2014)^[17], Dinh Phi Ho and associates (2010), Nguyen Tien Dung and associates (2014)^[19], and Pham Tan Hoa (2014)^[23]. Most loans (83%) are used for agricultural production, and statistical analysis shows households with loans tend to have higher incomes than those without loans. Loan access enables households to improve income levels, aligning with theoretical research.

LnNH (Labor Force) has a coefficient $\beta = 0.145$. Assuming other factors remain constant, an increase in the labor force results in increased income. The study shows an average of 2.56 workers and 3.85 members per household in Dong Hy District, meaning approximately 1.67 dependents per household. Increasing the labor force reduces dependency ratios, and households with higher labor force levels tend to have higher incomes. This finding aligns with research by Abdulai & CroleRees (2001)^[1], Yang (2004), Huynh Truong Huy (2007)^[12], and Nguyen Quoc Nghi and associates (2011)^[18], who noted that household size positively influences income.

LnEL (Education Level) has a coefficient $\beta = 0.110$. Assuming other factors remain constant, higher education levels of household heads positively correlate with income. This finding is consistent with studies by Nguyen Lan Duyen (2014)^[17], Xiong and Niu (2010)^[25], Nguyen Quoc Nghi and associates (2011)^[18], Huynh Truong Huy (2007)^[12], and Le Khuong Ninh (2014)^[13]. Education enhances the ability to acquire agricultural knowledge, apply technical advancements, access information, and plan production, influencing household members' participation and income generation.

LnBC (Biological Costs) has a coefficient $\beta = -0.178$. Assuming other factors remain constant, biological costs negatively impact income. This finding aligns with studies by Adil and associates (2004)^[2], Dinh Phi Ho (2010), and Huynh Truong Huy (2007)^[12] due to the following reasons: Fertilizer and pesticide costs are significant concerns for tea farmers due to limited support for managing low-quality agricultural inputs (e.g., counterfeit fertilizers and environmentally harmful pesticides) despite high costs. Climate change increases farming challenges, necessitating higher spending on pest control, fertilizers, and pesticides. Farmers' lack of knowledge and production skills exacerbates this issue, increasing production costs and reducing income.

LnMC (Mechanical Costs) has a coefficient $\beta = -0.411$, indicating a negative relationship with household income. While this aligns with initial expectations, it contrasts with conclusions by Dinh Phi Ho and Pham Ngoc Duong (2010)^[7], who noted that mechanical costs reflect farmers' technological application levels in tea production. The negative impact can be attributed to: Farmers primarily rely on renting equipment (e.g., harvesters, plowing machines) with payments based on local customary rates, as owning machinery (e.g., combine harvesters costing over 500 million VND) is unaffordable. This reliance increases costs. Fragmented and small-scale landholdings hinder machinery application, preventing economies of scale and reducing

labor and rental costs.

LnTP (Tea Productivity) has a coefficient $\beta = 0.473$, indicating a positive relationship with income. This aligns with the findings of Nguyen Tien Dung and associates (2014)^[19], who identified a strong linear relationship between tea output and household income. Given the current production and pricing mechanisms set by the government, farmers must increase productivity to enhance profits.

5. Conclusion and Policy Implications

From the results of the regression model, it is evident that the factors influencing the income of tea-farming households include agricultural land area, household labor participation in production, the size of loans from formal credit institutions, household heads' educational level, biological costs, mechanical costs, and tea productivity. To improve the income of tea-farming households in Dong Hy District, Thai Nguyen Province, the following issues need to be addressed:

The current situation of fragmented and small-scale land plots leads to spontaneous farming practices. Therefore, tea-farming households must embrace a spirit of cooperation among themselves and with the government to reduce investment costs, improve tea quality, and increase selling prices. Farmers should participate in new production models such as cooperatives, local partnerships, income diversification, or tea production under the VIETGAP model.

The issue of household labor resources must be resolved. Family labor is a major contributing factor to household income. Farmers need to:

1. Ensure family health and maintain a stable workforce.
2. Enhance the application of scientific and technological advancements in production to reduce dependency on manual labor, replacing it with machinery in various stages of tea production, including soil preparation, sowing, care, and harvesting.

Household heads must improve their educational level to access and apply scientific and technological advancements in tea production through various means. In reality, agricultural products face many challenges during the integration process. Many agricultural products, due to small-scale production, low labor productivity, and limited application of scientific and technological advancements, have high production costs. This risk is particularly significant for rice products, which are closely associated with vulnerable farmers in the integration process.

Regarding biological costs (fertilizers, pesticides, irrigation, and seeds) and mechanical costs (machinery and equipment rental), farmers need to calculate input expenses for tea cultivation rationally. Continuous cultivation under conditions of frequent pests and stunted tea plants often leads to overuse of fertilizers and chemical inputs, further aggravating pest infestations and increasing the reliance on pesticides. This vicious cycle not only raises production costs but also disrupts beneficial ecosystems, leading to higher pesticide use and increased financial burdens.

Farmers must recognize that borrowing capital is not a "debt" burden but should be calculated and utilized effectively. In practice, the demand for loans among households accounts for a significant proportion to expand production and purchase production equipment. However, households often borrow for consumption, sell their

products to repay loans after harvest, and then borrow again for further consumption. Production materials are usually purchased on credit from local dealers.

To enhance tea productivity, farmers must improve production techniques, learn and apply new farming methods and technologies. Tea production heavily relies on the household head's level of cultivation skills. Therefore, farmers must effectively implement the five recommendations presented above to improve tea productivity while ensuring economic efficiency. High productivity does not equate to high output with poor quality, as increased productivity with high quality yields higher selling prices. Conversely, focusing solely on increasing production at the expense of quality results in lower selling prices, putting farmers in the situation of "bumper crops with low prices."

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