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Factors influencing farmers' decision to join Paksong Coffee Production Cooperative, Paksong District, Champasak Province, Lao PDR

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ABSTRACT

Purpose- the purpose of this paper aims to study the factors that influence the decision to join a coffee production cooperative and compare members and non-members. This study utilized a quantitative research methodology, specifically a survey-based approach using a questionnaire using primary data obtained from interviews with farmers who grow coffee in Pasong District, Champasak Province, a total of 370 households, using the logit model to estimate. The results found that the factors affecting the decision to join the cooperative are: gender of household head; ethnicity; occupation of the household head based on farming; experience in coffee cultivation; coffee cultivation area; access to credit; average return per hectare; and receiving training. In terms of economic factors, it was discovered that households that are members of cooperatives have a lower average cost of Robusta coffee production than households that do not join cooperatives, but the average cost per hectare for medium coffee is not different. However, in terms of quantity of production and income from coffee production, it was discovered that the quantity of coffee production in both groups is not statistically significant.

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1. Problem statement

Rural coffee farmers are often hugely vulnerable to climate change conditions and market shocks that leave them struggling to explore their main source of income. (Barrett, 2010). It is usual in Laos that agricultural transactions are traditionally made through spot markets. However, the issue with spot markets and the traditional price taker mechanism are deficiencies in transferring production and marketing information in terms of quality, timing, and future demand (Wiemann et al., 2009). High agricultural transaction costs are core marketing constraints for smallholder farmers in developing countries (Arinloye et al., 2015). Aversion to risk and uncertainty, social network and organization, age, gender, and education are also household-specific factors that influence participation decisions to participate in market information exchange (Cuevas, 2014). These variables affect the transaction cost in terms of information investigation, negotiation, monitoring business performance evaluation, and enforcement (Pingali et al., 2005). Depending on the circumstances, Laos is a country rich in cultivated areas, so long as the conditions are favorable to agriculture production and potential. This is especially true in the sustainable green growth agriculture sector, which is becoming a more competitive market for domestic and foreign businesses. Laos offers preferential trade and export quotas for agricultural products to other nations, especially China and the EU.

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Coffee is a commodity exported by Laos in 2020. The value of coffee exports reached 56,356,661.02 US dollars. The majority of coffee plantations are located in the southern part of the particular plateau area of Paksong, Champasak province, Laos. Because of the volcano, the region is rich in suitable areas for coffee cultivation because of the volcano. The elevation level from the sea is about 600–1,400 meters, and the weather is suitable for coffee cultivation. Therefore, Paksong coffee is well-known for its unique taste and enjoys the popularity of consumers both domestically and abroad. In 2019, the area of coffee plantations is all-around 50,250 hectares (Robusta Coffee at 26,107 hectares, Arabica Coffee at 23,363 hectares, and Leberica Coffee at 780 hectares). Red coffees are produced all-around 478,367 tons (Department of Agriculture and Forestry, Champassak Province, 2019).

Cooperatives cover a huge part of the agricultural sector and could therefore play a role in the improvement of farm sustainability cooperation in terms of market information data sharing, coffee plantation disease issue solution pathways, and pesticide control utilization. Coffee cooperatives' production might be the core key element in value chains to encourage farmers to switch their agricultural practices and favor the adoption of more sustainable practices. Cooperative values such as democratic decision-making, equality, and solidarity give cooperatives a unique identity, which differentiates them from other types of enterprise and implies that they have a distinct organizational characteristic (Jimenez et al., 2020).

However, the coffee cooperative farmers cannot be profiled for positive or negative outcomes because, in previous decades, there were serious issues related to farmers, particularly the important role of chemical fertilizer usage, which may cause the coffee farmers to decide whether or not to participate the group. And still have not estimated the pros and cons of joining a group. Technically, there are many researchers have tried to find out the factors that influence farmers' decision-making to join the Coffee Production Cooperative, but they have found different answers. Especially, the study of (Thomas et al., 2012) research conducted in Ethiopia has found that the household's head, the nature of cooperation, household size, and education level of the head's household influence the participation of farmers in attending the cooperative. From the previous review, there was no clear answer to the decision to join the cooperative group, and there was a lack of comparison of the pros and cons between the group participants and those who did not join the group, especially the cooperative group of coffee farmers in the plateau area of Paksong district, Champassak province.

2. Literature Reviews

Members always have similar as association with the enterprise as producers to consumers of its products or services or as its employee (Nigusie, 2013). Quality of coffee cooperation from social and the economic rationale of endless effects of collective action, have led to the beginning of formal cooperation (Simmons and Birchall, 2008). As a result, certain values and principles (self-help, self-responsibility, democracy, quality, equity, and solidarity) have emerged that lead the operation of cooperative behavior. According to (Nigusie, 2013) cooperatives are thus democratic organizations controlled by their members, who actively participate in setting policies and making decisions. In more democratic cooperatives, men and women serving as elected representatives are accountable to the members of the cooperative. In this sense, members have equal voting rights and thus contribute equitably to the capital of the cooperative. In the case of coffee production and marketing, cooperatives should support smallholder farmers to increase their bargaining empowerment, pricing strategy, knowing their problem and solution which mean understanding their target customer's paint point in order to become more coffee market competition (Balgah, 2019).

Enormous research exists on the roles of cooperatives which investigate the value position, a feature that makes coffee production attractive to customers (Musa Hasen and Mesfin, 2017). Being voluntary, democratic, and self-controlled, cooperatives offer institutional forms through which local communities gain control over productive resources and activities from which they derive their improvement livelihood and well-being enhancement (Ozuomba et al., 2016). Cooperatives contribute services ranging from group purchasing discounts, bank credit access, reaching market strategy, ability to track the progress, competitive advantage, through risk-sharing and reduced transaction costs, to increased coffee farm income and joint ownership of common facilities (Musa Hasen and Mesfin, 2017). For some scholars, cooperatives has been conducting the long run business in a transformational development platform, by allowing members to take charge of their own destinies and bring desired services to their communities (Ahmed and Mesfin, 2017). In addition, cooperatives facilitate decision making, build trust and accountability through democratic processes, while generating sustainable profit and protecting assets (Ozuomba et al., 2016).

Several studies indicated that the membership in cooperatives improves the commercialization behavior of smallholder farmers (Stel and Abate, 2014). Cooperatives also minimize costs and information asymmetry by strengthening farmers' negotiation ability (Trebbin, 2014). Enhancing the cash flow of coffee farmers by fostering collaboration across various roles and providing informed support on exceptional marketing strategies that drive up the price of their products and reduce the cost of input purchases. Additionally, inclusive cooperatives especially those with an all-female membership play a significant societal role in enhancing gender relations by assisting women in creating safe places to strengthen their

ability for problem-solving and social solidarity (Baden and Pionetti, 2011). Some scholars therefore, rightfully contend that cooperation amongst members could be a way out in enhancing cooperative benefits and reducing membership problem (Kumar et al., 2015) This can be crucial for the survival of the largely smallholder-oriented coffee sector in Lao PDR, whose current production is largely under expectation.

3.Data and Methodology

3.1 Data

According to the report of the socio-economic - development plan for the period of 5 years 2015–2020, it is seen that in Paksong district there are farmers who participate in agricultural production groups, including 20 villages from 88 villages divided into 28 production groups, which are divided into priority areas in the development of each village group, including 10 groups of coffee production cooperatives covering 15,850 village households, for a total of 827 households, and the remaining 15,023 households are not members of coffee production cooperatives. There are 144 households that are members of coffee production cooperatives and 4,649 households that are not members of coffee production cooperatives. The sample group used in this research is a total of 370 households, consisting of 144 households that participate in coffee production cooperatives and 226 families that do not participate in coffee production cooperatives

Table1. Shows the size of the population and the sample group

Village name	Population			Sample		
	Total	Attend cooperative	Not attend cooperative	Total	Attend Cooperative	Not attend cooperative
Group 1						
Pakong	379	6	373	30	6	24
Watluang	559	5	554	44	5	39
KM 48	250	1	249	20	1	19
Group **2**						
Nongkali	51	3	48	4	3	1
Huaisan	287	1	286	23	1	22
Group 3						
KM 40	292	13	279	23	13	10
KM 35	205	1	204	16	1	15
KM 43	462	2	460	37	2	35
KM 33	124	1	123	10	1	9
Group 4						
Xaisomboun	232	44	188	50	44	6
Group 5						
Huaiwai	109	31	78	35	31	4
Setkod	543	30	513	43	30	13
Group 6						
Huaiset	370	1	369	5	1	4
Group 7						
Tongkatai	502	1	501	7	1	6
Group 10						
Chansavang	284	4	280	23	4	19
Total	4,649	144	4,505	370	144	226

Source: Author's summary

3.2 Methodology

The estimation is used Logit Model, the variable that will be used in the analysis is a dummy variable with two values: 1 and 0. By estimating with the Maximum likelihood method which is a repeated calculation (Iterative algorithm) so that the estimated value of the coefficient has the closest value to the reality (Parameter). Then check the appropriateness of the equation by considering the values. The details of the analysis are shown below

Hence, the opportunity arises in an interested case

$$\Pr(y = 1) = \frac{1}{1+e^{-x'\beta}} \quad (1)$$

Opportunity for non-events of interested to be studied

$$\Pr(y = 0) = 1 - \Pr(y = 1)$$

Insert equation (1) we will have the equation of Pr (y=0) = $1-\frac{1}{1+e^{x'\beta}}$

$$\Pr(y=0) = \frac{e^{-x'\beta}}{1+e^{-x'\beta}} \quad (2)$$

An opportunity in the case of an interested event and a non-interested event will be held in the odd equation as following:

$$\frac{\Pr(y=1)}{\Pr(y=0)} = \frac{\left(\frac{1}{1+e^{-x'\beta}}\right)}{\frac{e^{-x'\beta}}{1+e^{-x\beta}}} = e^{x'\beta} \quad (3)$$

The model used to find the factors that affect the event of interest by converting it to a straight-line equation can be written as follows:

$$\mathrm{Ln}\left(\frac{\Pr(Y=1)}{\Pr(Y=0)}\right) = \quad ^{x}\ \beta = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \beta_3 x_3 + \cdots + \beta_k x_k + \mathrm{u}$$

Where y is a variable with two values: 1 and 0 Prob (y = 1) is the chance of an event that we are interested in studying, where y is equal to 1, and when Prob (y = 0) is the chance of an event that we are not interested in, which y is equal to 0 (Gasso, 2019).

Variables $X_1, X_2, X_3 \ldots X_k$ are independent variables that influence the variables according to Y or the probability of an event that we are interested in studying, which will indicate how much each variable variables influence the variables depending on the parameter values $\beta_1, \beta_2, \beta_3, \ldots \beta_k$, The value β_0 refers to the value of other factors that we have not studied, but also have an effect on the variable Y as well.

To estimate the impact on the Marginal Effect, to estimate how much the independent variables will change when the value of one variable changes to one WTP variable, as shown equation below:

Then calculate the Marginal Effect to find the final effect. Explain that if the value of an independent variable increases by 1 unit, then the probability of occurrence (variables) will change, as shown equation the bellows:

$$\text{Marginal Effect} = \frac{\partial \Pr(\mathrm{WTP}=1)}{\partial \mathrm{X_n}}$$

The model used to estimate the factors influencing farmers' decisions to join a coffee production cooperative in Paksong district, Champassak province, is based on the model of (Wainaina et al., 2012).

$$Ln\left(\frac{\Pr(FDPCPC=1)}{\Pr(FDPCPC=0)}\right)_{ij} = \beta_0 + \beta_1(HC_{ij}) + \beta_2(\mathrm{E}F_{ij}) + \beta_3(\mathrm{SF}_{ij}) + u_i$$

Where $FDPCPC$ is farmers' decision to join Paksong Coffee Production Cooperative

HC_{ij} is a vector of the household's characteristics, such as: Household gender, Age, Ethnic minority, Education, Main Occupation, Labor force of household, Household member school enroll, Experience in coffee planation, Household-owned coffee area.

EF_{ij} is a vector of the household's economic factors include: Income, Benefit per hactor, Cost per hactor, Loan access

SF_{ij} is a vector of the social factors such as: Acknowlegment of coffee cooperative, Receive help, Be trained

β_0 is an intercept of independence variables

$\beta_1, \beta_2, \beta_3$ is a slope of independence variables

u is a standard

4. Results and Discussion

4.1 Analysis of factors affecting the decision to join a coffee production cooperative

The logit model is used to estimate the parameter. The estimation result of the marginal effect is illustrated in Table 1. Multicollinearity was checked for the independent variables used in the model. The results of the examination found that the coefficient of the independent variables used in the model has a maximum correlation equal to 0.47, which is lower than 0.60, indicating that the variables used in the model are not multicollinear.

We found that the male household head has a positive significant at a 99% confidence level. The reason for this may be due to the fact that coffee farming is a profession that requires a lot of labor in various tasks, such as clearing the land, preparing the land, planting, maintaining it, as well as harvesting, transforming, and distributing the produce. These tasks are mainly based on male labor. Therefore, when the male household head, who is the pillar of the family, decides to become a member of the cooperative, the chances of being accepted by other members of the family will be higher.

Ethnicity has a positive influence on the decision to join a coffee production cooperative. It means that households that represent the Lao Loum ethnic group will have more opportunity to decide to join the cooperative than households that represent other ethnic groups, up to 25.76% with a statistical confidence level of 99%. Lao Loum ethnic groups have the potential to access information better than households of traditional or local ethnic groups, especially in terms of understanding the role of the cooperative because the information put down by the cooperative is created in a way that uses the main language and official explanation guidelines.

Table 2: Logit Analysis Results.

Independent Variable	Maximum Likelihood			Marginal effect		
	Coefficient	Z	P>|z|	dy/dx	Z	P>|z|
Gender of household head (1=male)	1.3272***	3.84	0.000	0.2523***	4.36	0.000
Age of household head (year)	0.5899	1.32	0.186	0.1116	1.46	0.144
Ethnicity (1= Lao Loum)	1.4842***	3.97	0.000	0.2576***	4.78	0.000
Occupation of household head (1=farming)	1.2524**	2.49	0.013	0.2138***	3.23	0.001
Education of household head (1=agriculture)	0.4304	0.76	0.448	0.0951	0.72	0.470
Experience of coffee plantation (year)	0.0415*	1.82	0.069	0.0086*	1.82	0.069
Coffee plantation area (ha)	0.9611***	2.88	0.004	0.2006***	2.90	0.004
Average return per hectare (USD)	0.5225*	1.82	0.069	0.1084*	1.82	0.068
Access to credit (1=yes)	1.4256***	2.89	0.004	0.3323***	2.86	0.004
Getting trained for coffee plantation (1=yes)	2.1689***	7.01	0.000	0.4595***	7.67	0.000
Constant	-15.1439	-3.07	0.002			
LR χ^2	191.68					
Prob > χ^2	0.0000					
Pseudo R^2	0.3930					
No of observations	370					

Note(s): ***Significant at 1% level, **significant at 5% level and * significant at 10% level
Source: Author's estimation

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The main occupation of the household head is farmer, which is related in the same direction as the decision to join a coffee production cooperative. It means that the households that are mainly engaged in agriculture have a better chance of deciding to become members of the cooperative than the households that are mainly engaged in other occupations. There were 21.38% with a statistical confidence level of 95%, which may be due to the households that are mainly engaged in agriculture.

Experience in coffee cultivation has a positive correlation with the decision to become a member of a coffee production cooperative, which means that households with experience in coffee cultivation for more than 1 year have a higher chance of deciding to join the cooperative (0.86% with a statistical confidence level of 90%). This is why, according to the interpretation from the data survey, it is seen that households with experience in coffee cultivation for a long time have been through many periods of time, making them learn both good and bad aspects.

The coffee plantation area has a positive influence on the decision to join a coffee production cooperative. The finding was that 20.06% with a statistical confidence level of 99% indicated that households with a production area of more than 4 hectares have a higher chance of deciding to join a cooperative than households with a production area of less than 4 hectares. The reason may be due to households with a production area of more than 4 hectares. They have a higher risk of distribution than households with a production area of less than 4 hectares. They become members of the group, and they may feel more secure than before.

Access to credit has a significant positive influence on the decision to join a coffee production cooperative. This means that households that used to receive loans from various financial institutions such as banks, microfinance institutions, or other credit cooperatives have a chance to become members of the cooperative up to 33.23% with a statistical confidence level of 99%. This may be due to the

fact that most of the households that have access to funding sources will have more coffee production. Therefore, it persuades them to become members of the cooperative in order to increase their confidentiality in coffee production and distribution.

The average return per hectare has a positive relationship in the same direction with the decision to become a member of the cooperative, meaning that a household that has increased the average income per hectare by 1% has a chance to decide to join the cooperative by 10.84% with a statistical confidence level of 99%. It may be due to households with a high average income per hectare, mostly from receiving more produce. Therefore, when they receive more coffee production, there might be a higher risk of coffee distribution than in the case of receiving less coffee production. Encourage farmers to become members of the cooperative to increase the confidentiality of coffee distribution.

Getting trained for coffee plantations is related to the decision to become a member of the cooperative, which means that any household that has participated in training on various topics related to the promotion of coffee production by enhancing farmers has a higher chance of deciding to join the cooperative than households that did not participate in the training (45.95% with a statistical confidence level of 99%).

4.2 Comparing the differences in economic factors between households that are members of cooperatives and households that are not members of cooperatives.

In Arabica coffee, it is seen that the average cost per hectare of both groups is not statistically different. The test of the difference in the total cost of coffee production without separating the two types of coffee found that the average cost per hectare of households that are members of the cooperative and households that are not members of the cooperative is different with a statistical confidence level of 99%. The households that are members of the cooperative will have an average cost lower than the households that are not members of the cooperative, with an average cost equal to $120.96 USD/hectare, while households that are not members of the cooperative have an average cost of $193.48 USD/hectare

Table 3. Comparing the differences in economic factors between households that are members of cooperatives and households that are not members of cooperatives.

Economics factors	Comparative (Mean)		Sig
	Atten comperative	Not attend comperative	
1. Variable cost (USD/ha)			
Arabica Coffee	131.14	198.87	0.000***
Robusta Coffee	71.99	65.40	0.640
Robusta & Arabica	120.96	193.48	0.000***
2. Average coffee production (Kg/ha)			
Arabica Coffee	5,081.54	5,106.90	0.926
Robusta Coffee	1,975.28	3,677.78	0.111
Arabica & Robusta	4,204.62	4,576.60	0.144
3. Average income (USD/ha)			
Arabica Coffee	1,043.29	899.27	0.012**
Robusta Coffee	451.89	849.55	0.073*
Arabica & Robusta	937.68	868.84	0.177
4. Income and expenditure (USD/year)			
Total income	5,820.28	3,880.42	0.001***
Income (excluding income from coffee)	1,853.31	1,969.88	0.637
Total expenditure	2,025.63	2,213.57	0.152
Cost (excluding coffee plantation cost)	1,442.74	1,684.04	0.001***

Note(s): ***Significant at 1% level, **significant at 5% level and * significant at 10% level
Source: Author's estimation

According to actual information inquiries, the households that join the cooperative use natural fertilizers instead of chemical fertilizers, so they can reduce the cost of buying chemical fertilizers, pesticides, and herbicides. In addition, the households that join the cooperative also get a reduction in the cost of roasting or coloring coffee because there is a lot of roasting or coloring, resulting in a reduction in price.

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For the analysis of the difference in the amount of output, the result was found that the two groups received the same amount of each type of coffee, which was statistically reliable. According to the inquiry with the household group, it was found that the reason why the coffee yield did not differ is because the plateau area around Paksong district is an area with rich soil, an old volcanic soil that is suitable for the cultivation of many types of crops, especially coffee.

The comparison of the difference in tern of income from the selling coffee the result represented that both groups have income from the distribution of both types of coffee. In the case of Arabica, there was also found that households that are members of the cooperative will have a higher income from the selling coffee than the households that are not members of the cooperative, with a statistical confidence level of 95%. The households that are members of the cooperative will have an average income from selling Arabica equivalent to $1,043.29 USD/hectare, while the households that are not members of the cooperative will have an average income from selling Arabica $899.27 USD/hectare. However, we also found that Robusta Coffee has effect on households that are members of the cooperative have a higher average income from selling Arabica than the households that are not members of the cooperative. The households that are not members of the cooperative have an average income of $849.55 USD/hectare, while the households that are the members of the cooperative have an average income from the selling Robusta is just only $451.89 USD/hectare. Households that are not the members of the coffee cooperative a slightly higher income with statistically significant at a 90% confidence level. The fact that the total income of the two groups from the average sale of coffee per hectare is not very different, it might be due to the fact that both groups have different advantages. which allows them to get higher productivity than households that are members of the cooperative.

In addition to comparing the cost factors and returns from coffee cultivation, the research results also compare the difference in household income and expenditure. The test results found that households that are members of the cooperative and households that are not members of the cooperative have different incomes and expenditures. In terms of income, it was found that households that are members of the cooperative have a higher average household income than households that are not members of the cooperative, which have an income of up to $5,820.28 USD/year, while households that are not members have an average annual income $3,880.42 USD/year. In terms of household expenses, it is found that both groups have no difference in total expenses, but when the expenses used in coffee plantations are not taken into consideration, it will be seen that the households that are not members of the cooperative have an average annual expenditure higher than the households that are members of the cooperative. With a statistical confidence level of 99%, it means that becoming a member of the cooperative will not only reduce the cost of coffee production but also reduce the indirect expenses of households that do not include expenses from coffee plantations. which may be due to receiving training, sharing information within the group, and learning new techniques that enable them to apply them in various family activities.

5. Conclusion and policy implications

It can be shown that there is no statistically significant difference between the two groups' average cost per hectare of Arabica coffee. With a statistical confidence level of 99%, the average cost per hectare of households that are members of the cooperative and households that are not members of the cooperative differs, according to the test of the difference in the total cost of coffee production without separating the two types of coffee. The study's findings highlight the value of working through production cooperatives, particularly those specializing in coffee. These cooperatives are supported by the government to help them increase their capacity for production and make it easier for different parties to monitor and inspect their operations. However, the cooperative must also consider the rules, deductions, conditions, or regulations that will direct the members of the implementation group to be in line with the realities of each locality. Farmers themselves need to balance short-

and long-term profits, and they should not just think about financial gains but also simultaneously take social and environmental issues into account

The research result was represented from analyzing the data using econometric methodology, we know crucial answers that can be brought to the recommendations as problem solution of outstanding coffee cooperative as follow:

1. The research findings have confirmed that joining a coffee cooperative requires facadism the minimization of costs associated with coffee cultivation and production activities, particularly the cost of purchasing chemical fertilizers and pesticides, which are thought to have a positive long-term impact on the environment and farmers' health. As a result, there should be a mechanism to encourage coffee production within the sustainable cooperative structure. Additionally, it will give farmers more opportunities to enhance their agricultural production knowledge and obtain training, allowing them to use this knowledge in other endeavors that could bring in more money for the household. Additionally, joining the cooperative provides farmers with additional access points.

2. There should be restructuring of the group to increase convenience for farmers, especially the form of repayment close to the farmer in the case that the farmer brings coffee production for selling in the representative of coffee cooperative, because most of the farmers see that the repayment of the cooperative is delayed compared to selling coffee in general.

3. Coffee cooperatives should receive special training from the government sector or university for financial management training, which includes a balance sheet that gives a snapshot of the assets and liabilities of the cooperative at any point in time, a profit and loss statement, and a cash flow statement that shows how much money is going into and coming out of the cooperative.

4. The coffee farmers should gain an opportunity for coffee cultivation issue solutions from plantation experts, which is necessary and helpful for their coffee production productivity to get economies of scale.

5. There should be a regulation that can probably be reasonable and available for coffee members to save their beneficial resources

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have influenced the work reported in this paper

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