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# Predicting the Success of Coffee Farmer Partnerships Using Factor Analysis and Multiple Linear Regression

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**Abstract:** The determinants of successful partnership models between coffee farmers and key stakeholders—comprising private enterprises, cooperatives, and governmental bodies—were investigated to enhance productivity and sustainability within the coffee sector in Mojokerto, Indonesia. A mixed-methods approach was employed, integrating factor analysis and multiple linear regression modeling to examine the predictive influence of partnership dimensions. Four core dimensions—economic, social, cultural, and agroclimatic—were evaluated through exploratory factor analysis to uncover latent structures underpinning partnership success. The analysis resulted in the identification of four principal components: socio-economic exchange dynamics, socio-economic connectivity of agriculture, capital networks and socio-economic experience, and economic and educational networks. These components were subsequently used as independent variables in a multiple linear regression model, where partnership success was operationalized through kernel weight outputs as a proxy for productivity performance. The regression model accounted for 84.19% of the variance in partnership success, indicating strong explanatory power. The findings underscore the critical role of non-economic dimensions—particularly social connectivity and education—in driving effective partnerships, alongside traditional economic considerations. Policy implications include the need to design intervention strategies that enhance farmers' access to capital, strengthen educational and training programs, and encourage participation in socio-economic networks. While the model demonstrates strong internal validity within the context of the coffee industry, its applicability to other agricultural commodities remains to be tested. Further research is recommended to validate these findings across diverse agro-industrial contexts, thereby supporting the development of inclusive and scalable partnership models. This study contributes empirical evidence to inform stakeholder decision-making and promote resilient, equity-driven frameworks for agricultural collaboration.

**Keywords:** Partnership; Coffee farmers; Economy; Social; Culture; Agroclimate

## 1. Introduction

Coffee producer partnerships with multiple stakeholders, including businesses, cooperatives, and government agencies, are critical to increasing production, improving crop quality, and enhancing farmer welfare. The success of these collaborations relies heavily on complex interactions across multiple elements, including economic, social, cultural, and agroclimatic factors (Etzkowitz & Leydesdorff, 2000). To develop sustainable and successful strategies that support a competitive coffee industry, it is essential to have a comprehensive understanding of the elements that influence collaboration performance. Hernandez-Aguilera et al. (2018) confirmed that a deep understanding of the interactions of these factors is necessary to improve the effectiveness of partnerships in the coffee value chain. Economic factors influence market access and prices received by farmers; social factors determine the strength of networks and trust between partners; cultural factors shape farming practices and shared values, while agroclimatic factors determine land suitability and crop resilience.

It has been consistently recognized by various researchers that developing more and better partnerships between farmers and other stakeholders is an important approach to achieving sustainable agriculture. Pretty (1995) emphasized the importance of farmer participation in decision-making processes, while Beus & Dunlap (1990) and Cobb et al. (2005) showed how partnerships can address knowledge and resource gaps. Velten et al. (2015) further outlined how partnerships contribute directly and indirectly to the creation of ecological, cultural, social, agroclimatic, and economic benefits in the agricultural context. Partnerships facilitate efficient natural resource management and coordination of farming operations. Velten et al. (2021) explained that partnerships enable interventions at scales that are more appropriate to the geographical reach of ecological processes than the usual farm or field scale. For example, as shown by Leventon et al. (2017), if the development of landscape elements is coordinated at the landscape scale across multiple farms, habitat connectivity and overall landscape complexity can be increased.

Partnerships or collaborations between organizations are based on two main theories, namely Resource Dependence Theory (RDT) and Transaction Cost Economics (TCE) which are rooted in three disciplines, namely sociology, economics, and organizational theory. RDT emphasizes the importance of building relationships to access and manage the resources needed by the organization, thereby helping to reduce dependence on the external environment (Salancik, 1978). In the context of coffee farming, Bacon (2005) showed how small coffee farmers in Nicaragua who joined a cooperative managed to reduce their dependence on local middlemen and access the international specialty coffee market, thus receiving prices 20-30% higher than non-cooperative farmers. In line with this, Méndez et al. (2010) in El Salvador proved that farmers involved in partnerships with certification bodies were able to access critical resources in the form of technical knowledge of organic cultivation and buyer networks, which they could not have obtained individually. On the other hand, TCE provides a framework for understanding how organizations can reduce or optimize costs through strategic collaboration, by choosing whether activities are performed internally or through efficient partnerships. Coase (2009) and Muradian & Pelupessy (2005) demonstrated the application of TCE in a study of coffee partnerships in Uganda, where groups of coffee farmers partnering with exporters managed to reduce transaction costs by up to 45% related to buyer search, contract negotiation, and quality monitoring. Transportation costs, which are a significant component of transaction costs in mountainous coffee-producing areas, also decreased by up to 35% when farmers coordinated collection and delivery together through partnerships, as documented by Ponte (2002). A comprehensive study by Dietz et al. (2019) on the coffee value chain further confirmed that vertical partnerships between farmers, processors, and exporters effectively reduce search and negotiation costs, which are major components in traditional market transactions in the coffee sector.

Partnerships can help align multiple objectives within a single environment (Fischer et al., 2019; Schoon & Cox, 2018), as demonstrated by a case study in Colombia where coffee farmers and conservation organizations successfully integrated high-quality coffee production with biodiversity conservation (Fischer et al., 2019). In terms of ecological impacts, collaboration can result in more integrated biological networks and reduced habitat fragmentation, as seen in the highlands of Chiapas, Mexico (Leventon et al., 2017). Socially, partnerships increase social capital, as demonstrated by a longitudinal study in Rwanda where farmers in partnerships had higher levels of trust among community members (Mills et al., 2008). In addition, partnership groups are more likely to receive assistance from organizations (Velten et al., 2021), have greater bargaining power, and can make larger joint investments (Newig et al., 2019), as seen in Vietnam where groups of coffee farmers managed to negotiate 23% higher prices and collectively invested in processing facilities (Velten et al., 2021).

Climate change has significant environmental, social, political, and economic impacts, with the coffee sector being one of the most vulnerable to changes in rainfall and temperature patterns (Araújo et al., 2024). Partnerships play a critical role as an adaptation mechanism in addressing this global challenge, with farmers involved in partnerships having 3.5 times greater access to climate information and adaptation technologies (Feldmeyer et al., 2021). Advanced agricultural techniques, such as efficient irrigation and proper land management, have been shown to be effective in mitigating the adverse impacts of climate change (Araújo et al., 2024), as demonstrated by a partnership between coffee farmers and an agritech company in Brazil that increased water use efficiency by 35% (Araújo et al., 2024). However, partnerships also face significant challenges, including power imbalances (Lamichhane et al., 2016), fluctuating international coffee prices, limited access to premium markets, and inconsistent government policies (Prager, 2015). Partnerships can only be successful if specific requirements are met, taking into account the interaction between socio-economic and agroclimatic aspects (Uetake, 2014).

The success of this partnership is measured by increasing economic output, efficient environmental management, and ecosystem preservation. Thus, the partnership does not only focus on economic growth but also emphasizes the importance of environmental sustainability and overall social well-being (Hernandez-Aguilera et al., 2018). The success of coffee farmer partnerships is influenced by various integrated factors from economic, social, cultural, and agroclimatic dimensions. Factor and regression analysis can be used to map the relationships between these dimensions and identify the factors that most influence partnership success. It is important to consider all of these dimensions in designing policies and strategies that support the success of coffee farmer partnerships. Supported by previous research findings, economic, social, cultural, and agroclimatic dimensions play an

important role in coffee farmer partnerships. Specifically, Wisadirana et al. (2024) demonstrated that access to financial capital, land tenure arrangements—particularly land borrowed from Perhutani—the costs associated with agricultural inputs such as fertilizers and pesticides, farmers' knowledge levels, and the structure and accessibility of markets significantly affect coffee production and the viability of partnerships. These findings suggest that profitable partnerships not only enhance income stability for coffee farmers but also incentivize improvements in product quality and yield. Social aspects, such as interpersonal relationships and trust between farmers and partners, also have a significant influence. Nainggolan et al. (2024) emphasized the importance of communication and trust in partnerships and found that partnerships based on strong social relationships have a greater chance of success. Cultural aspects, including local values and traditions, influence farmers' attitudes towards partnerships. Zakki (2020) identified that local culture can influence farmers' attitudes towards partnerships, as well as the success of technology transfer and more efficient agricultural practices. Agroclimatic factors such as soil conditions, weather, and water availability greatly influence the success of coffee farmer partnerships. Araújo et al. (2024) showed that a good understanding of agroclimatic conditions and adaptation of agricultural technology to local conditions can increase productivity and the success of partnerships.

This study provides new insights into the complexity of factors influencing the success of coffee farmer partnerships, with a holistic and multidimensional approach. Unlike previous studies that often emphasize one or two aspects, this study integrates multiple interrelated dimensions, such as socio-economic exchange dynamics, agrarian connectivity, capital networks, and economic and educational networks. This novelty is particularly relevant in the current global context, where challenges such as climate change and worsening markets are increasingly pressing. Therefore, a more comprehensive understanding of the interactions between farmers and business partners can contribute to the well-being of partnerships and improve the welfare of farming communities as a whole. Therefore, this study aims to synthesize insights from a large number of case studies of partnership projects for more sustainable agriculture to assess the elements that influence the performance of these initiatives based on clear and comprehensive success criteria. These influences include social, agroclimatic, cultural, and economic issues, among others. The study aims to provide substantial empirical insights by using factor analysis techniques to group factors in these four dimensions and regression analysis to estimate the impact of each element on the success of the relationship. The results of this study are important not only for academics but also for policymakers, strategic partners, and coffee farmers, as they will help create more inclusive and sustainable partnership models in the future.

## 2. Methodology

### 2.1 Research Location

The research was conducted in Trawas, Mojokerto, East Java (see Figure 1), to evaluate the value addition in Arabica coffee production and to explore the potential for coffee partnership development. The area was chosen for its favorable agroclimatic conditions and the presence of active coffee farming communities.

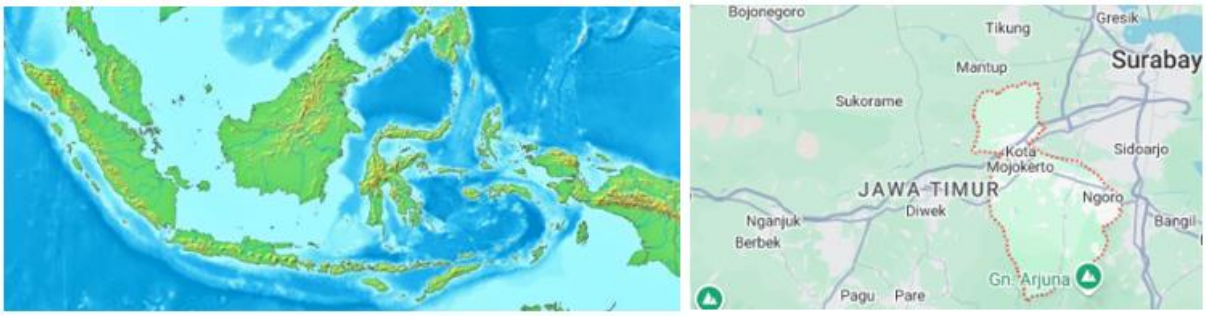


**Figure 1.** Research location
Source: Google Maps, 2025.

### 2.2 Sample Procedures and Data Collection

This study employed a purposive sampling method to identify the population, specifically farmers who are members of three coffee farmer groups in the Mojokerto region of Indonesia: Bon Tugu, Bon Bendil, and Dlundung coffee groups. A total of 282 respondents were selected based on established criteria, ensuring they were directly involved in coffee plantation activities. This approach guarantees that the data collected accurately reflects the conditions of all coffee farmers in the study, resulting in more comprehensive and representative findings. Additionally, 15 key informants were chosen for their strategic roles, including three representatives

from farmer associations (gapoktan), three representatives from each coffee farmer group, three community leaders from Forest Community Institutions (LMDH), two village government officials, two representatives from Perhutani, and two third-party stakeholders such as banks and brokers.

Measurement of the four aspects or dimensions of the partnership includes: (a) the economic aspect which consists of the variables of price, capital, demand, income and coffee preference; (b) the social aspect which consists of the variables of land area, age, level of education, farming experience, number of family dependents and total income; (c) the cultural aspect which consists of the variables of customs, beliefs, farming habits or planting and social systems in the community; and (d) the agroclimatic aspect which consists of the variables of rainfall, topography, cultivation techniques, productivity and processing of results. Primary data relevant to the activities of farmers, coffee entrepreneurs, LMDH, and Perhutani Trawas were used in this study. The data were obtained through observation and distribution of questionnaires involving related parties, such as farmers, coffee entrepreneurs, LMDH Margomulyo, and Perhutani, both individually and in groups. Data collection techniques included observations carried out systematically to obtain direct data from respondents in accordance with the research concept, and questionnaires were used as the main instrument to collect in-depth data from farmers and coffee industry players.

To ensure the reliability and accuracy of the research instrument, validity and reliability tests were conducted. The validity test aims to measure the extent to which the instrument is able to measure the intended variables, while the reliability test is used to assess the consistency of the measurement results. The validity of the instrument was tested using the Spearman correlation test, which showed that all items on the instrument, both partnership factors and partnership success, had a significance value of less than 5% ($p<0.05$), indicating that the instrument was valid. Meanwhile, reliability testing was carried out using the Cronbach's alpha method, the results of which showed that the instrument for the partnership factor had a reliability value of 0.833, while for partnership success, it obtained a value of 0.686. The results of both showed that this instrument had a sufficient level of reliability to be used in further research.

### 2.3 Analysis Techniques

Factor analysis was chosen for its ability to reduce data complexity by identifying underlying factors, while multiple linear regression was preferred for modeling relationships between variables, allowing for predictions and understanding of variable impacts. Together, they provide a comprehensive approach to data analysis.

Factor analysis was conducted on all dimensions of partnership in economic, social, cultural, and agroclimatic aspects to rank their relative significance and to describe their relationship pattern with partnership success. For factor analysis, the basic equation of factor analysis can be represented in a matrix form as follows:

$$Partnership_{px1} = \lambda_{pxm} F_{mx1} + \epsilon_{px1} \quad (1)$$

where, $\lambda$ is the vector of variables $px_1$ and the $pxm$ matrix of factor loadings; $F$ is the $mx_1$ vector of factors; and $\epsilon$ is the $px_1$ vector of error factors (unique or specific) (Sharma, 1996). It is assumed that the factors are uncorrelated with the error components. Since different units of each variable are used in factor analysis, the variables were standardized, and the correlation matrix of the variables was used to obtain the eigenvalues. Loadings are the correlation coefficients between variables and factors. Varimax rotation was used to facilitate the interpretation of factor loadings (*Lik*). Coefficients (*Cik*) were used to obtain factor scores for the selected factors. The use of eigenvalues > 2 as a threshold in factor analysis is justified because this value indicates that the factor explains a larger proportion of the variance in the data. Therefore, only significant factors were retained. This stricter threshold helps to produce simpler and more interpretable models, avoid overfitting, and increase the stability and reproducibility of the analysis results. Factors with eigenvalues greater than 2 were used in multiple regression analysis (Johnson & Wichern, 2002; Sharma, 1996; Tabachnick & Fidell, 2001).

In multiple linear regression analysis, the score values of selected factors were considered as independent variables to predict kernel weights. The regression equation is presented as follows:

$$Partnership_K = \alpha + \beta_1 \mathrm{FS} + \beta_2 \mathrm{FS2} + \beta_3 \mathrm{FS3} + \beta_4 \mathrm{FS4} + \epsilon \quad (2)$$

where, $\alpha$ is the regression constant (its value is zero); $\beta_1$, $\beta_2$, $\beta_3$, and $\beta_4$ are the regression coefficients of the factor score (*FS*); and $\epsilon$ is the error term of the regression model. The regression coefficients were tested using the t-test. The coefficient of determination ($R^2$) was used as the predictive success criterion for the regression model (Draper & Smith, 1998).

## 3. Results

### 3.1 Factor Analysis Test

The results of the Kolmogorov-Smirnov normality test of 0.808 with a significance value (Sig.) of 0.531 indicate that the data used in this study are normally distributed. Data normality is one of the important assumptions in factor analysis because it ensures that the variables analyzed have a distribution pattern that is appropriate for the statistical technique used. With normally distributed data, the results of the factor analysis are more stable and can be better interpreted. Fulfillment of this normality assumption also allows for further statistical tests, such as the Kaiser-Meyer-Olkin (KMO) test to assess sample adequacy and Bartlett's test of sphericity to test for the existence of sufficient correlation between variables so that factor analysis can be carried out validly and reliably (Sugiyono, 2022). Using the KMO test and Bartlett's test of sphericity, a high KMO value ($\geq 0.5$) indicates that the data is suitable for factor analysis, while a significant Bartlett's test ($p < 0.05$) indicates that there is sufficient correlation between variables for further analysis (Sharma, 1996). The test results show a KMO value of 0.973, indicating that the sample adequacy is very good and meets the minimum requirement of 0.5, so that factor analysis is feasible to use. In addition, the Bartlett's test value of 94,774.487 with a significance of 0.000 indicates a significant correlation between variables. These results indicate that the variables in the study have a data structure that is good enough to be explored using factor analysis, which aims to identify latent dimensions and group data based on their correlation.

In factor analysis, only factors with an eigenvalue > 2 were considered because this value indicates that the factor can explain a large amount of variance and has significant meaning in the model. This approach is stricter than Kaiser's criterion, which usually retains factors with eigenvalue > 1 because they are considered to explain more variance than one individual variable. By using the eigenvalue > 2 limit, only factors that are truly strong and meaningful were retained so that the analysis becomes more stable and the interpretation is clearer. The results of the factor analysis show that from a comprehensive set of factors examined in this study, totaling 140 variables, four dominant factors emerged with eigenvalues greater than 2, which collectively account for 84.19% of the total variance. This shows that the four factors represent most of the information contained in the research data.

**Table 1.** Eigenvalues

| Var | Factor | Eigen-value | Percentage of Variance |
|---|---|---|---|
| *F*1 | 1 | 40.65384 | 29.03845% |
| *F*2 | 2 | 37.11168 | 26.50835% |
| *F*3 | 3 | 23.67119 | 16.90799% |
| *F*4 | 4 | 16.4266 | 11.73329% |

Source: Statistical Package for the Social Sciences (SPSS) processed data, 2025.

Based on Table 1, the first factor explains 29.04% of the total variance with an eigenvalue of 40.65384, followed by the second factor explaining 26.51% with an eigenvalue of 37.11168. The third factor has an eigenvalue of 23.67119 and explains 16.91% of the total variance, while the fourth factor has an eigenvalue of 16.42660, which explains 11.73% of the total variance. Thus, these four factors together provide a simple yet profound picture of the research data structure so that factor analysis can identify relevant latent dimensions in this study.

Table 2 shows the factor analysis results. The selection results of factors for the first factor, with a contribution of 29.04%, include economic aspects, including price variables (subjective and objective), capital (social, fixed, and active/passive), potential demand, dividend income, and social preferences. Social aspects include age (pre-retirement and retirement), education level (elementary school-bachelor's degree), number of family dependents (1-3 or <5 people), and total income (>5 million). Cultural aspects consist of customary variables (market calculations and village rituals), beliefs (contractual and relational), and farming habits (hereditary, innovative, or mixed). Meanwhile, agroclimatology aspects include equatorial rainfall, cultivation techniques (cuttings, grafting, grafting, tissue culture, and shoots), and multifactor productivity. Hereinafter, this factor is referred to as the socio-economic exchange dynamics variable.

The selection results of factors for the second factor, with a contribution of 26.51%, include economic aspects, including price variables (cost of goods and selling price), capital (individual and labor), effective demand, sales income, and individual preferences. Social aspects include land variables (dry land), age (early workers and middle-aged workers), and number of family dependents (>5 people). Cultural aspects include organic trust in the form of contract trust. Agroclimatology aspects include rainfall (season and local type), topography (highlands and mountains), productivity (partial and total factors), and processing of results (semi-finished products and finished products). Furthermore, this second factor is called the variable of socio-economic connectivity of agriculture.

**Table 2.** Factor analysis results

| | | | |
|---|---|---|---|
| **Factor 1** | | | |
| - Subjective price | - SD | - Hereditary | - Retirement age (55-64 years) |
| - Objective price | - Junior high school | - Innovative | - Village cleaning customs |
| - Social capital | - Bachelor | - Mixture | - Trust contract |
| - Fixed capital | - Liability: 1-3 people | - Rainfall in equatorial regions | - Relational trust |
| - Active/passive capital | - Dependents: <5 people | - Cuttings | - Plant tissue isolation method |
| - Potential demand | - Income: >5 million | - Corruption | - Shoot |
| - Dividend income | - Customs Market Calculation | - Grafting | - Multifactor productivity |
| - Social preferences | - Pre-retirement age (45-54 years) | | |
| **Factor 2** | | | |
| - Cost of goods sold | - Sales revenue | - Family dependents >5 | - Mountains and mountain ranges |
| - Selling price | - Individual preferences | - Trust contract | - Partial productivity |
| - Individual capital | - Dry land | - Rainy season rainfall | - Total factor productivity |
| - Working capital | - Early working age (25-34 years) | - Local type rainfall | - Semi-finished products |
| - Effective request | - Middle age (35-44 years) | - Plateau | - Finished product |
| **Factor 3** | | | |
| - External capital | - Wetlands | - Middle age (35-44 years) | - Modern farming habits |
| - Absolute demand | - Young age (15-24 years) | - 16-20 years of experience | - Parenting System (bilateral) |
| - Rental income | - Early working age (25-34 years) | - Experience > 20 years | - Matrilineal system |
| **Factor 4** | | | |
| - Interest income | - High school education | - Master's education | - Income: 1-2 million |
| - Asset income | - Diploma education | - 1-5 years of experience | - Income: 3-5 million |
| | | | - Lowland |

Source: SPSS processed data, 2025.

The selection results of factors for the third factor, with a contribution of 16.91%, include economic aspects, including external capital variables, absolute demand, and rental income. Social aspects include wetland variables, age (young and early workers and middle-aged workers), and farming experience (16-20 years and more than 20 years). Cultural aspects include modern farming habits and social systems (parental and matrilineal). Furthermore, this third factor is called the capital networks and socio-economic experience variable.

The selection results of factors for the fourth factor, with a contribution of 11.73%, include economic aspects, including income variables, such as interest income and asset income. Social aspects include education level variables (high school, diploma, and master's education), farming experience (1-5 years), and total income (1-2 million and 3-5 million). Agroclimate aspects include topography variables related to lowlands. Furthermore, this fourth factor is called the variable of economic and educational networks.

### 3.2 Regression Analysis

Furthermore, the new factors formed through factor analysis were tested using multiple regression analysis to see the magnitude of their influence on the success of coffee farmer partnerships both simultaneously and partially. The regression analysis is shown in Table 3.

**Table 3.** Summary of the multiple linear regression model

| Model | *R* | $R^2$ | Adjusted $R^2$ | Std. Error of the Estimate |
|---|---|---|---|---|
| 1 | 0.649(a) | 0.421 | 0.413 | 0.21952 |

Note: a) Predictors: (Constant), economic and educational networks, socio-economic connectivity of agriculture, socio-economic exchange dynamics, and capital networks and socio-economic experience; b) Dependent variable: Successful partnerships. Source: SPSS processed data, 2025.

The multiple linear regression analysis was used to measure the influence of the factors (*F*1, *F*2, *F*3, and *F*4) on the success of the coffee farmer partnership formed. The results of the analysis showed an $R^2$ value of 0.421, which means that 42.10% of the success of the coffee farmer partnership was influenced by factors *F*1, *F*2, *F*3, and *F*4. The results of the factor analysis showed four main variables that influenced the coffee farmer partnership. The identification of these factors is in line with research on socio-economic complexity in the coffee value chain, which shows that multi-dimensional structures greatly influence the sustainability of coffee farmer partnerships (Grabs & Ponte, 2019).

**Table 4.** Multiple linear regression coefficients

| Model | Unstandardized Coefficients | | Standardized Coefficients | t | Sig. |
|---|---|---|---|---|---|
| | B | Std. error | Beta | | |
| (Constant) | 0.086 | 0.288 | | 0.298 | 0.766 |
| *F*1 | 0.234 | 0.037 | 0.299 | 6.346 | 0.000 |
| *F*2 | 0.222 | 0.057 | 0.180 | 3.884 | 0.000 |
| *F*3 | 0.174 | 0.051 | 0.214 | 3.448 | 0.001 |
| *F*4 | 0.241 | 0.042 | 0.358 | 5.765 | 0.000 |

Note: Dependent variable: successful partnerships. Source: SPSS processed data, 2025.

The naming of the factors was adjusted to better reflect the broader scope of the variables encompassed within each factor, making them more aligned with the characteristics being measured. The results of the t-test presented in Table 4 indicate that the independent variables have a significant partial effect on the dependent variable (*Y*), with the calculated t values as follows: Factor 1 (*F*1) "socio-economic exchange dynamics," which encompasses economic aspects, has a t value of 6.346; Factor 2 (*F*2) "socio-economic connectivity of agriculture," reflecting social aspects, has a t value of 3.884; Factor 3 (*F*3) "capital networks and socio-economic experience," representing cultural aspects, has a t value of 3.448; and Factor 4 (*F*4) "economic and educational networks," which includes agroclimatic aspects, has a t value of 5.765, all with a significance level of <0.05.

## 4. Discussion

After conducting factor analysis and multiple regression analysis, it can be concluded that four variables influence the success of coffee farmer partnerships, namely socio-economic exchange dynamics, socio-economic connectivity of agriculture, capital networks and socio-economic experience, and economic and educational networks. The results of the regression analysis show that socio-economic exchange dynamics (which include patterns of interaction between farmers and partners, as well as adaptation to market dynamics) have the greatest influence on the success of the coffee farmer partnership model. The findings of this study align with previous research highlighting the significant challenges faced by coffee partnerships. Schaafsma et al. (2023) revealed that adaptive interactions between farmers and business partners are key to the sustainability of partnerships, especially when facing global market fluctuations. These findings primarily support RDT, which emphasizes that organizations depend on external resources to survive and must interact with other entities that control those resources. While Samper & Quiñones-Ruiz (2017) highlighted that successful partnerships depend on the balance of power in price negotiations and risk sharing, Bager & Lambin (2020) added that transparency in transactions and access to market networks significantly increase trust in coffee farmer partnership relationships. This is in line with the findings of Afandi et al. (2022), which emphasize that socio-economic characteristics play an important role in shaping policies for economic welfare and empowerment of farming communities. Specifically, it was found that as farmers' age and income increased, they were more likely to choose intermediary sales channels, highlighting the importance of understanding socio-economic dynamics in fostering successful partnerships and improving the economic conditions of coffee farmers (Grabs & Ponte, 2019).

Socio-economic connectivity of agriculture (which includes relationships between farmers, coordination between farming communities, and access to agribusiness information) also has a significant influence on the success of coffee farmer partnerships, i.e., strong social connectivity between agricultural actors creates synergy in the partnership system. This supports the distribution of resources and information evenly so that it can increase productivity and efficiency. The findings of this study align with previous research highlighting the significant challenges faced by coffee partnerships. Hernandez-Aguilera et al. (2018) found that smallholder farmers who participate in long-term partnerships with coffee buyers based on product quality are more likely to adopt sustainable practices, have better access to credit, and have higher levels of optimism and information about the coffee business. This is in line with the idea that social connectivity between farmers plays an important role in enabling the exchange of valuable information and resources (Devaux et al., 2018). This factor is most in line with TCE because strong social connectivity between agricultural actors creates an efficient information exchange system and reduces information search costs. Although their study did not find significant differences in prices at

the farm level, the study emphasized that the adoption of sustainable agricultural practices, such as organic farming and shade planting systems, can improve coffee quality and promote long-term sustainable business strategies (Hernandez-Aguilera et al., 2018). This integration of socio-economic connectivity with sustainable resource management practices creates a framework that enhances the success of coffee farmer partnerships (Grabs & Ponte, 2019).

The role of capital networks and socio-economic experience (including access to financial capital, social capital such as trust, and farmers' experience in running coffee businesses) provides an important contribution to the success of coffee farmer partnerships. The combination of adequate financial support and farmers' experience can increase their business resilience in facing various challenges. The findings of this study align with previous research highlighting the significant challenges faced by coffee partnerships. Jezeer et al. (2018) explained that coffee farmers with strong social networks and access to financial capital are better able to adopt sustainable agricultural practices and improve the resilience of their businesses, while Rivera et al. (2019) strengthened this argument by emphasizing that social capital in the form of trust, cooperation, and a sense of community plays a critical role in the success of rural agricultural development initiatives by facilitating the exchange of knowledge and resources among farmers. This factor strongly supports RDT, as it focuses on how access and control over critical resources (financial and social capital) influence the dynamics of power and dependency within partnerships. The study by Contreras-Medina et al. (2024) further provided empirical evidence through statistical integration of environmental, economic, and social data, with partial associations of 0.000 ($p > 0.05$), respectively, and identified the establishment of local banks, training and assistance programs, and networks for exchanging experiences ($p = 0.002$) as strategic interventions that can increase farmers' capacity to develop productive and sustainable partnerships, thus confirming the importance of the combination of adequate financial support and collective farmer experience in building the resilience of their businesses.

The test results also show that economic and educational networks (which include farmers' access to new economic opportunities and capacity building through education and training) also play a significant role. This factor shows that education-based collaboration and skills development provide opportunities for farmers to increase the added value of their products and contribute more to the supply chain. The findings of this study align with previous research highlighting the significant challenges faced by coffee partnerships (Opolot et al., 2018), which shows that training has a positive influence on farmers' entrepreneurial and organizational competencies. Through training, farmers gain better agronomic practices, business planning skills, and knowledge in terms of added value, packaging, branding, and marketing (Ibnu et al., 2018). In addition, leadership, accountability, communication, networking, and marketing competencies of farmer groups are strengthened. Lamichhane et al. (2016) also emphasized the importance of knowledge and technology exchange in partnership relationships as a critical success factor. This approach can enhance the capacity of universities to promote rural entrepreneurship, thereby contributing to sustainable agricultural development (Opolot et al., 2018). This factor best fits TCE, as it focuses on how increased knowledge and skills can reduce information asymmetries and uncertainty in economic transactions. Dietz et al. (2019) found a positive correlation between farmers' education levels and their ability to adopt innovative practices and access premium markets, leading to increased income and sustainability of their coffee businesses. These studies collectively emphasize the importance of economic and educational networks as catalysts that empower farmers to manage their businesses more effectively and add value to their products within a sustainable partnership framework.

The findings of this study indicate that power imbalances between smallholders and large companies do not significantly impact the success of coffee partnerships, contrary to the assertions made by Lamichhane et al. (2016). Coffee partnerships face significant challenges in the form of power imbalances between smallholders and large companies (Lamichhane et al., 2016), fluctuating international prices, and limited access to premium markets (Vicol et al., 2018). Partnerships often fail when the distribution of economic benefits is inequitable, and logistical barriers in remote areas make them difficult to be effective (Samper & Quiñones-Ruiz, 2017). The success of partnerships depends on the principles of mutual benefit, accountability, and equity, with ongoing evaluation of welfare impacts and development of risk management strategies (Ibnu et al., 2018). To address these challenges, further efforts are needed to build farmer capacity, improve access to capital and technology (Devaux et al., 2018), and create more supportive regulations for agribusiness partnerships (Vicol et al., 2018). In addition, further studies with a multi-disciplinary approach can provide more comprehensive insights into the best strategies to improve the socio-economic connectivity of coffee farmers (Long & Khan, 2025) for the sustainability of their partnerships (Samper & Quiñones-Ruiz, 2017).

The findings of this study have important implications for policymakers and stakeholders involved in the coffee sector. To foster more equitable and sustainable partnerships, it is crucial for policymakers to implement regulations that promote fair distribution of economic benefits among all participants, particularly smallholder farmers. This includes creating frameworks that ensure transparency and accountability in partnership agreements, as well as providing support for capacity-building initiatives that enhance farmers' skills and access to resources. Additionally, stakeholders should collaborate to improve infrastructure and logistics in remote areas, thereby reducing barriers to market access. By prioritizing these strategies, policymakers can help create an environment

that not only supports the growth of coffee partnerships but also enhances the overall welfare of farming communities. Ultimately, a concerted effort to address these challenges will lead to more resilient and sustainable coffee production systems that benefit all stakeholders involved.

## 5. Conclusions

This study shows that the success of the coffee farmer partnership model is strongly influenced by a combination of socio-economic, social, cultural, and agroclimatic factors. Specifically, the four identified factors, i.e., socio-economic exchange dynamics, socio-economic connectivity of agriculture, capital networks and socio-economic experience, and economic and educational networks account for the majority of the variability in partnership success. These findings emphasize the need for a multidimensional approach that goes beyond economic considerations to include social and educational aspects. Strengthening these dimensions can lead to more sustainable and productive partnerships, which benefit not only coffee farmers but also all stakeholders involved, including cooperatives, companies, and government.

These findings emphasize the importance of adaptive interactions between farmers and business partners in facing global market necks, as well as the need for a balance of power in price negotiations and risk sharing. Socio-economic exchange dynamics have the most significant impact because adaptive interactions between farmers and business partners play a critical role in ensuring partnerships, especially in communicating with the global market. Socio-economic connectivity of agriculture strengthens relationships between farmers and facilitates more effective distribution of resources and information, thereby increasing productivity and efficiency in the partnership system. Capital networks and socio-economic experience are also important in building farmer business resilience. Access to financial and social capital, together with farmers' experience in coffee business management, contributes to their ability to overcome industry challenges. In addition, economic and educational networks, which provide access to new economic opportunities and capacity building through education and training, enable farmers to increase the value of their products and play a more significant role in the coffee supply chain. Strengthening socio-economic networks through BUMDES and farmer associations can improve connectivity and bargaining power, while tailored education and training programs can improve agribusiness skills and market understanding. Policies that support transparency in transactions and access to market networks should be developed to increase trust in coffee farmer partnership relationships. Training and capacity-building programs for farmers should be encouraged to improve managerial and agronomic practices, and existing social networks should be strengthened to facilitate the exchange of information and resources. Further research is needed to explore the long-term impacts of these partnerships on the economic and social mortality of coffee farmers, as well as to identify innovative strategies that can improve their business resilience amidst evolving challenges. With these recommendations, coffee farmer partnerships are expected to be more sustainable and provide greater benefits to the farming community.

### Informed Consent Statement

Informed consent was obtained from all subjects involved in the study.

### Data Availability

The data used to support the findings of this study are available from the corresponding author upon request.

### Conflicts of Interest

The authors declare no conflict of interest.

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